NUTRITIONAL ANALYSIS OF SCHOOL MEALS IN SOME SASKATOON ELEMENTARY SCHOOLS

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By

LAURA ANDRÈS ROSSI GOUGEON

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ABSTRACT

Canadian scientific literature lacks quantitative information on school meals, which, in Canada, are not regulated by law and do not have any national nutritional standard. Nutritional standards and guidelines are essential in evaluation and monitoring studies to maintain—or improve—school meals' quality. This research looked at the nutritional quality of meals served by some elementary schools running a school meal program administered by CHEP Good Food Inc., a non-profit organization, in Saskatoon, SK. Data collected from 1997 until 2006 were combined to those collected in the 2007/08 school-year. Lunches were compared to 1/3 Dietary Reference Intakes (DRI), and breakfasts and snacks, to ¼ DRI. Using one-sample *t*-tests and ANOVA, $p < 0.05$, we evaluated nutrients that were suggested to be below the standard. Saskatchewan's food-based standards were also used to evaluate food group content according to the Canada's Food Guide to Healthy Eating. On-site observations in selected schools shed light on children's choices and plate waste. Focus groups with selected nutrition coordinators (NC) provided insight into their practices. Overall, lunches and breakfasts had a good nutrient profile but were low mainly in energy, vitamin E, potassium, and, in some years, folate and calcium, particularly for 9-13 year-olds. Findings suggested that snacks seem to be below the DRI standards, but they can be an opportunity for nutrition education. We observed no clear or significant trend across the years. All meals offered good amounts of fruits and vegetables, grains, and dairy products. Plate waste was low and related to NCs' practices. Analysis of the interviews exposed some possible explana-

tions for the quantitative results and allowed some recommendations. Findings from this study provide support for future establishment of school meals' nutritional standards and for possible changes and improvements of the program, and will enrich knowledge regarding school meals.

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Dedication

I would like to dedicate this work to my husband, Felipe Gougeon, and my family, in especial my parents, my aunt Angélica, my grandmother Alzira, and my grant-aunt Arly, who were of great support and help since the beginning of my master's and even before coming to Canada. I am extremely grateful to all of them.

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CHAPTER 1
INTRODUCTION

On December 10, 1948, the Universal Declaration of Human Rights guaranteed the right of food provision for adequate health and well-being:

> "(1) Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, **including food**, clothing, housing and medical care and necessary social services […]". *Universal Human Rights – Article 25*. (General Assembly of the United Nations, 1948)

The Human Rights are for all human beings only and exclusively because they were born as a member of the human specie. These rights are inalienable and independent of national, provincial, or municipal legislations. The Assembly called upon all member countries to publicize the text and "to cause it to be disseminated, displayed, read, and expounded principally in schools and other educational institutions, without distinction based on the political status of countries or territories" (General Assembly of the United Nations, 1948).

However, food insecurity has compromised this human right for centuries. But only in 1974, during the World Food Conference, it was recognized as a worldwide public concern, (United Nations, 1974, cited in Food and Agriculture Organization (FAO), 1996). Food security "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996).

Food insecurity is not a problem exclusively of poor countries; as it is commonly thought. In reality, all nations experience some level of food insecurity (Tarasuk, 2001).

In Canada, 2.7 million people, or 8.8 percent of the population, lived in food insecure households in 2004 (Health Canada, 2004a). Defined in financial terms, food insecurity struck more than 1.1 million households (9.2 percent) at some point in 2003 as a result of financial challenges in accessing adequate food (Ledrou & Gervais, 2005). In these households, at least one adult or child member experienced multiple conditions characteristic of food insecurity (Health Canada, 2004a). In fact, a low-income family is less likely to get required nutrients for good health and to enjoy diets consistent with healthy eating (McIntyre & Tarasuk, 2004). Consequently, children in a family reporting hunger may see their diet compromised by unbalanced meals and/or meals of reduced size (McIntyre, Connor, & Warren, 1998). Food and nutrition programs, such as school nutrition programs, are designed to provide safety net for children at risk of poor intakes (Stang, Bayerl, & American Dietetic Association, 2003). Indeed, in 1998/99, 10 percent of 850 000 food insecure children aged sixteen years or less used school meal programs in Canada (Rainville & Brink, 2001).

On the other end of food insecurity is the excess of (unhealthy) food that combined with low physical activity may lead to overweight and, very often, obesity. The World Health Organization (WHO) estimates that, in 2005, approximately 1.6 billion adults (15 years of age or older) were overweight and at least 400 million were obese. These numbers are expected to nearly double by 2015 (World Health Organization (WHO), 2006). The 2000/01 Canadian Community Health Survey (CCHS) showed the same tendency in Canada: more than 6 million adults, one out of every seven, aged 20 to 64 were overweight and nearly 3 million were obese—an increase of 24 percent from 1994/95 in obesity (Canadian Institute for Health Information (CIHI), 2004; Statistics

Canada, 2002). Several non-communicable chronic diseases such as diabetes, cardiovascular disease, hypertension, and cancer are consequences of persistent overweight (CIHI, 2004), burdening the health care system. In 1997, the costs associated with obesity were greater than $1.8 billion. After 10 years, this figure increased to $4.3 billion, or 2.2 percent of the total care costs in Canada (Birmingham, Muller, Palepu, Spinelli, & Anis, 1999; Katzmarzyk & Janssen, 2004). Overweight and obesity are also becoming great concerns during childhood. Globally, at least 20 million children under the age of 5 years were overweight in 2005 (WHO, 2006). In Canada, 36 percent of children aged 2 to 11 are overweight or obese; nearly three times as great as 25 years ago (CIHI, 2004; Public Health Agency of Canada, 2007).

Both the lack and the excess of food affect children undesirably. Poverty and hunger, an origin and a consequence of food insecurity, are too often translated into ill-health, poor nutrition, unhealthy development, and poor school readiness (McIntyre et al., 1998). Similarly, overweight and obesity not only increase the risk for chronic diseases, but compromise children's well growth, cognitive development, and school performance (Story, Kaphingst, & French, 2006). Hence, both extremes are great concerns for schoolchildren.

Compared with infancy, school-aged children have a slow, yet steady, physical growth. From 6 to 12 years of age, they have increased appetite and, consequently, higher food intake. Physical, cognitive, and social-emotional growth is very strong after one year of age through adolescence (Betty & Ogata, 2005). Good nutrition contributes to maintaining children's health and optimal learning capacities (Centers for Disease Control and Prevention (CDC), 1996).

Initially, the family is responsible for feeding the child and setting norms within the family, acting as role models, encouraging certain behaviours, and rewarding or limiting other (Birch & Fisher, 1998). The social environment of children diversifies as they enter the school age; extrafamilial influences progressively become more important references. Schoolchildren are more independent, begin making their own food choices, and take personal decisions on what they eat (Story, Neumark-Sztainer, & French, 2002). These new acquired food habits will persist during adolescence and more likely will track onto adulthood (Pérez-Rodrigo & Aranceta, 2003).

Given the importance of children's environment, one automatically thinks about schools; no other institution has as much continuous and intensive contact with children during their first decades of life (Story et al., 2006). Schools are not only teaching centres but a place where children and families come in contact with society and where services in addition to education must be provided if education is to be effective (Worsley, 2005). These institutions are ideal settings to develop a comprehensive health promoting program to address all areas of health knowledge, such as supportive environment, health services, healthy school meals and food service, classroom health education, role model staff, among many other components. Schools not only promote good nutrition, physical activity, and healthy weights among children, but also prevent both extremes: food insecurity and obesity (Stang et al., 2003; Story et al., 2006).

Recognizing the essential schools role in a child's life, several organizations have been partnered with schools to promote healthy life style through school-based programs; CHEP Good Food Inc. (hereinafter referred to as CHEP), in Saskatoon, Saskatchewan, is one such organizations. Formerly known as the *Child Hunger and Educa-*

tion Program, CHEP is a non-profit organization that promotes and supports several initiatives related to healthy eating primarily in schools in Saskatoon and vicinity. CHEP involvement began in 1988/89, with a focus on hungry children and developing community response to food insecurity (CHEP Good Food Inc. (CHEP), 2004), but quickly broadened to include health and wellness focus. An example of this is the child nutrition component offered in partnership with elementary schools, both Public and Catholic elementary schools, in Saskatoon (CHEP, n.d.). The nutrition programs offered by CHEP, especially the meal program, are evaluated annually through the efforts of the College of Pharmacy and Nutrition, University of Saskatchewan as part of the *Children's Nutrition Program.*

School meals are recognized as a key element in promoting good nutrition and health for schoolchildren (CDC, 1996). Research suggests that the consumption of inadequately balanced diets, especially those high in fat, may lead to the development of chronic diseases such as obesity, heart disease, and diabetes; whilst diets high in sugar may predispose children to dental decay (James, 2008; McNaughton, Ball, Mishra, & Crawford, 2008; Naidoo & Myburgh, 2007). These evidences have led some governments to establish health policies, guidelines, and standards for populations and institutions in attempt to reverse the present consequences of unhealthy dietary behaviours.

Although health promotion policies have been implemented in various countries and constituencies over the past decades, Nutbeam (1992) contends that the increasing rates in obesity and non-communicable chronic diseases in most industrialized societies suggests a lack of policy or policy failures at both local school and government levels. The narrow emphasis on health in the curriculum and the focus primarily on biomedical

outcomes to the exclusion of social and food consumption skills maybe a contributor to the increasing rates of chronic disease evidence in children (Worsley, 2005). Worsley (2005) notes that a lack of regular monitoring of program effectiveness weakens both the schools' abilities to defend their programs and the arguments for government support. Hay (2000) concur noting that support for school food programs should be based on stronger evidence of their effectiveness in meeting health and education outcomes of children. Evaluation research is designed to document effectiveness and improvements of programs and policies and can provide policy makers with the required information needed to support programs such as nutrition programs offered in schools. It is clear that continued investment in ongoing evaluations is necessary to provide evidence-based outcomes for polices and program effectiveness (Lister-Sharp, Chapman, Stewart-Brown, & Sowden, 1999). The study sought to compare the nutritional quality/content of meals offered as part of CHEP's Children's Nutrition Program, from 1997 until 2007/08, with established scientific standards and published guidelines.

In Canada, there is no national policy or regulation governing the provision of school meals. Consequently, programs administration and evaluation do vary. Findings from this study may enhance the child nutrition program and the literature on policy development and will be useful to policy makers, planners, and other stakeholders. The study seeks to extend the existing literature by its focus on the school meal intervention strategies which includes comparisons of the food offered to, chosen and/ or wasted by children against nutritional quality and content of the meals.

1.1 Research Questions

The following research questions guided the study:

1. To what extent do meals (breakfast/snack/lunch) offered by some elementary schools in Saskatoon meet the recommended guidelines of one-third of the Dietary Reference Intakes (DRI)—defined later in Chapter 2, page 58—for specific nutrients for lunch and one-fourth for, each, breakfast and snacks?

2. What are the trends in food/ nutrient quality for meals served in selected Saskatoon schools? How do meal compare along the years?

3. What are the perceptions of nutrition coordinators concerning menu planning and service practices, and adherence to nutrition standards/ guidelines?

1.2 Importance of the study

The setting's approach has become increasingly popular in health promotion; it recognizes the valuable opportunity to influence health outcomes through policy measures and education within settings such as schools, workplaces, hospitals or cities (Stewart-Brown, 2006). Schools provide an excellent arena for reaching large segments of the population, such as young people, school staff, families, and the surrounding community (Pérez-Rodrigo et al., 2001). Globally, a growing but limited number of studies have demonstrated that school health interventions can lead to positive change, thus improving the potential of students to benefit fully from schooling as a result of having simultaneously a positive health status (Stewart-Brown, 2001). This study seeks to evaluate the nutritional quality of CHEP's Children's Nutrition Program in an effort to assure the provision of quality nutritional meals to schoolchildren.

1.2.1 Benefits of Child Nutrition Programs to Children

The link between good health status and learning is very well established. Consuming nourishing, wholesome, and attractive food in the early ages is fundamental to

developmentally appropriate learning experiences, to health and well-being, and physical growth in childhood but also in later stages of life (Edelstein, 2006).

Children who eat school lunches and breakfasts have higher mean intakes of micronutrients at mealtime and over a twenty-four hour period than those who do not (Gleason & Suitor, 2001; Gordon & Fox, 2007). Good nutrition status is linked to learning readiness, better academic achievement, decreased discipline and emotional problems (Bellisle, 2004; Briggs, Safaii, & Beall, 2003; Jacoby, Cueto, & Pollitt, 1998; Papamandjaris, 2000).

Research suggests that child nutrition programs can have significant positive effects on growth and cognitive performance of disadvantage children and can contribute to good health outcomes and to essential efforts to improve education access and completion, particularly for the poor (Bundy, 2005; Kristjansson et al., 2007). These outcomes are seen through improved school attendance, duration of schooling, and educational outcomes (performance, dropout, and repetition) (Rosso & Weill, 2005).

Children who experience hunger at school not only can have undesirable academic performance, but are more likely to have greater problems with teachers, to be less attentive in class, and to engage in fighting with other children (Abidoye & Eze, 2000; Benton & Jarvis, 2007; Kennedy & Cooney, 2001; López-Sobaler, Ortega, Quintas, Navia, & Requejo, 2003; Mahoney, Taylor, Kanarek, & Samuel, 2005; Muthayya et al., 2007; Taras, 2005). In Ontario, teachers reported that children attending breakfast programs became more attentive in classroom (Edward & Evers, 2001).

Child nutrition programs have also been targeted as important school-based strategies in obesity and chronic disease prevention (Gleason & Suitor, 2001; Story et al.,

2006). Children spend approximately one third of every weekday in school, where they can consume up to two meals, sometimes three (Story et al., 2006). Therefore, schools are in a unique position to promote healthy dietary behaviours and to help assure appropriate nutrient intake (Pateman et al., 1995) to help reduce the risk of obesity and other chronic diseases (Gleason & Suitor, 2001; Gordon & Fox, 2007).

Schools meals are one of several child nutrition interventions that can address some children's nutrition and health issues in schools. Studies have shown that nearly 70 percent of Canadian children aged 4 to 13 had less than five servings of vegetables and fruit a day in 2004. Regarding milk and alternatives, more than one-third of children aged 4 to 9 did not consume the minimum of three servings, nor did 61 percent of boys and 83 percent of girls aged 10 to 16 (Garriguet, 2004). School meal programs along with classroom lessons are able to help students increase their fruits and vegetables consumption when proper strategies are implemented (Hendy, Williams, & Camise, 2005). Classroom lessons alone might also provide support for lasting changes in students eating behaviours (CDC, 1996). Children need support from school environment in to make sustained changes. Nutrition coordinators responsible for the preparation and delivery of school meals play an important role; to be effective, school food staff such as nutrition coordinators must adhere to the minimum nutritional standards in order to deliver good quality, healthy meals (Kaufman, 2007). The formal evaluation of school meals as part of a child nutrition program strategy may contribute to strengthening the quality and service of meals offered in schools.

1.2.2 Benefits to the Community

School meals offer broad benefits to the community. The offering of meals that are of good nutritional quality can teach healthy eating not only to children, but also to the community. Community-based nutrition programs executed within schools—which are the majority in Canada (McIntyre & Dayle, 1992)—increase contact and communication between parents and teachers, officials, and others. This increased communication gives parents the opportunity to became aware of what is happening at schools and raises the education's and the school's value for parents and the whole community (Rosso & Weill, 2005). Benefits to the community can also be seen when the food provided by a school nutrition program is locally grown and purchased, helping the development of the local community (Levinger, 2005).

Volunteers are an important source of community participation. A study on children's feeding programs across Canada, including those run in schools, revealed that the majority was supported by volunteer work, 28 percent were parents acting as volunteers (McIntyre & Dayle, 1992). As children's families may assist in the school cafeteria as volunteers, they can also be influenced by a healthy food service and could learn about healthy eating to apply the acquired knowledge and abilities in their own home (Worsley, 2005). Guaranteeing a healthy school food program can thus affect these participants indirectly.

1.2.3 Benefits to School Personnel

A good quality child nutrition program can also educate school personnel and encourage teachers and staff to improve their own eating habits. As Nutbeam (1992) points out, school staff, including teachers, is the "hidden curriculum" in the school, the role

model for children. Apart from teachers, school food staff also play a critical role in promoting healthy eating through the foods they make available each day and the interactions they have with students (Pateman et al., 1995). Gaining insight in their practices, knowledge, and opinions, which is one of the objectives of this study, is also crucial to guarantee good meals and to pinpoint possible improvements.

1.2.4 Nutrition Policies and Policy Makers

A primary function of official public health agencies is to protect the health of its citizens. This protection includes formulating health and nutrition policies, initiatives, and practices that should not only attend community needs and affect people's lives positively but also be based on sound science (Bundy, 2005; Kaufman, 2007). Policies are a cost-effective method of bringing about environmental change, which may inspire individual change as well, whereas individual interventions can be labour intense, costly, and reach a limited number of people (Vecchiarelli, Takayanagi, & Neumann, 2006). School nutrition policies, particularly, govern programs that can change the whole school nutrition environment and, therefore, make a compelling case for public sector intervention. In addition, they are seen as powerful tools to shape students' dietary habits by helping them to make healthier food choices (Karen Weber Cullen, Watson, Zakeri, & Ralston, 2006; Neumark-Sztainer, French, Hannan, Story, & Fulkerson, 2005; Vecchiarelli et al., 2006), thereby reducing health risks among children and adolescents (Stang et al., 2003). Studies have been shown that children have increased consumption of fruits, vegetables, milk, and several nutrients and lower intakes of foods high in fat in sugar when nutrition policies are present in schools (Cullen et al., 2006; Story et al., 2006). Nutrition policies can potentially impact students' food choices and

eating habits outside school by teaching good nutrition inside school (Vecchiarelli et al., 2006).

Teachers may also be directly and indirectly affected by nutrition policies in schools. Their perceptions of health education practice are significantly higher in policy holding schools (Adamson, McAleavy, Donegan, & Shevlin, 2006). A study from 2004 on nutrition policies in Saskatchewan schools revealed that the majority did not have written nutrition policies mainly because schools did not perceive a need of implementing these policies (Berenbaum, 2004). Since results from evaluation research can be then translated into programs and policies (Kennedy & Cooney, 2001), this study may contribute with scientific evidence for policy making in schools.

1.2.5 Contribution to the school meal programs' evaluation

Researchers (Hay, 2000; McIntyre, Travers, & Dayle, 1999; O'Toole & McKenna, 2006; Raine, McIntyre, & Dayle, 2003) suggest that most of the evaluations conducted on Canadian school meal programs collect qualitative perceptual data, relying on anecdotal feedback from principals, teachers, parents, and students to assess program impact. As Williams et al. (2003) point out, many programs are not formally evaluated, and their continuance is justified by the "wonderfulness" consensus innately attached to child programs. In reviewing the available Canadian literature, it is assertable that, besides the lack of evaluation studies, Canada and provinces also lacks national and local comprehensive school nutrition standards.

In Canada, extensive evaluations on nutritional quality of school meals have not been conducted as in other countries such as the United States and the United Kingdom, with well established school meal policies and standards (e.g. Burghardt, Gordon, &

Fraker, 1995; Drummond & Sheppard, 2004; Dwyer et al., 1996; Fox, Crepinsek, Connor, & Battaglia, 2001; Gleason & Suitor, 2001; Hyndman, 2000; Mock, Adams, Snowdon, & Griffiths, 1997; Osganian et al., 1996; Sanigorski, Bell, Kremer, & Swinburn, 2005). Nonetheless, the few conducted evaluations have uncovered some positive impacts on the health and well-being of participants (Government of New Brunswick, 2002; Henry et al., 2005; Hyndman, 2000; McCuaig, 2005; McCuaig & Chang, 2002; Murton, 2004). Research on school programs and interventions is means to identify and replicate best practices (Story et al., 2006) and to pinpoint shortcomings, such as poor nutritional content, attempting to achieve the desirable outcomes such as the improvement of children's health and school performance and the teaching of lifelong healthy eating habits.

Considering these aspects, this present research is a potential contributor to the scientific literature, particularly to the Canadian, in which such important evaluation studies on school meal programs are lacking.

1.3 Definition of Terms

School meals (school lunch, school breakfast, and school snack). *School meal*, in this study, was any food that could be obtained directly from the kitchen during mealtime, excluding all food bought from vending machines, tuck shops, or purchased off the school premises, food brought from home to eat at school, packed lunches, and any items bought from the kitchen at other time of the day (adapted from Gould, Russell, & Barker, 2006).

School Meal Program or School Food Service Program or School Food Program. Although these three terms are used interchangeably in the literature to refer to

school-based nutrition programs that focus on serving meals/food at school to children, this study uses hereinafter the term *school meal program*.

CHEP (administered) school nutrition program. The name *Children's Nutrition Program* is used by CHEP to refer to their program that supports the serving of meals at schools. This study, however, uses the term *CHEP (administered) school nutrition program*, because the *Children's Nutrition Program* involves other components besides meal offering, such as nutrition education.

Nutrition coordinators. Nutrition coordinators are community members in charge of delivering the meals to the children at schools running the CHEP school meal program (breakfast, lunch, and/or snack). Their basic duties are to plan, prepare, and deliver meals for the nutrition program in their respective school. The meals they serve can be breakfast, morning and/or afternoon snacks, and/or noon lunches (cold or hot meals) (R. Mireles, personal communications, September 10, 2007). These coordinators may be a community volunteer receiving honorarium from CHEP, a teacher/education associate who is also a volunteer and thus receives an honorarium from CHEP, or a school board employee, what is happening now in Catholic schools.

Public schools / Catholic schools. These two terms refer to the two school divisions that took part in this study: Saskatoon Public School Division and Greater Saskatoon Catholic School Division, respectively. It is noteworthy to explain the main differences among these participant schools, which are related to the School Division (Public or Catholic) and the type of school (community or non-community school). Public and Catholic schools differ on how the nutrition coordinator is hired and how the program works. Public schools have nutrition coordinators mainly as "volunteers", who receive a

small honorarium paid by CHEP. On the other hand, Catholic schools, just very recently, began to hire nutrition coordinators through the Education Board; nutrition coordinators are now school employees receiving wages.

The funding depends whether the school is Public or Catholic, community or non community school. The *Saskatchewan Community School Program* was developed in 1980 by Saskatchewan Learning (then Saskatchewan Education) and based on community education principles to address the needs of the communities the school serves, such as poverty and other complex social issues (Saskatchewan Community Schools Association, 2006; Saskatchewan Learning, 2005). Schools participating in this program are called *community schools*. These schools receive funding from the Saskatchewan Community Schools Association (SCSA) to run CHEP nutrition program, whereas non-community schools receive funding from CHEP and other associations such as the school's Parent Council.

If a school is a Public community school, the funding for the nutrition program usually comes from both the SCSA and the Parent Council. If it is a Public non-community school, CHEP and Parent Council provide the financial requirements to run the program. This picture changes if the school is Catholic, whose funding then comes from the School Division and CHEP if it is a non-community school, or from the School Division and SCSA if it is a community school. Nonetheless, all schools running CHEP school nutrition program are under CHEP's orientation (R. Mireles, personal communication, September 10, 2007).

Minimum nutritional standards. According to the scientific literature, discussed in the next chapter, school meals can have positive impact on children's health and aca-

demic performance by offering one-third of a child's daily needs—defined by the Dietary Reference Intakes (DRIs) (Institute of Medicine (IOM), 2006)—at lunch and one-fourth at breakfast and snack. Minimum nutritional standards are the minimum amount of nutrients each type of meal should offer daily according to children's age.

Standard Child. To establish the minimum standards for school meals, some DRI equations, such as for energy and protein, require information on age (in years), weight (in kilograms), height (in meters), and PAL. This information comprises a *standard child* whose characteristics of age, weight, height, and PAL were used to establish the minimum nutritional standards.

Chapter 2 will review the relevant scientific literature on school health and nutrition policies, school nutrition education, school nutrition standards, monitoring and evaluation of school meals, establishing minimum standards, and, finally, the background of the study design.

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CHAPTER 2
LITERATURE REVIEW

Usually, school meals are one component of a large system of health policies, as depicted in Figure 2.1. This chapter provides some background on school health and nutrition policies, including the *Health Promoting Schools* concept, comments on school nutrition education and nutrition at schools, discusses about evaluation studies on school meal programs, and, lastly, examines the literature on the methodology used.

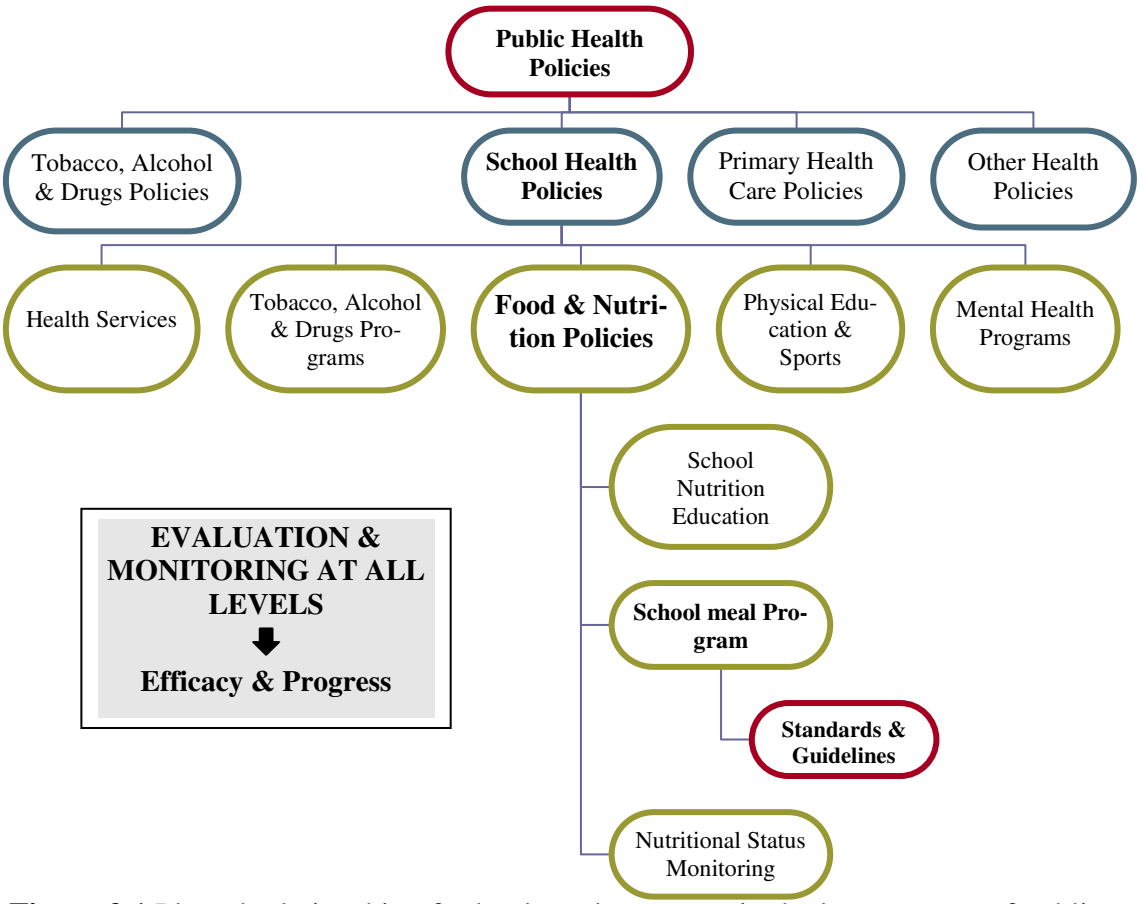

Figure 2.1 Plotted relationship of school meal programs in the large system of public health policies. Evaluation should be conducted continuously at all levels to assure efficacy and desirable outcomes.

2.1 School Health Policies

Chapman and Edmonds (2007) define policies as "statements of principle or intent that guides the selection of priorities [setting] the direction of programs and actions of individual, organization, or government. Values, convictions, and beliefs form the basis for a policy statement" (page 103). Policies are neither a plan for action, nor an anticipated outcome of an action. They may guide plans for programs, services, products, or campaigns and set standards for measuring the quality of programs, services, or products. Policies may also allocate funds and set directions and priorities for research and development. Granted that policies have broad and strong implications and, consequently, far-reaching influence, they have long been used to deter people from unhealthy practices and behaviours (Chapman & Edmonds, 2007; Vecchiarelli et al., 2006). Because schools can reach large portions of the community, they become a main venue for the establishment of health policies to impact school physical and cultural environment (Vecchiarelli et al, 2006) and, consequently, improving children's health and health knowledge.

Typically, policies are initiated in response to a perceived problem. McKenna (2000) writes that, traditionally, health policies in schools were developed in response to acute diseases, such as tuberculosis, pneumonia, or polio, with a focus on the prevention and treatment of such illnesses. However, school health policies shifted their focus from disease treatment to health promotion in the 1960s, when non-communicable chronic diseases, as cardiovascular disease and cancers, became public health concern. In Canada, a new school health program developed in the province of British Columbia, in 1962, illustrates the beginning of this shift in the country (see Benson & Beattie, 1964). Benson and Beattie (1964) commented that, although the program's objectives did not

introduce too many radical changes for that time, the objectives did recognize and register as policies certain health promotion practices such the encouragement of fostering attitudes in the children to help them in conserving and promoting their own health. Thus the concept of health promotion and the recognition of schools' role in teaching lifelong health knowledge were emerging.

On the international scene, the WHO launched a series of initiatives that contributed to the conceptual development of health promotion and helped to legitimate health promotion in schools worldwide. In 1977, the 13th World Health Assembly initiated *Health for All*, a document compelling governments to achieve a level of health that would enable world's population to lead a socially and economically productive life by the year 2000. WHO noted that this goal should be achieved through the promotion of health and through providing the right environment and enabling people to develop skills (Denman, Moon, Parsons, & Stears, 2002). *Ottawa Charter for Health Promotion* (WHO, 1986), in 1986, further legitimized the concept of health promotion, which was then defined as:

> […] the process of enabling people to increase control over, and to improve, their health. To reach a state of complete physical, mental and social well-being, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment. Health is, therefore, seen as a resource for everyday life, not the objective of living. (WHO, 1986)

The Charter further suggests that "health promotion is not just the responsibility of the health sector, but goes beyond healthy life-styles to well-being" (WHO, 1986). By focusing on people and places, rather than diseases, the document creates the venues for the "settings" where health promotion could—and should—happen, e.g. hospital, schools, and workplaces. WHO's (1986) guidelines recommend five main areas of ac-

tion for a health promoting school: the building of health public policy, the creation of supportive environments, the strengthening of community action, the development of personal skills, and the reorientation of health services (Denman et al., 2002; WHO, 1986). The recognition of schools as an important setting for health promotion is an important step in the initiation of a *Health Promoting Schools* (HPS) framework.

Health Promoting Schools

Immediately after the *Ottawa Charter for Health Promotion*, a European symposium entitled *The Health Promoting School* provided an opportunity for the WHO to apply the above principles in developing the model health promotion to the school setting (Young, 2007), which gave birth to the *Health Promotion School* concept .

The terminology that describes health promotion in schools differs a little from country to country. To some extent, the concept of HPS evolved independently across the world. Interestingly, however, are the similarities in the approaches and the fact that, to some extent, they represent convergent thinking on how schools can affect the health of young people and bring this together into all-encompassing coherent models (Young, 2007). In Europe, the HPS contain three main elements: 1) time allocated to health-related issues in the formal curriculum through subjects including home economics, physical education, social education, and health studies; 2) the hidden curriculum of the school including staff/pupil relationships, school/community relationships, the school environment, and the quality of services, e.g. school meals; and 3) the health and caring services providing a health promotion role in the school through screening, prevention, and child guidance (Young, 2007).

In the United States, the presence of terms like the "healthful school environment," in the early 1950s, indicates an awareness of the wider influences on health in schools beyond the "health instruction" of the classroom. In the early 1980s, the term *comprehensive school health program* became the common term to encompass a broader approach. At that time, this concept comprised the health instruction, the school health services, and the school environment—remarkably close to the WHO's HPS model. Since 1987, the US *Comprehensive School Health* model comprises eight elements: health education, physical education, health services, nutrition services, health promotion for staff, counselling, psychological and social services, healthy school environment, and parent and community involvement (Allensworth & Kolbe, 1987; Young, 2007).

In Canada, already in the 1960s, the concept of health promotion in schools was already being seeded (Benson & Beattie, 1964). With the *Ottawa Charter for Health Promotion* (WHO, 1986), attention moved to the notion of comprehensiveness. In 1988, a national conference sponsored by Health Canada led to a national consensus statement of *Comprehensive School Health* (Canadian Association for School Health (CASH), 1991), which was endorsed by over 20 national education and health organizations and was revised in 2007 (CASH, 2007). Based on WHO's European model, the Canadian approach aims at

- "foster[ing] health and learning with all the measures at its disposal;
- engag[ing] health and education officials, teachers, teachers' unions, students, parents, health providers and community leaders in efforts to make the school a healthy place for all;
- […] provid[ing] a healthy environment, school health education and school health services, health promotion programs for staff, healthy food choices, daily physical

activity/education, and programs for counselling, social support and mental health promotion;

- implement[ing] policies and practices that respect an individual's well-being and dignity, provide multiple opportunities for success, and acknowledge good efforts and intentions as well as personal achievements." (CASH, 2007, page 1)

Unlike the approach in the United States, comprising eight elements, the Canadian *Comprehensive School Health* incorporates four main ones. These four elements follow the same three principles of WHO's *Health Promoting Schools* (CASH, 2007):

- **Teaching and learning**: students and staffs receive information about health, wellness, health risks and health issues;
- **Health and other support services**: not always they are responsibility of the school. Some examples are child protection and other social work services; guidance services, psychological counselling and mental health promotion, and pre-service and in-service training of health and other professionals;
- **Supportive social environment**: formal or informal psychological and social support, such as role modeling by school staff; and
- **Healthy physical environment**: clean, safe, health-promoting environment to help prevent injuries and disease and to enable healthier food choices, for example: safety procedures and regulations; environmental health standards; accessible and sustainable environments that promote physical activity, and food and nutrition policies and services that promote healthy eating.

The endorsed approach can be found in several provincial programs. A health promotion program in British Columbia, for example, called *ActNow BC*, created the *Action Schools! BC*, designed to assist schools in promoting healthy living through best practices on physical activity and healthy eating (Government of British Columbia, 2008). The *Action Schools! BC* is an example of a comprehensive school approach that was able to modify chronic disease risk factors in elementary school children (Naylor, Macdonald, Reed, & McKay, 2006).

In Saskatchewan, the *Evergreen Curriculum* also applies some *Comprehensive School* principles by providing learning resources to integrate four main topics—

Bullying Prevention and Intervention, *Celebrate Saskatchewan*, and *Drug Awareness*, *Respect for Diversity* (sexual orientation and gender identity)—into curriculum subjects such as Math, Languages, and Arts (Saskatchewan Learning, n.d.-a).

HPS is clearly a comprehensive set of principles and guidelines to help schools to improve children's health, health knowledge, and healthful behaviours not only during their childhood and school years, but for their life.

Though little research has been conducted on schools with a HPS approach, it has been shown that the model may impact on the social and physical environment, school lunch provision, exercise programs, and social atmosphere. The approach shows promise in improving health-related behaviour, such as dietary intake, and aspects of health, such as fitness. In fact, programs promoting healthy eating are amongst the most effective (Lister-Sharp et al., 1999; Stewart-Brown, 2006); and school meals are one resource of these programs.

Nutrition and healthy eating are strong components of any comprehensive school health approach and contribute to achieving several objectives such as the promotion of health and well-being since healthy eating is strongly associated with good health; the teaching of adequate individual health skills and action competencies since the nutrition component links theoretic classroom education with practical experience; the offering of good health services, which may improve nutrition status and cognitive development; and the creation of a healthy physical environment, enabling healthy food choices and to restating classroom messages (CDC, 1996; Pérez-Rodrigo et al., 2001).

Given the importance of the nutrition component, the CDC, in the United States, adopted the comprehensive school approach and recommended seven essential actions

for schools to work towards a successful promotion of lifelong healthy eating (CDC, 1996):

1. **Policy**: adopt a coordinated school nutrition policy that promotes healthy eating through classroom lessons and supportive environment;

2. **Curriculum for nutrition education**: implement nutrition education from pre-school through secondary school as part of a sequential, comprehensive school health education curriculum designed to help students adopt healthy eating behaviours;

3. **Instruction for students**: provide nutrition education through participatory activities that involve social learning strategies;

4. **Integration of school food service and nutrition education**: coordinate school food service with nutrition education and with other components of the comprehensive school health program to reinforce messages on healthy eating;

5. **Training for school staff**: provide staff involved in nutrition education with adequate pre-service and ongoing in-service training that focuses on teaching strategies for behavioural change;

6. **Family and community involvement**: involve family members and the community in supporting and reinforcing nutrition education.

7. **Program evaluation**: regularly evaluate the effectiveness of the school health program in promoting healthy eating and change the program as appropriate to increase it effectiveness.

The recommendations revolve around classroom nutrition education and reinforcing strategies. These strategies should include the development and implementation of a comprehensive school nutrition policy and a supporting school food service environment, which can be achieved through the offering of nutritious meals and adequate training of school nutrition staff (CDC, 1996).

Recognizing the essentiality of nutrition policies, school nutrition education, and program evaluation in a comprehensive school nutrition program, these components are discussed in the next sections of this chapter.

2.2 School Nutrition Policies

Granted their importance and large effectiveness, as mentioned earlier (refer to Chapter 1), school nutrition policies can affect a broad constituency: students, the direct customers; parents, the indirect customers for providing money to their children; school administrators and staff, also direct customers and/or program organizers; and school groups, the organizer of events, including fundraising (Bundy, 2005; McKenna, 2000). Therefore, countries such as Britain, the United States have increasingly been adopting school nutrition policies, both locally and nationally, mainly in response to concerns about child overweight. But Canada remains one of the few developed countries with no national school nutrition policy (O'Toole & McKenna, 2006).

School Nutrition Policies in Britain, United States, and Canada

In Britain, the School Food Trust, established in 2005 by the Department for Children, Schools and Families (DfES), former Department of Education and Skills, supports the improvement of school food and food skills through school nutrition policies (Golley & Clark, 2007). The United States, on the other hand, have established national school nutrition policies through the National School Lunch Act in 1946 and the Child Nutrition Act in 1966 (Kennedy & Cooney, 2001). In addition, local educational agencies in the United States are required to develop and implement wellness policies targeting student health promotion and childhood obesity reduction through school nutrition policies—e.g. nutrition education, nutrition guidelines (National Alliance for Nutrition and Activity (NANA), 2004).

In Canada, although there is no national school health policy, three major policy documents illustrate the country's endeavours in the health promotion of its population: *New Perspective on the Health of Canadians*, from 1974; the *Ottawa Charter for Health*

Promotion, from 1986; and *Achieving Health for All*, also from 1986 (Public Works and Government Services Canada, 1990). The federal Ministry of Health called for the development of nutrition policies in 1990, through *Action Towards Healthy Eating* document, and again in 1996. The ministry also identified schools as an ideal setting for reaching children and adolescents (McKenna, 2000; Public Works and Government Services Canada, 1990).

No national nutrition policy has been developed to date in Canada. Instead, the government urges provinces to integrate nutrition into their school policies. An example is the suggestions made by the *Scientific Review Committee for Nutrition Recommendations* after a national extensive review of the health knowledge and behaviours of Canadian youth was conducted in 2001 (Health Canada, 2001). The committee suggested that provincial, territorial, and municipal governments fully integrate nutrition into curricula at all levels of the formal education system, including teacher education programs, make food served in Canadian schools consistent with the *Canada's Food Guide to Healthy Eating* (CFGHE), and initiate coordinated comprehensive food and nutrition policies in schools (Alberta Coalition for Healthy School Communities (ACHSC) & Dietitians of Canada (DC)-Alberta and Territories Region, 2006).

Some provinces have developed and implemented school nutrition policies or recommended guidelines prior to the federal government's recommendations such as in New Brunswick (Department of Education of New Brunswick, 1991). The majority, however, began to establish policies or to recommend guidelines mainly after 2000, outlining broader healthy living strategies, e.g. Alberta (Canadian Cancer Society, 2004), Manitoba (Government of Manitoba, 2005), British Columbia (Directorate of Agencies

for School Health (DASH), 2004), Ontario (Ontario Public Health Association, n.d.), Nova Scotia (Province of Nova Scotia, 2006), and Saskatchewan (Public Health Nutritionists of Saskatchewan Working Group, 2004). In the majority of provinces, including Saskatchewan, school policy falls under the purview of Boards of Education, consequently, much of the directives developed are called guidelines. Some provinces have more limited policies/guidelines such as relating to vending machines, cafeterias, and fundraising, whilst others have a more comprehensive approach to encompass aspects such as food security and nutrition education. Nonetheless, limited data exist on implementation and evaluation (O'Toole & McKenna, 2006).

Research on New Brunswick's school nutrition policy, which was proclaimed by the Department of Education in 1991, identified the selling of food for profit, students' choice, interpretation of the policy, and the approach to implementation as the main barriers in implementing school nutrition policies (McKenna, 2003), observed also in other studies (Berenbaum, 2004; Cullen et al., 2006; Gross & Cinelli, 2004). Hence, New Brunswick revised and approved the new *Healthier Foods and Nutrition in Public Schools* in October 11, 2005, through the Department of Education, to substitute the 1991 policy (Department of Education of New Brunswick, 2005).

In Newfoundland and Labrador, a school survey of food and nutrition policies and services conducted in 2001 observed that 59 percent of the province's schools did not have any specific food and nutrition policies or guidelines, and, in these schools, the incidence of non-nutritious food such as deep fried and processed food was the highest (Coalition for School Nutrition, 2001).

British Columbia has one of the most comprehensive school nutrition policies in the country. Its *Guidelines for Food and Beverage Sales in B.C. Schools*, for example, mandate no sales of foods in the "not recommended" and "choose least" categories for elementary schools by January 2008 and for middle and secondary schools by September 2008 (Ministry of Education & Ministry of Health of British Columbia, 2007). Also, the Directorate Agencies for School Health (DASH) in British Columbia developed the *School Food and Nutrition Policy Project* in 2004. Schools received CAD $1 500 in funding to help achieve the project objectives: to develop a school food and nutrition policy, to provide opportunities for students to practice choosing and preparing healthy foods, to increase access to healthy foods, to transfer lessons about healthy eating to the home environment, and to participate in nutrition education workshops/events (DASH, 2004).

Unlike British Columbia, Saskatchewan has very broad school nutrition guidelines. Developed by the Public Health Nutritionists Working Groups in partnership with the Saskatchewan Board of Education, these guidelines are considered less regulatory than other jurisdictions (Berlinic, 2007) and are meant "to strengthen awareness of the links between nutrition, health, and school performance, to serve as a resource for boards of education and school administrators in analyzing current nutrition practices in schools, and to provide a framework for developing nutrition policies in schools" (Public Health Nutritionists of Saskatchewan Working Group, 2004). A study with 252 Saskatchewan schools in 2004 reported, however, that participant schools did not perceive the need of establishing nutrition policies in schools (Berenbaum, 2004). It showed that about 126 participant schools did not have any kind of policy governing

vending machines, canteens, or cafeterias. Other policy-holding schools have mainly informal (unwritten) ones; a handful has formal policies (Berenbaum, 2004).

On the other hand, the study reported the nutrition education in Saskatchewan schools seemed relatively stronger and better perceived and implemented than nutrition policies (Berenbaum, 2004). In fact, this appears to be the reality in many school nutrition programs in Canada (Joint Consortium for School Health Secretariat, 2006). As school meals are an important tool of comprehensive school nutrition education programs, next section comments on history, components and a few other aspects related to nutrition education.

2.2.1 School Nutrition Education

Health education in schools has been practiced since the beginning of last century mainly due to the widespread concern about the physical condition of the population. Topics such as dental and personal hygiene, effects of alcohol on physical health, and cookery, hygiene, and domestic economy were part of the curriculum (Denman et al., 2002).

Just as health policies shifted their focus when obesity and related diseases became a growing public health concern, especially among children, the already existent nutrition education and training programs shift their emphasis from prevention of dietary deficiencies to the promotion of healthful eating habits. School nutrition education could then contribute that children and adolescents have the appropriate knowledge and skills to develop eating habits that promote health and prevent chronic diseases and obesity (Edelstein, 2006; Stang et al., 2003).

Components of a School Nutrition Education Program

In the school environment, classroom lessons alone may not be enough to provoke long lasting changes in students' eating behaviours. Students also need access to healthy food and the support of people around them throughout school life. They are more likely to receive a strong, consistent message when healthy eating is promoted through a comprehensive school health education program (CDC, 1996; Edelstein, 2006). The CDC guidelines for promoting healthy eating in schools (CDC, 1996) advocates that classroom lessons can be supported through the provision of healthier food choices in vending machines and the serving of healthy, well-balanced meals in cafeterias by school food service personnel, for example.

Nutrition education in schools focuses ideally on both nutrition information and developing skills and behaviours related to areas such as food preparation, food preservation and storage, social and cultural aspects of food and eating, enhance self-esteem and positive body image, and consumer aspects (Dixey et al, 1999). Pérez-Rodrigo and Aranceta (2003) identified that successful school-based nutrition education programs have certain characteristics such as behavioural focus, theory-driven strategies, adequate time and intensity, family involvement; multicomponent strategies, adequate and age-appropriate teaching methods, objectives of modifying school environment including access to healthy food, school food policies, and school meals, and they are also periodically evaluated. Figure 2.2 shows the main components to be considered in school-based nutrition education.

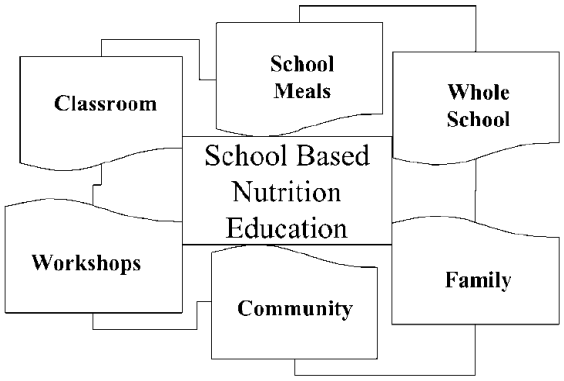

Figure 2.2 Components of school-based nutrition education (Source: Pérez-Rodrigo et al., 2001. Reproduced with permission of the authors).

Nutrition Education in Canada

In Canada, there is documentation of introducing health education in the curriculum in 1968, in Newfoundland, when the province was facing many health problems in schools, including diet-related issues (Dawson, 1970).

Currently, many jurisdictions have recently or are in the process of updating their health education related curriculum and related resource materials (Joint Consortium for School Health Secretariat, 2006). In British Columbia, besides the opportunities for teaching nutrition in Health and Career Education and Home Economics, some curriculum-based nutrition education programs are run by institutions that provide resources and, very often, teacher workshops. Some examples are the BC Dairy Foundation (BC Dairy Foundation, 2006), the Heart and Stroke Foundation of British Columbia and Yukon (2004) through the HeartSmart Kids™ programs, and the Mission Nutrition® (Kellogg Canada Inc., 2007).

Ontario has incorporated several nutrition and physical education subjects into the school curriculum. But most of them are taught only for grade 9 and above (Joint Consortium for School Health Secretariat, 2006).

In Saskatchewan, the Evergreen Curriculum incorporates health education in the school curricula and includes some nutrition topics. The health education curriculum is required from grade 1 to 9, and is optional for secondary level (Saskatchewan Learning, n.d.-b). For elementary school (grades 1 to 5), topics such as decision-making, infection prevention, emotional support, and self-esteem are approached in different years. Lessons on nutrition are designed to be taught in grade 2 (Saskatchewan Learning, 1998), and nutrition activities are incorporated piecemeal in the school mainly through incidental teaching anytime of the year (Berenbaum, 2004). Linked to the Saskatchewan Learning's Evergreen health education curriculum guide for grades 6-9 is *Fluids Used Effectively for Living* (FUEL). Based on the Comprehensive School Health model, FUEL is a multifactorial and interactive nutrition education program developed to positively influence knowledge, attitudes, and behaviour of students (Lo, 2005).

As indicated earlier, institutions such as CHEP have partnered with the school divisions (boards), Saskatoon Public Health, and the College of Nutrition from the University of Saskatchewan to deliver the program *Nutrition Positive*. The program aims at creating and supporting healthy food environment in participant schools by promoting healthy choices among children, advocating for nutrition policy for schools, addressing unhealthy practices, performing classroom and school activities, staff events, fundraising projects, and supporting meal programs. *KidsCAN* is another program offered by classroom teachers' requests and its sessions include, among other activities, "where

does our food come from?" activities and hands-on cooking. Saskatoon Public and Catholic Schools are actively engaged in CHEP's programs and activities to promote nutrition in their schools. Public schools engaged in the *Nutrition Positive* program have created a *Healthy Food Environment* to change awareness, education, behaviour, policy, and long term health of students and staff (Berlinic, 2007; CHEP, 2007).

2.2.2 School Meal Programs in Britain, United States, and Canada

As stated previously, the provision of food in schools either as school meals or in any other potential ways plays an important role on establishing a supportive environment for healthy food choices (Pérez-Rodrigo & Aranceta, 2003). Initially, the goals were to safeguard children from hunger, to prevent nutritional deficiencies, and to improve school attendance. It was done primarily through charitable or private institution concerned about children's health. During World Wars I and II, authorities began to demand provision of food in schools as means of improving children's physique to build up armies (Gunderson, 1971; Martin, 1996; Passmore & Harris, 2004). As time went by, schools meals demonstrated greater outcomes than merely feeding hungry, poor children. Currently, they aim mostly at promoting health and healthy eating habits among children.

Overall, the regulation of school meals provision varies widely within and between industrialized countries (Bartrina & Pérez-Rodrigo, 2006). Those holding national regulations seem the most advanced both in providing school meals and in conducting research to prove program's efficacy and to suggest improvements.

Britain

In Britain, the provision of school meals began in 1906, with the Education (Provision of Meals) Act, which permitted—but did not compel—Local Education Authorities to provide school meals to poor elementary school children. The aim was to enabling undernourished and needy children to benefit fully from their education. The number of school meals increased during the two World Wars and decreased in post-war periods. Between 1944 and 1980, school meals were then regulated through a new Education Act, becoming a duty upon Local Education Authorities. This regulation lasted until 1980, when the Act was abolished and school meals became discretionary again, i.e. Local Education Authorities could decide whether or not to provide meals in schools (Passmore & Harris, 2004). Short after the *Ottawa Charter for Health Promotion* (WHO, 1986), in 1992, the UK government set, for the first time, national targets for improving health. Objectives such as the decrease of heart diseases and obesity and the improvement of population's diet compelled the implementation of health promotion in many settings nationwide, schools included. Since then, initiatives such as the Health Promoting Schools led to the improvement in health education curriculum. Minimum nutrition standards were also developed since school meals became more common in schools—standards are presented in the next section of this chapter. Currently, school meals make a vital contribution to the dietary intake of school children in England; 43 percent of primary and secondary students receive school meals (Gunderson, 1971; Nelson et al., 2006; Passmore & Harris, 2004).

United States

In the United States, the National School Lunch Program (NSLP) was nationally established by the National School Lunch Act in 1946 "as a measure of national security, to safeguard the health and well-being of the Nation's children and to encourage the domestic consumption of nutritious agricultural commodities" (National School Lunch Program, 1946, cited in Kennedy & Cooney, 2001). Besides the national supported school lunch, the United States also established the School Breakfast Program (SBP) in 1966. SBP received permanent authorization in 1975 and has made breakfast available for many schoolchildren daily (Burghardt & Devaney, 1995; United States Department of Agriculture (USDA), n.d.). Being regulated by law, school meal programs in the United States have to follow certain nutritional standards in order to guarantee healthful food provision in schools. These standards are presented later on in this chapter.

Japan

The impact of a national law can also be evidenced by the school lunch in Japan, which was significantly improved after the establishment of the school lunch law in 1954. In 1992, over 98 percent of the children in primary schools and over 85 percent in junior high schools received lunch at school. The benefits were seen through the improved physical condition of those children and better relationship between teachers and children, and the increased knowledge on food, nutrition, and food hygiene (Fukuba, 1992).

Canada

Canada, unlike Britain, United States, and Japan, has no legislative framework supporting children's nutrition program, even in schools. Apart from no national effort,

throughout the 1940s and 1970s very little support was given to provincial initiatives (Henry, Allison, & Garcia, 2003). In fact, this lack of support is still observed for the absence of substantial data on the national status of school meals.

What is similar to the other countries, however, is that small local programs were initiated as a collective attempt to reduce the problem of hunger in young schoolchildren. Even though school-based nutrition programs were widespread across Canada by the end of 1980s, most were locally initiated and operated though community volunteers' efforts and propounded mainly by concerned community members and teachers who perceived the need of a feeding program (Dayle, McIntyre, & Raine-Travers, 2000; McIntyre & Dayle, 1992).

In the late 1960s, some provinces such as Newfoundland and Labrador attempted the implementation of a school meal program after perceiving the need of serving meals in schools. With the centralization of schools, children could no longer go home during lunch and recess time. Schools had inadequate, if any, food service facilities, making access to healthy meals difficult; but sugared beverages were widely available thought vending machines, contributing to huge increases in the consumption of soft drinks among children. A survey conducted in 1967 pinpointed the urgent need of establishing cafeterias and lunchroom facilities for the provision of better quality food. The uncovering of several problems on children's diet called the attention of both education and health departments. Health messages were then given in the classrooms, but the food available at schools was not yet in accordance with these messages (Dawson, 1970). Nonetheless, despite early efforts in implementing school food services, Newfoundland and Labrador had, in 2001, 45 percent of the province's schools not participating in any

type of school feeding program, from which only 29 percent offered breakfast, 15 percent, lunch, and 25 percent, snack (Coalition for School Nutrition, 2001).

The lack of government support combined with the Canadian Constitution, which assigns responsibility to the provinces and territories for providing direct health and education services, compelled some provinces to establish their own school food service program, whilst others continued to rely on community-based initiatives (Mutter, Ashworth, & Cameron, 1990).

British Columbia's *School Meal Program* is a great example of a provincial initiative which was operating in approximately 300 schools in 1999. Its purpose is "to feed as many students as possible, who would otherwise go hungry: safely, nutritiously, and economically," as well as lifelong nutrition education for both students and families. *Investing in All Our Children: A Handbook of Social Equity Programs* was distributed in September 1996 to help schools and districts operate their School Meal and Inner City Programs. Resources, guidelines, and evaluation tools provided through the program received collaboration from community nutritionists, principals, teachers, and School Meal Program coordinators. The Social Equity Programs, administered by the Ministry for Children and Families, provide funding through annual contribution agreements and schedules that outline terms and conditions. The school district and the regional operating agency of the Ministry for Children and Families are responsible for executing the agreement (McCall, 2003; Ministry for Children and Families of British Columbia, 1999). British Columbia also runs the *School Fruit and Vegetable Snack Program*, a pilot study that provides one serving of locally grown fruits or vegetables, two times a

week during the school year for elementary school children (Government of British Columbia, 2008).

New Brunswick implemented a pilot breakfast program named *Healthy Minds* in 1999 under the National Child Benefit program. The purpose of *Healthy Minds* was not to replace the breakfast that most students would normally receive at home but to provide hungry children in kindergarten to grade five with breakfast foods on an as-needed basis. Besides receiving some financial support to assist in implementing the program pilot, participant schools received a handbook outlining basic program goals and suggestions for implementation regarding, e.g., menu planning, food safety, ways to involve volunteers and the community. After its overall positive evaluation in 2000, authorities decided to continue the program and expended it in 2001 (Government of New Brunswick, 2002; National Child Benefit, n.d.).

In 2004, the government of Manitoba launched the *Healthy Kids, Healthy Futures All-Party Task Force* to promote healthy eating and active living for young people. The task force report, released in June 2005, recommended that the provincial government increased access to nutritious foods in schools as one strategy to address healthy eating. A survey on school nutrition in Manitoba schools, conducted in 2006 to create a baseline for the Task Force, reported that 44 percent of participant schools have funded school food programs, being the majority in elementary/middle schools. Sixty-one percent operated a milk program, 36 percent, a breakfast program, which increased 48 percent since 2001, 25 percent had a snack program, and 21 percent, a lunch program (Government of Manitoba, 2006).

The most common, however, are those programs executed by community and/or non-profit institutions within the school (McIntyre & Dayle, 1992).

School Meal Programs run by the Community

School meal programs run by the community are those initiated and administered by community members and/or community institutions within a school setting. The provision of meals is done in partnership between these stakeholders and school personnel or otherwise (McIntyre & Dayle, 1992). In Canada, there are several examples of community organizations that provide meals in schools.

In Alberta, the E4C, a charitable human services organization, is an example of a community-based strategy. It runs, among other programs, the Edmonton's *School Lunch Program*. It aims at "providing children with a hot lunch that meets a third of their daily nutritional requirements." Although families are asked to contribute financially, children are fed regardless of payment. Paid staff hired from the surrounding community is in charge of serving the meals—nearly 2 300 at a cost of about CAD $2 per meal. E4C also runs the Nutrition Snack Program (E4C Alberta, n.d.).

CHEP in Saskatoon is another example of community-based strategy that provides school meals through its *Children's Nutrition Program*. As many other programs—provincially or community operated—, CHEP school meal program was initially created to feed poverty-stricken children.

Advantages and Disadvantages of School Nutrition Programs run by the Community

Some Canadian school nutrition programs has documented some benefits, such as hunger alleviation, improved children's behaviour and cognitive performance (Edward

& Evers, 2001), as well as strong potential for preventing childhood obesity (Veugelers & Fitzgerald, 2005). The programs in British Columbia, New Brunswick, Manitoba, Alberta, Saskatchewan, as well as programs across Canada not mentioned in this review, share some common aspects: they started aiming at feeding poor, hungry children; they were rarely established though a systematic needs assessment; and evaluations of effectiveness are rarely conducted (McIntyre & Dayle, 1992; McIntyre, Travers, & Dayle, 1999). Once in place, their aims go beyond their original purpose. They purport to improve children's learning, model good nutrition, and relieve family stress for a wide catchment of children, not only the poor (Williams et al., 2003). Although this shift is not totally undesirable, undesirable, however, are their possible unintended negative consequences, such as dependency and stigmatization due to their *ad hoc* charitable characteristic (Hay, 2000; Raine, McIntyre, & Dayle, 2003). These issues could reproduce, rather than reduce, social inequities (McIntyre et al., 1999).

In addition to these consequences, children's nutrition programs may take on a family substitution role, thereby systematically excluding most parents from participating in program planning and operations. The waning active participation of community members makes such programs to be institutionalized and to lose community focus. At the same time, they are depoliticized, legitimating hunger as a matter of charity, rather than social justice. Nonetheless, community-based nutrition programs may be conceived from a social justice perspective, rather than a charitable perspective, if they are active components of a comprehensive strategy to enhance food security through poverty reduction (McIntyre, Raine, & Dayle, 2001; Raine et al., 2003).

It is indeed a comprehensive strategy that the American Dietetic Association (ADA), the Society for Nutrition Education, and the School Food Service Association support. They advocate that nutrition services must be integrated with a coordinated, comprehensive school health program and implemented through a school nutrition policy (Briggs et al., 2003) ADA also emphasizes that "community has a shared responsibility to provide all students with access to high-quality foods and school-based nutrition services as an integral part of the total education program" (Pilant, 2006).

One may conclude that even small, local programs such as CHEP's should be well planned, have clear and sound objectives, and be carefully implemented, allowing stakeholders' active participation at all levels—planning, implementation, evaluation, and modifications. The *Comprehensive School Health* framework and above arguments guide to the importance of comprehensive nutrition policies, which include standards and guidelines for ensuring that school meals are meeting the goals of the program—which might not be, indeed, only to feed hungry children—and for assessing how well policies are being implemented (Story et al., 2006).

2.2.3 Nutrition Standards

School nutrition standards or guidelines are rules or principles that govern the provision of food in schools. Although guidelines would be broader statements, such as "lunches should offer healthy food items", standards are more specific for they define a level of excellence or attainment as the measure of what is adequate for some purpose (adapted from Oxford University Press, 2008), such as "lunches should offer one-third of the Dietary References Intakes daily". Very often nutrition guidelines include nutrition standards. For instance, in the United States, school districts implementing local

School Wellness Policies covered standards in their nutrition guidelines that promoted whole grains, low-fat/nonfat dairy, and fresh fruits and vegetables (Weber, 2007). Thus the guidelines would state that these items should be given preference, while the standards would establish that grain products should contain a certain minimum amount of fibre and a maximum of fat per serving, for example. Being more specific, standards guide food personnel on what is the (un)acceptable range in a more practical, measurably way.

Nutrition standards can be food- or nutrient-based, and they are complementary to each other. The first type establishes the minimum number of servings, serving sizes, and food groups, usually according to the local food guide, whilst the second is based on the minimum nutrient content of the meal, such as calories, protein, fat, vitamins, and minerals. Nutrition and nutrient standards are somewhat different: nutrition standards include all of the nutrition goals for school meals, but nutrient standards are the required levels of calories and key nutrients for a specific grade or age group according to the meal served (breakfast, lunch, or snack) (Team Nutrition, n.d.).

The Importance of Nutrition Standards

Whatever way food service is provided—canteen, tuck shop, cafeterias, etc.—nutrient-based standards for school meals are desirable to guide food personnel and ensure adequate food and beverages are provided in schools. They should include information on food nutritional quality and portion sizes according to recipients' nutritional needs, age, and physical activity (Bartrina & Pérez-Rodrigo, 2006; Kaufman, 2007).

Standards for school food are the foundations on which all the other factors are set, which, in turn, influence eating well among schoolchildren (Crawley, 2005a). Estab-

lishing clear and objective standards help program evaluators check for program's efficacy and possible necessary changes for improvements. If standards/guidelines are unclear, there might be problems resulting from misinterpretation and, therefore, compromising the program's potential outcomes (McKenna, 2003; Nelson et al., 2006). Dietitians and nutritionists have always advocated that the most sensible method of ensuring a firm foundation is through compulsory nutrient-based standards (Crawley, 2005b).

Furthermore, nutrition interventions in school very often happen through changes in the already existent standards or through the establishment of standards if they are inexistent (Bartrina & Pérez-Rodrigo, 2006). To illustrate, an intervention in some Quebec primary schools established guidelines for peanut-free lunches and observed significant reductions in lunches' peanut content (Banerjee et al., 2007). Interventions through guidelines/standards modifications combined with nutrition education and/or with other modifications such as in the school environment, outcomes from these interventions can be even more effective, such as improve nutrient intake (Lytle et al., 1996), decrease consumption of soft drinks and sweets (Vereecken, Bobelijn, & Maes, 2005); and increase the availability and, consequently, the intake of fruits (Cassady, Vogt, Oto-Kent, Mosley, & Lincoln, 2006). The greatest promise for fruit and vegetable promotion among children is indeed through multi-component school-based interventions that combine classroom curriculum, parent and food service components (Blanchette & Brug, 2005).

Standards for foods in schools vary immensely from place to place, not only because standards should reflect local needs, but also because each site has different laws, policies, and regulations. Some countries regulate the quality of school meals by de-

manding certain nutrient content or consistency with national dietary guidelines, e.g. United Kingdom and United States. However, in most places existing regulations refer particularly to the hygienic aspects of food quality, food preparation and delivery, and program administration, e.g. Canada (Bartrina & Pérez-Rodrigo, 2006; Department for Children Schools and Families (DfES), 2006; Gordon, Crepinsek, Nogales, & Condon, 2007). Although compulsory standards can be seen in the United States and very recently in the United Kingdom, Canada is still very far from any national standard, both food- and nutrient-based, even farther from being compulsory.

School Food Standards in the United Kingdom and the United States

In the United Kingdom, guidelines for food served in schools were first established in 1941 covering energy, protein, and fat, and revised in 1955 and 1975. In 1980, however, with the abrogation of the Education (School Meals) Act, Local Education Authorities were required neither to provide school meals nor to meet any nutritional standard. Growing concerns about the nutritional content of school lunches and the increasing levels of childhood obesity in England compelled the DfES to introduce new compulsory National Nutritional Standards in 2001. These standards were food-based and aimed at ensuring to schoolchildren the opportunity to select healthy balanced meals at lunchtime. Meals should offer at least one item from the following food groups daily: starchy foods (e.g. bread, potatoes, rice), fruit, vegetables, milk or dairy item, and meat, fish or alternative source of protein (Nelson et al., 2004; Nelson et al., 2007; Rogers, Ness, Hebditch, Jones, & Emmett, 2007). In 2006, the UK Government endorsed, with some minor amendments, the *School Meal Review Panel*'s recommendations of establishing a nutrient-based standard besides the food-based one. The new standards will

come into force in September 2008 for elementary schools and in September 2009 for secondary and special schools (DfES, 2006).

In the United States, nutritional standards were set in 1946, when the NSLP was approved, and were revised in 1995, shortly after the 1991/92 School Nutrition Dietary Assessment Study (SNDA-I) uncovered several inconsistencies between what meals were offering and what they should be offering. The revision resulted in the *School Meals Initiative for Healthy Children* (SMI). The SMI not only maintained the long-standing standard of providing one-third (lunches) and one-fourth (breakfasts) of the 1989 RDA for calories and key nutrients (vitamins A and C, and calcium and iron) over a five-day period, but also included goals that are consistent with the Dietary Guidelines for Americans (USDA, 2001).

Table 2.1 presents the nutrient standards from the United States' NSLP and SBP, the United Kingdom's school lunches.

School Food Standards in Canadian Provinces

In Canada, there are neither food-based nor nutrient-based standards regulating food in schools. Provinces and local initiatives have been developed their own guidelines; most bases on food quality and uses the CFGHE as reference. In 2005, under the *Integrated Pan-Canadian Healthy Living Strategy* (Secretariat for the Intersectoral Healthy Living Network, 2005), health ministers committed to develop school nutrition standards as part of comprehensive school health efforts. Even though few local guidelines have been created, they are not compulsory and constitute solely a guide for those schools willing to serve children a healthful meal (Harper & Wells, 2007).

Table 2.1 Nutrient standards for the United States' National School Lunch Program and School Breakfast Program, and the United Kingdom's school lunches.

Country	Relevant Standards
United Kingdom[1]	**Energy**: 30% of the estimated average requirement[4] **Protein**: Not less than 30% of reference nutrient intake (RNI) [4] **Total carbohydrate**: Not less than 50% of food energy **Fat**: Not more than 35% of food energy **Fibre**: Not less than 30% of the calculated reference value **Sodium**: Not more than 30% of the SACN[4] recommendation **Vitamins A and C, folate/folic acid, calcium, iron,** and **zinc**: Not less than 40% of the RNI
United States[2,3]	**BREAKFASTS** One-fourth of the Recommended Dietary Allowances (RDA) for appropriate age/grade for protein, calcium, iron, vitamins A and C. Recommended Energy Allowances (calories) appropriate for age/grade group. Note: the minimum calories for Grades K-12 according to the Traditional Menu Planning Approach[5] are 554 kcal. **Sodium**[6]: Not more than 75 mg **Total Fat**[6]: Not more than 30% of total energy **Cholesterol**[6]: Not more than 600 mg. **Dietary fibre**[7]: one-fourth of daily target.
	LUNCHES One-third of the RDA for appropriate age/grade for protein, calcium, iron, vitamins A and C. Recommended Energy Allowances (calories) appropriate for age/grade group. Note: the minimum calories for Grades 4-12 according to the Traditional Menu Planning Approach[5] are 785 kcal. **Sodium**[6]: Not more than 100 mg **Total Fat**[6]: Not more than 30% of total energy **Cholesterol**[6]: Not more than 800 mg. **Dietary fibre**[7]: one-third of daily target.

[1] DfES, 2006

[2] USDA, 2007; Team Nutrition, n.d.

[3] Proportion of nutrients that children should receive from a school lunch of an average over five consecutive school days.

[4] *Estimated Average Requirement*: the average amount of energy or nutrients needed by a group of people; *Reference Nutrient Intake (RNI)*: the amount of nutrient which is enough to meet the dietary requirements of about 97 percent of a group of people. *Fibre*: the calculated reference value has been estimated on a proportion of the recommendation for adults based on the percentage of energy requirements. *SACN*: Scientific Advisory Committee on Nutrition, Salt and Health 2003, London.

[5] The Traditional Menu Planning Approach is one of the options that the School Breakfast (SBP) and the National School Lunch Programs (NSLP) offer for assessing menu nutrient quality. Nearly half of participant schools use traditional food-based menu-planning (Gordon & Fox, 2007).

[6] Based on National Research Council (NRC) 1989. Standards are not a requirement but are used to assess dietary components of meals offered through the SBP and NSLP (Gordon & Fox, 2007).

[7] Based on Institute for Cancer Prevention. Daily target for fibre: age + 5 grams. The 2005 Dietary Guidelines for Americans considers 14 grams per 1,000 calories. Standards are not a requirement but are used to assess dietary components of meals offered through the SBP and NSLP (Gordon & Fox, 2007).

An analysis of the implementation of the *Food and Nutrition Policy for New Brunswick Schools* (Department of Education of New Brunswick, 1991), which establishes guidelines for food served in schools, revealed that the objective of having all food services following provincial guidelines for healthy eating was so controversial that implementation was inconsistent and had little impact on school foods. Apart from inconsistency, misinterpretation and schools' priorities were also common issues (McKenna, 2003).

In British Columbia, *Guidelines for Food and Beverage Sales in BC Schools*, released in 2005 as part of the provincial health promotion program *ActNow BC*, regulate the quality of foods offered by schools (Government of British Columbia, 2008). They were revised in 2007 and established radical changes that schools must comply by this year of 2008: foods and beverages categorized under "not recommended" (e.g. candies and drinks where sugar is the first ingredient or the second ingredient after water) and "choose least" (e.g. french fries) must be eliminated from school; the "choose sometimes" foods and beverages (e.g. flavoured yogurts) can account for up to 50 percent of total items sold in schools; and the "choose most" category (e.g. whole grain breads and fresh vegetables) must account for 50 percent or more (Ministry of Education & Ministry of Health of British Columbia, 2007).

In 2005, New Brunswick's Department of Education approved a nutrition policy that sets standards and guidelines for healthy food awareness, food options available in schools, and sale of foods in and through the public school system (Department of Education of New Brunswick, 2005).

The *Healthy Kids, Healthy Futures All-Party Task Force* in Manitoba called on government to require all schools to have a written school food and nutrition policy with minimum standards as part of their school plan (Government of Manitoba, 2006).

Research on nutrition policies in Saskatchewan schools revealed that, in 2004, many participants did not have any set guidelines for foods in school, except informally. The few formal guidelines for school cafeteria focused mainly on healthy and affordable food, were unspecific, and lacked clear standards (Berenbaum, 2004). In that same year, the Saskatchewan School Boards Association partnered with the Public Health Nutritionists Working Group of Saskatchewan to create the *Nutrition Guidelines for Schools* (Public Health Nutritionists of Saskatchewan Working Group, 2004). This document provides general guide to help schools develop their own nutrition policy/guidelines.

Table 2.2 shows relevant aspects from food-based guidelines created in some Canadian Provinces approaching the provision of food in schools. Differences in components and comprehensiveness are clearly noticed when comparing provincial guidelines' contents. Some only list foods under certain categories (e.g. Manitoba), whilst others provide more details on number of servings according to children's age (e.g. British Columbia).

2.2.4 Monitoring and Evaluation of School Meals

This section presents the importance of monitoring and evaluation school meals and their programs, main evaluation studies on school meals conducted in the United States, England, and, lastly, studies already conducted in Canada and some provinces.

Table 2.2 Relevant aspects from food-based guidelines created in some Canada's provinces regarding the provision of food in schools.

<table>
<tr><th>Province</th><th>Relevant Aspects</th></tr>
<tr><td>British Columbia[1]</td><td>Lists "not recommended," "choose least" – foods in these categories were banned from schools in 2008 –, "choose sometimes," and "choose most" foods. Servings sizes according to the CFG. Milk as a beverage must be offered at least three times in a five-day period.
Minimum daily number of servings:
<table>
<tr><th>Grades</th><th>Grain products</th><th>Fruits and vegetables</th><th>Dairy</th><th>Meat and alternatives</th></tr>
<tr><td>4 to 7</td><td>2-3</td><td>1-2</td><td>1</td><td>1</td></tr>
<tr><td>8 to 12</td><td>3-4</td><td>2-3</td><td>1-2</td><td>1</td></tr>
</table></td></tr>
<tr><td>Manitoba[2]</td><td>Lists grain products, vegetables and fruits, dairy products, and meat and alternatives that should be served "most often," "sometimes" (3-4 times per month), and "rarely" (1-2 timer per month).</td></tr>
<tr><td>New Brunswick[3]</td><td>Lists foods of "maximum," "moderate," and "minimum nutritional value". Foods with "maximum nutritional" value should be available and promoted wherever and whenever food is sold or otherwise offered at school, including vending machines, canteens, cafeterias, and hot lunch programs.
Also offers a guide with age-appropriate serving sizes.</td></tr>
<tr><td>Newfoundland and Labrador[4]</td><td>Recommends that the number of servings in each meal should be chosen according to recipients' age and activity level. For that, it suggests ranges from each food group that could be served during school hours:
Grain products: 2-4 servings
Vegetables and fruits: 2-4 servings
Milk products: 1-2 servings
Meat and alternatives: 1 serving.</td></tr>
<tr><td>Ontario[5]</td><td>A snack should contain at least one serving from a minimum of two food groups of CFG with at least one serving from the Vegetables and Fruit food group.
Breakfast and lunch should contain at least one serving from a minimum of three out of the four food groups of CFG with at least one serving from the Vegetables and Fruit food group and at least one serving from the Milk Products food group.
Lists selection criteria for foods from each food group.</td></tr>
<tr><td>Saskatchewan[6]</td><td>Lists foods under "serve most often" (daily), "serve sometimes" (maximum of 2-3 foods per week), and "serve least often" (maximum 2 times per month).
Menus should be based on the nutrition guidelines in CFG:
Breakfast: one serving from each of three food groups
Snack: one serving from each of two or more food groups
Lunch: at least one serving from each of the four food groups</td></tr>
</table>

[1] Ministry of Education & Ministry of Health of British Columbia, 2007; DASH, n.d.
[2] Healthy Child Manitoba, n.d.
[3] Department of Education of New Brunswick, 2005.
[4] Ministry of Education of Newfoundland and Labrador, 2006.
[5] Ministry of Children and Youth Services, 2005.
[6] Public Health Nutritionists of Saskatchewan Working Group, 2004.

Importance of Monitoring and Evaluation of School Meals Program

Monitoring and evaluation are essential to improve the quality of the service to assure the potential contribution the service may have to promoting the health and well-being of schoolchildren (Pérez-Rodrigo et al., 2001). Even though evaluation can focus solely on assessing the effectiveness and efficiency of programs and their components, it is indispensable to follow the progress towards the major goals and to use the obtained results to encourage and enhance strategies, shaping a framework for action (Harper & Wells, 2007; Pérez-Rodrigo & Aranceta, 2003). Apart from framing actions, formal evaluations conducted regularly can increase parent and community support for school programs and support grant applications for enhancing the program (CDC, 1996).

Bartrina and Pérez-Rodrigo (2006) suggest a number of aspects that should be included in the evaluation of school meals and their outcomes, always focusing on the needs of users: high-quality foods of adequate portion sizes and nutrient supply and consistent with dietary guidelines; food variety and adequate food preparations; school policies supportive of a positive school environment; pleasant atmosphere (adequate physical structure, equipments, environment, etc.); user's needs and preferences; and positive nutrition and educational experiences. The first aspect is the most relevant for this study, since it deals with food quality.

The US School Nutrition Dietary Assessment Studies

About 20 years ago school meals' nutritional content has been more intensively evaluated—some countries more than others. Even in the United States, where the NSLP is in place since 1946, the first national formal evaluation happened only in the beginning of 1990s with the SNDA-I (Burghardt, Devaney, & Gordon, 1995). Although

another national study was conducted in 1984, it evaluated not the nutritional quality of the meals but particularly the differences of calorie and nutrient intakes of NSLP's and SBP's participants and non-participants (Hanes, Vermeersch, & Gale, 1984). Local, small studies evaluating nutritional quality of school meals have increased in the last decade in the United States, but most of them assess some level of intervention (Addison, Jenkins, White, & Young, 2006; Cullen, Watson, & Zakeri, 2008; Cullen et al., 2006; Seo, Hiemstra, & Boushey, 2003).

One of the landmark studies is the SNDA study, the major one in the country and commissioned by the USDA. Among other aspects, the study evaluates how lunches and breakfasts are complying with the SMI standards. Three SNDAs were conducted to date: 1991/92, 1998/99, and 2004/05. Although the second showed some significant improvements compared to the first one, the last did not show the improvement expected. In all three studies, selected nutrients (protein, vitamins A and C, calcium, and iron) have been meeting the standards; the main concerns lie on total fat, saturated fat, sodium, and, in some cases, calorie contents. Breakfasts seemed to have better nutrient profiles than lunches, as well as meals from primary schools were better than secondary schools (Burghardt et al., 1995; Fox et al., 2001; Gordon & Fox, 2007). Hence, the nutritional profile of school meals has improved over the past fifteen years but is not yet what it should be, particularly lunches.

Evaluation Studies in England

In England, either the Local Education Authorities or the board of Governors is now legally responsible for ensuring that the food and nutrient standards are met. In addition, schools have to provide evidence to the Office for Standards in Education about

how the learning experience incorporates issues around food and healthier eating and how school food is meeting the standards (Harper & Wells, 2007). Several studies have been already independently conducted on school meals' nutritional content, both in primary and secondary schools (Gatenby, 2007; Gould et al., 2006; Mock et al., 1997; Rogers et al., 2007). The landmark study in elementary schools was commissioned by the DfES and the Food Standards Agency in 2006 and carried out by Nelson and colleagues (Nelson et al., 2006). The survey assessed, among other factors, whether or not the food provided in a national representative sample of primary schools met the compulsory food-based standards set in 2001: only around 17 percent of the schools met all of the standards (Nelson et al., 2006).

Another study in England compared the food and nutrient intakes of primary school children eating school meals (hot lunch) and packed lunches through 3-day unweighed food record. The composition of those two types of lunches compared unfavourably with dietary guidelines. Intakes of energy and micronutrients such as calcium, iron, folate, zinc, magnesium, and riboflavin were too low, and intakes of total and saturated fat were too high. Nonetheless, standard of food brought from home by children was, if anything, worse than that served at school; children who ate school meals had higher lunchtime intakes of protein, starch, and most vitamins and minerals and lower intakes of sugar and saturated fat (Rogers et al., 2007).

Evaluation Studies in Canada and Provinces

In Canada, some evaluation studies have been conducted after policies were elaborated, particularly in the 2000s. Some examples are Newfoundland and Labrador (Coalition for School Nutrition, 2001), New Brunswick (Government of New Bruns-

wick, 2002), Nova Scotia (Murton, 2004), British Columbia (McCuaig, 2005; McCuaig & Chang, 2002), Ontario (Evers & Russel, 2005), and Manitoba (Government of Manitoba, 2006). In Saskatchewan, a report prepared for the Heart and Stroke Foundation was issued in 2004 with some findings regarding nutrition policies/guidelines in schools (Berenbaum, 2004).

Even though many provincial reports were issued only very recently, the impact of a food service in the school milieu was already being evaluated in the 1990s. Michel, Cyr, and Carbonneau (1994) evaluated and compared, from the viewpoint of the prevention of cardiovascular disease, meals from a school food service managed by a non-profit organization—as CHEP in Saskatoon—with those provided by a concessionaire in Quebec. Although the meals from the non-profit organization had somewhat better nutritional quality, both services offered meals rich in total fat and saturated fat.

Nonetheless, evaluations as this one in Quebec seem to be an exception. An exploratory analysis of 32 children's nutrition programs, including school-based ones, in Atlantic Canada revealed that more than half of the programs had been evaluated informally, only two had a formal evaluation been undertaken, and 13 did not perform any evaluation whatsoever or the information was unavailable. Eighty-five percent had the feedback from users, staff, volunteers, parents, and others as their benchmark of quality—in all instances, the responses were overwhelmingly positive. The fact that only two out of 13 programs were formally evaluated and others relied on users' feedback as evaluation implies that program operators do not seek external, objective validation of their outcomes. In fact, their own observations are used as measures of success and for program justification (McIntyre & Dayle, 1992). This conclusion is of great concern for

implementation of future programs and maintenance of those already in place. There might be great children's nutrition programs carried out by institutions or community, but, because formal evaluation is overlooked by most of them, this negligence results in the lack of reliable evidence of any positive outcomes. If it is for the Government to take over such responsibility—of feeding children—, providing authorities and policy-makers with clear evidence of benefits, possible barriers, and best practices should be a priority of any children's feeding program, school-based or not.

Tables 2.3, 2.4, and 2.5 provide a summary of published provincial reports and some findings relevant to this present study; many studies were conducted particularly after a commissioned request, usually from the provincial government. The tables show what appear to be the priorities across provinces. Evaluations conducted in Newfoundland and Labrador, Saskatchewan, and Manitoba (see Table 2.3), for instance, seem to focus on school nutrition policies/guidelines, and, in New Brunswick and Nova Scotia (see Table 2.4), on operational issues such as menu planning, delivery practices, and food service facilities. British Columbia and Ontario (see Table 2.5) have conducted studies on school nutrition programs' compliance with funder's guidelines which is, in this case, the Breakfast for Learning's. Since the existent provincial policies base mainly on food-based standards, the majority of studies that evaluated the nutritional quality of meals served gave priority to the food quality instead of the nutrient quality (e.g. calories, vitamins, and minerals contents). Programs funded by institutions or by the province seem more likely to be evaluated than independent programs.

Table 2.3 Summary of some Canadian studies focused on the evaluation of school nutrition policies and standards.

Author(s)	Year	Sample	Study Design	Studied Aspects	Relevant Findings
Coalition for School Nutrition (2001)	2000	- 251 schools (72% of province's schools)	- Self-administered questionnaire to school principals	- Existent food and nutrition polices and services, food service facilities, supports; - Identification of best practices, barriers and challenges.	- Overall, 46% of the food offerings in cafeterias were considered nutritious; - School cafeterias are often more likely to serve grilled or deep-fat fried items than salads, fruits, or yogurt.
Berenbaum (2004)	2004	- 252 schools (119 elementary) - 4 teachers, 3 students, 2 parents, and 2 community coordinators (interview)	- Self-administered questionnaire to principals - Telephone interviews of stakeholders	- Existence of nutrition & food policies, and barriers in developing them; - School nutrition and food activities; - Stakeholders' participation	- 15 schools had cafeterias; all offered lunch, and 13, breakfast. - Cafeterias typically served sandwiches/hamburger/hot dog/french fries, baked goods, juice, milk, and soft drinks.
Government of Manitoba (2006)	2006	- 539 schools (79% of province's schools), being 171 elementary, 136 elementary/ middle school, and 108 contained all	- Self-administered questionnaire (does not specify to whom)	- Assessed food services and food provision, guidelines and policies, food sold in schools and offered in cafeterias, and vending machines.	- In cafeterias, dairy products were the most common item, followed by 100% fruit juice and raw vegetables; - Hot foods contained a variety of nutritious and not so nutritious choices: 81% offered soup, 65%,

Table 2.4 Summary of some Canadian studies focused on the evaluation of operational issues of school nutrition programs.

Author(s)	Year	Sample	Research Design	Studied Aspects	Relevant Findings
Government of New Brunswick (2002)	1999 – 2000	- 52 schools from 2 school districts - K-G5 - "Healthy Minds" Breakfast Program Pilot	- Self-administered questionnaire to school personnel and parents - Interviews with school principals	- Program participation - Operational issues (e.g. menu planning, program delivery practices) - Major challenges - Partnerships	- Typical breakfast menus offered easy-to-serve items e.g. milk, juice, cereal bars, and toast; - Encountered problems with volunteers and stigmatization; - Students were behaving better since program implementation.
Murton (2004)	2003	- 26 informants (7 school board directors, 2 school board specialists in food & nutrition, 16 principals—8 from elementary—, and 1 in each provincial school board).	- In-depth telephone interviews	- Strengths and successes, issues, challenges, and opportunities related to the provision of healthy food choices; and - The use of local food products in public schools.	- Schools not always considered nutritional quality because of other challenges and priorities; - Very few insisted upon offering exclusively healthy choices; - Few schools had written policies; - Most elementary schools restricted student access to pop and candy, compared with very few junior and senior high schools.

Table 2.5 Summary of some Canadian studies focused on the evaluation of school nutrition programs against Breakfast for Learning's (BFL) best practices.

Author(s)	Year	Sample	Research Design	Studied Aspects	Relevant Findings
McCuaig (2005)	2004	- 36 BLF's *Progress Reports* (elementary, secondary schools) - 24 breakfasts, 13 snacks, 12 lunches	- Self-administered questionnaire (no specification to whom)	- Compliance with BFL's standards (best practices); - Reason for the program; - Types of food; - How, where, and when the food was prepared/served; - Target group;	- 9 programs followed CFG—thus considered nutritious; - Many of the programs met the standard for nutrition education support by serving nutritious food.
Evers & Russell (2005)	2003	- 119 BLF's *Progress Reports*; - 40 two-week menus - 26 schools were visited	- Self-administered questionnaire (does not specify to whom) - Two-week menu analysis - Observations and annotation of foods and amounts served in visited schools	- Assessed quantitatively breakfasts and morning snacks programs accordingly to the BFL's best practices; - Explored participants', parents', volunteers', educators', and program coordinators' attitudes towards child nutrition programs.	- 91% of breakfast programs served the minimum 3 food groups; - 90% of snack programs served the minimum 2 food groups; - Breakfasts and snacks provided an average of 364 kcal and 205 kcal, respectively; - Breakfasts and snacks had 26% and 22%, respectively, of energy from fat; - Breakfasts and snacks provided 2.2 g and 2.1 g, respectively, of fibre.

2.3 Methodology Background

This section presents the literature on both quantitative and qualitative methods used in this study, detailing the background on standards and techniques.

2.3.1 The Establishment of Minimum Nutrition Standards

Minimum standards are indispensables to evaluate nutritional content of school meals. This study used two sets of standards: nutrient-based, derived from the literature, and food-based, derived from the Saskatchewan's *Nutrition Guidelines for Schools*.

2.3.1.1 *Nutrient-based*

This standard was derived from the Dietary Reference Intakes (DRIs) (IOM, 2006), and its nutrient proportions were set according to those existent in the literature.

The Dietary Reference Intakes

The DRIs are a comprehensive set of nutrient reference values for healthy populations that can be used for assessing and planning diets according to specific age ranges. They reflect the current state of scientific knowledge with respect to nutrient requirements, both macronutrients and micronutrients, for the North-American population. For this study, the DRIs of most interest are the Estimated Average Requirement (EAR), the Recommended Dietary Allowance (RDA), the Adequate Intake (AI), the Estimated Energy Requirement (EER), and, to a smaller degree, the Tolerable Upper Intake Level (UL) (Health Canada, 2004b; IOM, 2006). The EAR is the median daily intake value that is estimated to meet the requirement of half the healthy individuals in a life-stage and gender group. It is based on a specific criterion of adequacy, being reduction of disease risk one of them. It is used to assess the adequacy of nutrient intakes, and can be

used to plan the intake of groups. The EAR derives the RDA. The RDA is the average daily dietary intake level that is sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) healthy individuals in a particular life-stage and gender group. The RDA is the goal for usual intake by an individual. If sufficient scientific evidence is not available to establish an EAR on which to base an RDA, an AI is derived instead. The AI is expected to meet or exceed the needs of most individuals in a specific life-stage and gender group, but it is not equivalent to an RDA. The EER is defined as the average dietary energy intake that is predicted to maintain energy balance in healthy, normal weight individuals of a defined age, gender, weight, height, and physical activity level (PAL) consistent with good health. In children and pregnant and lactating women, the EER includes the needs associated with growth or secretion of milk at rates consistent with good health. Lastly, the UL is the highest average daily nutrient intake level likely to pose no risk of adverse health effects to almost all individuals in a given life-stage and gender group (IOM, 2006).

As knowledge about specific nutrient requirements grows, so do the opportunities to apply these findings to populations served by public health programs. Thus, DRI nutrient recommendations are used as the foundation of federal nutrition policies. Applications and uses of the DRIs fall into two general categories: diet assessment and diet planning. In this study, the first interests us the most because it is the one used to measure progress of public health interventions to change consumer food choices. Besides these two categories, the use of the DRIs also depends on who will be assessed: individuals or population groups. For groups, which is the case of this study, the use of

RDA is inappropriate and the EAR should be used instead. If there is not an EAR, but an AI, it can be used for group assessment (IOM, 2006; Kaufman, 2007).

The NSLP's and SBP's nutrient standards (i.e. the SMI) are still based on the 1989 RDA (IOM, 1989) because, even though the current DRIs can be used to assess children's dietary intakes, they have not yet been translated for application to school meals program's menu planning (Gordon et al., 2007). Apart from that, the law supporting the NSLP and the SBP bases on the 1989 RDA (Burghardt, 1995; USDA, n.d.).

Because the 1989 RDA is not as complete and comprehensive as the new DRIs, in this study, the DRI's EARs and AIs were used to set up minimum standards.

Nutrient Proportions by Meal-Type

It is expected that each school meals—breakfast, lunch, or snack—offer a minimum amount of nutrients based on a certain percentage of a child's daily needs, which are dictated by the DRIs. According to the literature, these minimum amounts, or minimum standards, are usually one-fourth of the DRIs for breakfasts and snacks, and one-third for lunches (Crawley, 2005b; DfES, 2006; Fundo Nacional de Desenvolvimento da Educação, 2004; School Food Trust, 2007; USDA, 2007a, 2007b).

Age Groups

Evaluations of various population groups using the DRIs should be conducted accordingly to age range and gender for each nutrient (IOM, 2006), this study used nutrient recommendations for two age ranges: from 4 to 8 years old (4-8yr), or *younger children*, and from 9 to 13 years old (9-13yr), or *older children*.

Establishing Energy and Protein

To estimate the energy requirements it is necessary to determine age, weight, height, and PAL, which are inserted into the EER equation (IOM, 2006). The DRIs, particularly for vitamins and minerals, are based on references of heights and weights that were derived from CDC/NCHS Growth Charts' median height and median body mass index for ages 4 through 19 years (IOM, 2003). According to the Institute of Medicine (2003), these references are more closely related to low risk of chronic disease and adequate growth for children. Therefore, the same weight and height references were used in this study to establish standards for energy and protein (Table 2.6).

Table 2.6 Reference heights and weights of studied age groups[1].

Age Range	Reference Height (cm)	Reference weight (kg)	Reference Height (inches)	Reference weight (pounds)
Children 4 – 8 years old	115	20	45	44
Male 9 – 13 years old	144	36	57	79
Female 9 – 13 years old	144	37	57	81

[1] Source: IOM, 2003.

After weight and height were established, a specific age was set for energy calculations. In the CDC/NCHS Growth Charts(CDC/NCHS, 2000), the age that corresponds to the weight and height references is 6 years old, for the first age group (4-8yr), and 11 years old, for the second age group (9-13yr). Although females are also shown in Table 2.6, all calculations for older children were based exclusively on data regarding males, because their needs tend to be greater than girls' (IOM, 2006). Thus, if a lunch, for in-

stance, meets the standards for boys, most likely it will meet for girls as well. Besides, at the age 9 to 13, most of DRIs are the same for both genders (IOM, 2006).

Besides weight, height, and age, a PAL had to be set to complete energy equations. Although there is little hard evidence on trends in youth physical activity (French, Story, & Jeffery, 2001; Livingstone, Robson, & McKinley, 2003; Pratt, Macera, & Blanton, 1999), a recent Canadian survey revealed that younger children are more active than their older counterparts, being 5 to 10 year-olds more active than 11 to 14 year-olds, and these ones more active than 15 to 19 year-olds (Cameron, Wolfe, & Craig, 2005). Also, most of Canadian children participate in some kind of physical activity (organized or unorganized) after school hours, and that younger children are somewhat more likely than teenagers to participate in organized activities such as soccer, dance class, or competitive basketball (Cameron et al., 2005). The 60 minutes of moderate activities could be achieved cumulatively in school during physical education, recess, intramural sports, and before and after school programs. There are readily available opportunities to influence youth participation in physical activities at home and school, as well as in community (Strong et al., 2005). Granted these mentioned factors, the PAL factor used was that for *active* boys from 3 to 18 years old (i.e. 1.26). *Active* means the typical daily living activities plus at least 60 minutes of daily moderate exercise (IOM, 2006).

Carbohydrate and Fat

The DRI reports set carbohydrate recommendations based on the digestible carbohydrates. The methods used to obtain meal's nutrient content, described in the next chapter, make available only total carbohydrate content. Hence, to compare the carbo-

hydrate content of studied meals against DRI values, the total dietary fibre was subtracted from total carbohydrate, yielding the digestible carbohydrate content.

Since there is no recommendation for dietary fat (IOM, 2006), this nutrient was evaluated as percentage of total calories. The SMI standard, i.e. not more than 30 percent of total calories from fat, was used to assess meals' fat content (Gordon & Fox, 2007).

Studied Micronutrients (Vitamins and Minerals)

The analyzed vitamins were: vitamin A, C, D, E, B6, B12, folate in dietary folate equivalent (DFE), thiamine, riboflavin, and niacin in niacin equivalent (NE). And researched minerals were: iron, calcium, sodium, zinc, copper, magnesium, potassium, and selenium. Vitamins C and A, iron and calcium are addressed by both the NSLP and the SBP standards (Gordon & Fox, 2007). The other vitamins and minerals have also been largely investigated in other studies on school meal analysis, except B complex, copper, magnesium, and selenium (Addison et al., 2006; Burghardt, 1995; Dwyer et al., 1996; Fox et al., 2001; Gordon & Fox, 2007; Gould et al., 2006; Nelson et al., 2004; Nelson et al., 2006; Team Nutrition, n.d.). The exceptions were included in the analysis to verify if they would be a concern in CHEP school meals and, thus, provide better support and guidance for future establishment of nutrient standards.

2.3.1.2 *Food-based*

Unlike nutrient standards, food-based standards are already set for Saskatchewan schools. The *Saskatchewan's Nutrition Guidelines for Schools* are food-based guidelines for schools offering regular meal service (Public Health Nutritionists of Saskatchewan Working Group, 2004). It describes food safe and handling, lists examples of foods that

should be served most often, sometimes, and least often, and defines the number of servings and food groups each type of meal should contain. The guidelines establish that breakfast means one serving from three of the four food groups, snack means one serving from at least two food groups, and lunch means at least one serving from each of the four food groups (Public Health Nutritionists of Saskatchewan Working Group, 2004). Although their food groups, serving sizes, and number of servings were based on the 1992 CFGHE (Health Canada, 2007a), the only significant difference to the new CFGHE is the number of daily servings according to age groups (Health Canada, 2007b).

Only data from the three most recent years (2003, 2006, and 2007) were used, so that a recent pattern could be observed.

2.3.2 Background of Sampling Design and Data Collection

Previous research on school meal assessment describes the collection of samples being done through food recording by school staff (Burghardt, 1995; Drummond & Sheppard, 2004; Gordon & Fox, 2007; Gould et al., 2006; Government of Manitoba, 2006; Nelson et al., 2006; Sanigorski et al., 2005) or through collecting directly the menus and samples from schools (Addison et al., 2006; Dwyer et al., 1996; Evers & Russel, 2005). Some of these studies also weighed the food samples either throughout the collection process (Gould et al., 2006), occasionally (Nelson et al., 2004; Nelson et al., 2006), or when actual serving size could not be estimated (Sanigorski et al., 2005).

Most of these studies evaluate more than one day of food provision. In this research, however, more than one day of collection was not possible. Even though, the

results do provide some insight into what foods tend to be offered most frequently to students by the schools (Government of Manitoba, 2006).

2.3.3 Background of the Study Design

This study combines the use of quantitative and qualitative methods. In evaluation and monitoring of schools meals, a combination of qualitative techniques, such as focus groups, personal interviews, or observations, and quantitative methods, such as questionnaires or dietary assessment tools, is highly recommended and desired (Bartrina & Pérez-Rodrigo, 2006).

The use of both quantitative and qualitative approaches can be designed for complementary purposes and is becoming increasingly common in health and social science research (Sale, Lohfeld, & Brazil, 2002). Qualitative techniques have been shown to generate rich, detailed, and valid data that contribute to in-depth understanding of the context in which the studied phenomenon takes place, whereas quantitative approach generates reliable population-based and generalizable data (Casebeer & Verhoef, 1997; Johnson, Onwuegbuzie, & Turner, 2007; Sale & Hawker, 2005). Apart from allowing a more holistic interpretation of the research questions, the combination of qualitative and quantitative methods contributes to ensure high reliability of data and understanding the contextual aspects of the research (Creswell, 2003; Sale et al., 2002); it is the pursuit of knowledge in different but complementary ways (Casebeer & Verhoef, 1997; Thurmond, 2001; Yauch & Steudel, 2003).

The quantitative approach is the nutrient and food analysis. The qualitative techniques used in this study are coupled field observations and field notes, and focus groups interviews. This combination of methods allows triangulation of data.

Qualitative Approaches

Field notes. Field notes are a written/typed record of events and observations kept by a researcher when gathering data. This qualitative technique allows the researcher to prepare very detailed notes about events, as well as the date, time, and place of observation (Wason-Ellam, 2006). Since field notes are useful for summarizing conversations, insider language, and questions about people or behaviour at the site of an investigation (Morse & Field, 1995), they are a powerful technique for observations on children's food consumption behaviour and plate waste. Observations of excessive plate waste, for example, may indicate that children are not fully benefiting from the nutrients offered by meals served, especially if the waste is derived from foods such as fruits and vegetables (Guthrie & Buzby, 2002).

Qualitative interviews. Kvale (1996) defines qualitative research interviews as "attempts to understand the world from the subjects' point of view, to unfold the meaning of peoples' experiences, to uncover their lived world prior to scientific explanations" (p.1). Interviews with research or evaluation purposes may promote intellectual understanding and produce personal change, but the emphasis is indeed on understanding rather than changing (Kvale, 1996). Therefore, they can also be used to gain insight into interesting or unexpected findings after results of more standardized measures are analyzed. In qualitative evaluations, open-ended responses provide the evaluator with quotations, the main source of raw data (Sewell, 2006).

The technique of interview is recommended for this study because it may capture and describe program processes, explore individual outcomes and differences in experi-

ences among program's participants, and reveal the meaning of a program for its participants (Sewell, 2006).

Focus groups. Focus group interviews, unlike individual interviews, provide the added dimension of the interactions among members (Wason-Ellam, 2006). This interaction permits mutual influence of opinions, making the focus group an instrument to potential transformation of individuals' and group's reality (Castilho, 1998, cited in Gonçalves, Lima, Crisitano, & Hashimoto, 2007). This exchange of knowledge and perceptions becomes the learning instrument that promotes reflection and group's growth and may transform every day dilemmas into thoughts better adjusted to reality (Gonçalves, Leite, & Ciampone, 2004; Morse & Field, 1995).

Triangulation. Triangulation in research strengthens the study design and increases the ability to interpret the findings through the use of two or more aspects of research (Thurmond, 2001). Its primary purposes are to explore convergence, complementarity, and dissonance, leading to a multidimensional understanding of complex issues (Farmer, Robinson, Elliot, & Eyles, 2006). The between-method triangulation, which was used in this study, increases the potential of exposing unique differences or meaningful information that may have remained undiscovered with only one approach or data collection technique (Thurmond, 2001). In other words, the qualitative input from focus groups and on-site observations may clarify some aspects that the figures might have failed to answer, such as possible reasons and personal motives leading to some of the findings.

CHAPTER 3
RESEARCH DESIGN AND METHODS

This chapter details the research design, summarizes the standards used for assessing the meals samples, explains the data collection and its analysis, and, lastly, ethics and confidentiality of the study.

3.1 Research Design

As mentioned, this inquiry used both quantitative and qualitative research approaches. The quantitative comprises of two main components. The first are the previous reports of CHEP meals' nutrient content issued from 1997 until 2006. The second component contains the nutritional analysis of meals offered by CHEP supported schools for the 2007/08 school year.

Two qualitative techniques were used in this study. The first consisted of focus group interviews of selected nutrition coordinators. The second involved on-site observations of selected mealtimes to observe mealtime practices and plate waste among elementary school children.

3.2 Quantitative Analysis

The quantitative analysis was intended to answer research question number one and two: "*To what extent do meals (breakfast/snack/lunch) offered by some elementary schools in Saskatoon meet the recommended guidelines of one-third of the Dietary Reference Intakes (DRI) for specific nutrients for lunch and one-fourth for breakfast and*

snacks?" and "*What are the trends in food/ nutrient quality for meals served in selected Saskatoon schools? How do meal compare along the years?*", respectively.

3.2.1 The Minimum Nutrient Standards

According to the literature review, the final profile for the age ranges is a 6 year-old male, weighing 20 kg, 115 cm high, and active, representing the younger group (4 to 8 years old); and a 11 year-old male, weighing 36 kg, 144 cm high, and active, representing the older group (9 to 13 years old). These standard children provided the required information to set minimum standards for energy and protein. Table 3.1 details the EAR values and the set minimum nutritional standards for macronutrients according to each type of meal (one third for lunches and one-fourth of DRI for breakfasts and snacks) and age group.

One-fourth and one-third of the EAR or AI values (IOM, 2006) also dictated the minimum standards for vitamins and minerals in breakfasts, snacks, and lunches. Tables 3.2 and 3.3 show the DRIs and the minimum standards set for studied vitamins (vitamin A, C, D, E, B6, B12, folate DFE, thiamin, riboflavin, and niacin NE), and studied minerals (iron, calcium, sodium, zinc, copper, magnesium, potassium, and selenium), respectively.

3.2.2 Dataset I – Reports from 1997 to 2006

Dataset I consisted of reports issued in 1997, 1999, 2000, 2001, 2003, and 2006. Menus were assessed also in 1998, but there was no report available, and the other missing years—2002, 2004, and 2005—were not evaluated. The reports comprised summary analysis of breakfast, lunch, and/or snack programs (Table 3.4) obtained from data col-

lected annually around spring season, usually in May. The one exception, the 2006 report, collected data in November 2005. Elementary schools were the major participants in all years. Only two reports, one issued in 2003 (five schools) and other in 2006 (one school), included secondary schools as well. The inclusion of secondary schools in this Dataset I did not change the overall results considerably, since the number of its samples was not representative.

Table 3.1 Dietary Recommended Intakes (DRIs) and minimum standards for macronutrient content of breakfasts, snacks, and lunches, according to age group.*

Macronutrients		**Age range**	
		4-8 years old[a]	**9-13 years old[b]**
Estimated Energy Requirement (kcal) [c, d]		**1,718.4**	**2,282.1**
	1/3	572.8	760.7
	1/4	429.6	570.5
Total Protein (g) [e]	**EAR (g.kg.day^{-1})**	**0.8**	**0.8**
	1/3	5.1	9.1
	1/4	3.8	6.8
Carbohydrate (digestible) (g)	**EAR (g/day)**	**100.0**	**100.0**
	1/3	33.3	33.3
	1/4	25.0	25.0
Dietary Fat		≤ 30% of total calories	
Total Dietary Fibre (g)	**AI (g/day) [f]**	**25.0**	**31.0**
	1/3	8.3	10.3
	1/4	6.2	7.7

* Legend: EAR = Estimated Average Requirements; AI = Adequate Intake; 1/3 = one-third of Dietary Recommended Intakes—the minimum standard for lunches; 1/4 = one-fourth of Dietary Recommended Intakes—the minimum standard for breakfasts and snacks.

[a] Both boys and girls are under the same category (as "children").

[b] Although recommendations are separated by gender, boys and girls, the recommendations are the same for both.

[c] Boys 3-8 years old: 88.5 – (61.9 x age [y]) + PA x {(26.7 x weight [kg]) + (903 x height [m])} + 20

[d] Boys 9-18 years old: 88.5 – (61.9 x age [y]) + PA x {(26.7 x weight [kg]) + (903 x height [m])} + 25

[e] EAR for protein (g/day) was determined as the amount needed per kg of body weight multiplied by the reference weight established for each age range, i.e. 20kg and 36kg, respectively.

[f] Boys' Adequate Intake at the age range of 9-13 years is greater than girls' (26g/day).

Table 3.2 Dietary Recommended Intakes (DRIs) and minimum standards for studied vitamins, according to age group.*

Vitamin	4-8 years[1]			9-13 years[2]		
	EAR	**1/3**	**1/4**	**EAR**	**1/3**	**1/4**
Vitamin A RAE (IU)	**917**	305	229	**1483**	494	370
Vitamin C (mg)	**22.0**	7.33	5.50	**39.0**	13.00	9.75
Vitamin D (mcg)[†]	**5.0**	1.67	1.25	**5.0**	1.67	1.25
Folate DFE (mg)	**160**	53	40	**250**	83	62
Thiamin (mg)	**0.5**	0.17	0.13	**0.7**	0.23	0.18
Riboflavin (mg)	**0.5**	0.17	0.13	**0.7**	0.23	0.18
Niacin NE (mg)	**6.0**	2.00	1.50	**9.0**	3.00	2.25
Vitamin B6 (mg)	**0.5**	0.17	0.13	**0.8**	0.27	0.20
Vitamin B12 (mg)	**1.0**	0.33	0.25	**1.5**	0.50	0.38
Vitamin E (mg)	**6.0**	2.00	1.50	**9.0**	3.00	2.25

* Legend: EAR = Estimated Average Requirements; 1/3 = one-third of Dietary Recommended Intakes—the minimum standard for lunches; 1/4 = one-fourth of Dietary Recommended Intakes—the minimum standard for breakfasts and snacks.

[†] Recommendations are Adequate Intakes (AI); there is not EAR for vitamin D.

[1] Requirements are for both boys and girls.

[2] Although recommendations are separated by gender, both boys and girls at this age range have the same requirements.

Table 3.3 Dietary Recommended Intakes (DRIs) and minimum standards for all studied minerals, according to age group*.

Mineral	4-8 years[1]			9-13 years[2]		
	EAR	**1/3**	**1/4**	**EAR**	**1/3**	**1/4**
Iron (mg)	**4.1**	1.4	1.0	**5.9**	2.0	1.5
Calcium (mg) [†]	**800**	266	200	**1300**	433	325
Sodium (mg) [†]	**1200**	400	300	**1500**	500	375
Zinc (mg)	**4**	1.3	1.0	**7**	2.3	1.7
Copper (mcg)	**340**	110	90	**540**	180	140
Magnesium (mg)	**110**	36.7	27.5	**200**	66.7	50.0
Potassium (mg) [†]	**3800**	1266	950	**4500**	1500	1125
Selenium (mcg)	**23**	7.7	5.7	**35**	11.7	8.7

* Legend: EAR = Estimated Average Requirements; 1/3 = one-third of Dietary Recommended Intakes—the minimum standard for lunches;1/4 = one-fourth of Dietary Recommended Intakes—a the minimum standard for breakfasts and snacks.

[†] Recommendations are Adequate Intakes (AI); there is no EAR for these minerals.

[1] Requirements are for both boys and girls.

[2] Although recommendations are separated by gender, but both boys and girls at this age range have the same requirements.

As in this present study, the sample collection technique used in all these previous studies was identical—more details under Dataset II subsection. In a few words, random visits were carried out to schools where standard servings from all food items were collected and weighted. Consistency in the used methodology allowed for combining of data of all years (i.e. 1997, 1999, 2000, 2001, 2002, 2003, 2006, 2007) for analysis and comparison. Prior to analysis, information from the previous years (i.e. 1997, 1999, 2000, 2001, 2002, 2003, 2006) was reviewed for completeness and accuracy. Then the "raw data" was reanalyzed using ESHA Food Processor Nutrition Analysis for Windows, version 8.7.0 (Cox et al., 2006). Table 3.4 describes the meals and number of samples (N) for Dataset I according to reports' year (1997-2006).

Table 3.4 Studied meals and number of samples (N) according to reports' year (1997-2006) for Dataset I.

Year of the Report	Meals Studied	N
1997	Lunch	15
1999	Breakfast	14
	Lunch	17
2000	Breakfast	9
	Lunch	18
2001	Breakfast	10
	Lunch	16
	Snack	3
2002	Breakfast	15
	Lunch	26
	Snack	3
2003	Breakfast	17
	Lunch	27
	Snack	6
2006	Breakfast	13
	Lunch	22

3.2.3 2007/08 school year – Dataset II

As mentioned previously, the second dataset comprises data gathered from meals served during the 2007/08 school year.

3.2.3.1 *Sample*

Twenty-one elementary schools were invited to participate in this portion of the study; 18 accepted (N = 18), 12 were Public Schools and the other six, Catholic schools (see Table 3.5). Of the three schools that chose not to participate, one indicated that it was re-building the kitchen, so it was not serving any meals. At the second site, principal explained that the nutrition coordinator was not willing to participate in the study nor to take part in the focus group; and the principal of the third school did not grant the permission to conduct the study in that particular school. Table 3.5 shows the number and characteristics of the schools that agreed to participate in the study.

Table 3.5 Number of schools in each school system (Public/Catholic) and their school meal program(s)*.

School Division	N	B & L	S & L	B, S, & L	L (only)
Public Schools	12	4	-	4	4
Catholic Schools	6	2	1	2	1

* Legend: N = sample size; B = breakfast program; S = snack program; L = lunch program

Schools were selected from a list of 32 institutions where CHEP administered the school nutrition program. Only those elementary schools offering at least one full meal everyday (i.e. breakfast or lunch) were invited to participate. Despite their inclusion in Dataset I, high schools were not included in this Dataset II, first, because only one secondary school was running CHEP program that year, and, second, because they do not

represent Dataset I considerably. Besides high schools, three day cares, one lodge, one community centre, and six schools with only emergency food were also excluded because they did not have a nutrition coordinator and did not represent the study's population.

Food samples were collected from all meals served at mealtimes to elementary school children. For breakfasts and snacks this included items such as toasts, breakfast cereals, and fruits, and for lunch, sandwiches, fruits, and soups. Food samples were collected from a total of 12 breakfasts (N=12), 18 lunches (N= 18), and seven snacks (N = 7).

3.2.3.2 *Data Collection*

Food samples collection occurred at random throughout the month of October 2007. Samples were collected by the researcher using a similar protocol as that of Dataset I. In each visit, the researcher asked the nutrition coordinator to provide one sample from each food item offered as part of the meal at the day of the visit. This sample was a "standard serving," i.e. a portion-size that would be the most common among children for each item according to the nutrition coordinator's daily practice and experience. If the nutrition coordinator pre-portions the food, one portion was the "standard serving" collected as sample. Samples were placed in plastic bags or containers, coded for future analysis, stored in a thermal box, and taken to the lab to be weighed. The weighing method gives more accuracy to the data than using household measures (Robson & Livingstone, 2000; Rutishauser, 2005). A Sartorius digital precision scale, type 1401A MP7-1, maximum capacity of 1 500 g, and readability of 0.01 g, was used. Visits were carried out once for each meal, in other words, if a school offered three meals, the re-

searcher visited the school three times, one for each meal, and not necessarily in the same day.

If the nutrition coordinator served a mixed ingredient dish (e.g. mixed salads, stews, soups, porridge, pastas, cakes, etc.), she provided the recipe with all ingredients and amounts. Other similar studies also used collected recipes to evaluate menus' content (Burghardt, 1995; Gatenby, 2007; Gould et al., 2006). Through the recipe's information, we calculated, in ESHA Food Processor software, the proportion of each ingredient and obtained the nutrition information per serving (one serving was the "standard portion" sampled).

To ensure consistency, the main researcher did the entire process of sampling, codification, weighing, and including data into ESHA Food Processor software.

3.2.4 Combined Data Analysis of Datasets I and II (1997-2007)

The data from datasets I and II were collected and inputted independently but gathered for final analysis. The ESHA Food Processor yielded a mean value for the studied nutrients for each year. These years' means form a complete set of data on nutritional quality of school meals from 1997 to 2007/08, which was, therefore, analyzed as one single dataset. Hereinafter the term dataset stands for this pooled information from 1997 to 2007/08, unless specified otherwise.

As noticed, the methodology is an *unweighed nutrient analysis*, which constituted of a simple average of all foods offered and provides a picture of the average meal offered to students. Therefore, it did not consider the relative frequency with which different types of food are served or selected by students, in other words, it does not reflect

student choices; a factor which school food service programs may influence but cannot control (Fox et al., 2001).

3.2.4.1 *Data Input*

The 1997 Canadian Nutrient File, available in ESHA Food Processor database, was used for all entries. American counterparts were chosen only if a certain food was not found in the Canadian File, except for fortified foods, such as bread, milk, breakfast cereals, and margarine; then the closest equivalent was chosen from the Canadian database.

3.2.4.2 *Statistic Analyses*

The statistic analyses consisted mainly of descriptive statistics and parametric tests.

Descriptive Statistics

Means for each year, as well as percentages and standard errors, were the main resource to present and discuss the findings. The meals' average nutrient content (both macro- and micronutrients) from each studied year was converted into percentage of the minimum nutritional standards, which was considered satisfactory if equal or greater than 100 percent. If it was lower than the standard, significant difference was verified through parametric statistics.

Parametric statistics

The SPSS® for Windows statistical software package version 15.0.0 (SPSS, Inc, Chicago, IL) was used to perform the analyses.

If the mean for a certain nutrient did not meet its minimum standard, one-sample two-tailed *t*-tests, significance level of 0.05 (p), being the year's mean as the test vari-

able and the minimum nutritional standard as the test value, was used to compared statistically against the standards for which it fell short. This same procedure was also used by Addison et al. (2006). Besides one-sample *t*-tests, univariate analysis of variance (ANOVA) evaluated the existence of any possible trends in energy. Univariate analysis of covariance (ANCOVA), being energy the covariate, checked for possible trends in any other macronutrient (protein, carbohydrate, or fibre) that did not meet its minimum standards. *T*-tests and analysis of variance enabled us to pinpoint the main concerns in CHEP school meals' nutritional content and to verify if there were any significant changes along the years, proving potential improvements. Trends in micronutrient content were analyzed by visual observation of graphs.

Snacks were not statistically analyzed due to their very small sample size, which does not give enough power to any statistics test (Vincent, 2005).

3.3 Qualitative Analysis

This section describes the two qualitative components in this study: on-site observations of selected schools and focus groups with selected nutrition coordinators.

3.3.1 On-site Observations

The second component of the study was on-site observations of food consumed by children in some schools participating in the study. These observations, which included consumption and plate waste of some school breakfasts and lunches, complement the answer of research question number one. Children's choices and actual consumption might tell if they are indeed acquiring the nutrients offered by school lunches and breakfasts.

Observations were done in the schools in which the visit for collecting the food samples coincided with the mealtime. The entire mealtime was observed by eyeballing, i.e. just noting what was eaten by each student during the mealtime. Notes were taken throughout the observation with a worksheet developed for effective documentation (Appendix A). Because it was not feasible to observe all meals (breakfast, lunch, and snack) in all participant schools, four were selected for observations according to the visit schedule. Two breakfasts and two lunches were observed. Observation of snacks was not possible because the majority of participant schools served snacks in the class-room.

3.3.2 Focus Group Interviews

The third component of the study involved qualitative focus group interviews of selected nutrition coordinators. Information gathered was intended to answer the third research question: *What are the perceptions of nutrition coordinators concerning menu planning and service practices [adherence to nutrition standards/ guidelines]?*

3.3.2.1 *Subjects*

Nutrition coordinators from all participating schools were invited to take part in the study. Nine agreed to participate: four from Catholic schools and five from Public schools. Among those nutrition coordinators who chose not to participate, one could not coordinate her other job with the meetings, another one simply said she could not attend, and the third was in maternity leave. The other six who agreed to participate did not show up in the scheduled dates and did not give any explanation for their absence. Pro-spective interviewees were contacted initially by a mailed letter and, subsequently, by phone to be interviewed. Participating nutrition coordinators attended one from the three

offered meetings on the date and time that were more convenient to them (January 4th, 2008, at 13:30h; January 10th, 2008, at 18:00h; and January 11th, 2008, at 13:30h). These three different meetings hosting different nutrition coordinators increased the range of beliefs and values that represent the population under study and the heterogeneity between the groups (Morse & Field, 1995).

At the end of the interviews, each participating nutrition coordinator received a small honorarium from CHEP, as is usually the case when they attend monthly CHEP nutrition coordinators' meeting. They also received a small thank-you from the project—a five-dollar gift certificate as recognition for their participation.

3.3.2.2 *Interview Guide*

A semi-structured interview guide was developed for the study (Appendix B) (Greenbaum, 1998); three CHEP's personnel working in the *Children's Nutrition Program* reviewed its content for accuracy and suggested alterations. The guide was designed to be completed in about 60 minutes and to focus on the following themes: training, knowledge and use of nutrition standards, menu planning, perceived food and menu practices based on some results from the quantitative analysis of this study, and some barriers to implementing menu changes. The sessions were recorded using a Panasonic Digital Voice Recorder model RRUS450, along with some written notes. Written permission was obtained from participants prior to the beginning of the interview. The recordings were professionally transcribed verbatim by an administrative assistant from the College of Pharmacy and Nutrition, University of Saskatchewan, and a copy of the transcription was sent to all participants for their comments and revisions as needed.

3.3.2.3 *Interview Analysis*

Each transcription was read several times and notes were taken in the margins, summarizing the data and identifying key concepts. This process surfaced general themes and sub-themes, and the most outstanding issues.

3.4 Ethics and Confidentiality

Ethics approval from the University of Saskatchewan Advisory Committee on Behavioural Ethics in Human Experimentation was granted on May 23rd, 2007, prior to the beginning of the study. Permission was also sought from Saskatoon Public and Catholic School Divisions (Appendix C), which was granted in September 2007. Letters were sent out to all selected schools asking for verbal consent from the principals (Appendix D). Simultaneously, another set of letters were sent to nutrition coordinators outlining the research, what was expected from them, and the procedures that would be followed (Appendix E). The specific date of collection was not revealed either to the nutrition coordinator or to the principal to avoid bias from school personnel. It was assumed that knowing when the samples would be collected could somewhat interfere with the foods offered, and the samples would no longer represent usual offers. At the beginning of the focus groups, written permission was obtained from participants through a consent for participating in a focus group (Appendix F), in which they also authorized the interview to be audio-recorded.

Participation in the study was voluntary, and anonymity of those schools and individuals who chose to participate was assured. When applicable, pseudonyms were used to substitute the real names of the participants, location, and any other particular descriptors on the tapes, transcripts, analyses, and written summaries resulted from this

study, except for the consent forms. Participant schools and individuals who chose to participate were advised that they can withdraw at any time with no penalty. A copy of the transcripts was returned to the participants to revise for accuracy of data and permission was granted to use the information through a signed letter of consent for release of transcripts (Appendix G).

CHAPTER 4
RESULTS

This chapter presents findings from data collected about the nutritional analysis of school meals (Datasets I and II), and from interviews conducted with nutrition coordinators. Information pertained to the nutritional analysis is divided into nutrient-based and food-based analyses, presented in this respective order for all three meals (breakfast, lunch, and snack). The results of the site observation of meals and plate waste are described next, followed by results from the interview of nutrition coordinators.

4.1 Quantitative Analyses

4.1.1 Nutrient-Based Analysis

The results of Datasets I and II—available reports from 1997 to 2006 and the 2007/08 school year, respectively—were compared against the minimum nutritional standards, followed by trend analysis on energy's and fibre's content. Results are shown according to types of meals (breakfast, lunch, and snack) and then broken down into studied nutrients.

4.1.1.1 *Results Concerning Breakfasts*

Macronutrients

Table 4.1 and Figure 4.1 report findings related to macronutrient content of analyzed meals according to the age group and studies' year. Table 4.1 shows the years' means and one standard error for macronutrient content of meals, as well as which of the

studied years were found to be significantly below the standards. Figure 4.1 depicts the extent in which macronutrients were found to be above or below the standards.

Energy. Breakfasts' energy content usually met younger children's energy standard, except in 2002 (see Figure 4.1). On the other hand, mean energy content did not meet older children's (9-13 years old) standard in many years, being all significantly different from the standard ($p < 0.05$) except in 2007 ($p = 0.074$) (see Table 4.1 and Figure 4.1). Although the energy content did not change significantly across the years [$F(6,83) = 0.890$, $p = 0.506$], as depicted in Figure 4.2, it increased in 2007 to a level that it no longer differs significantly from the minimum standards for both age groups ($p = 0.492$ and $p = 0.074$, younger and older children respectively) (see Table 4.1 and Figure 4.1).

Table 4.1 Mean and standard error for macronutrients of breakfasts offered by schools participating in CHEP school nutrition program, according to studied years (1999-2007).

Year	N	Energy (kcal)	Protein (g)	Carbohydrate (g)		Total Fat (g)
				Total	Digestible[1]	
1999	14	409.7 ± 49.1[b]	12.6 ± 1.7	68.2 ± 7.2	63.2	11.2 ± 1.9
2000	9	435.8 ± 42.6[b]	15.2 ± 1.7	73.2 ± 8.1	68.2	10.3 ± 1.4
2001	10	439.8 ± 44.2[b]	16.6 ± 2.3	68.5 ± 6.1	63.9	12.6 ± 3.2
2002	15	347.1 ± 34.0[a,b]	12.3 ± 1.4	54.0 ± 4.3	49.9	10.3 ± 1.9
2003	17	433.6 ± 36.5[b]	15.8 ± 1.4	67.6 ± 6.7	63.2	12.2 ± 1.5
2006	13	432.6 ± 29.5[b]	15.8 ± 1.0	72.0 ± 5.8	67.1	10.2 ± 1.2
2007	12	466.9 ± 52.5	15.1 ± 2.2	87.0 ± 10.1	80.2	8.4 ± 1.7
Total Mean		**420.7 ± 15.7[b]**	**14.6 ± 0.6**	**69.3 ± 2.7**	**65.1**	**10.8 ± 0.7**

[1] Digestible carbohydrate was obtained by subtracting mean of total fibre from mean of total carbohydrate.

[a] Significantly different ($p < 0.05$) from one-fourth of energy estimated requirements for 4 to 8 year-olds (i.e. 429.60 kcal).

[b] Significantly different ($p < 0.05$) from one-fourth of energy estimated requirements for 9 to 13 year-olds (i.e. 570.53 kcal).

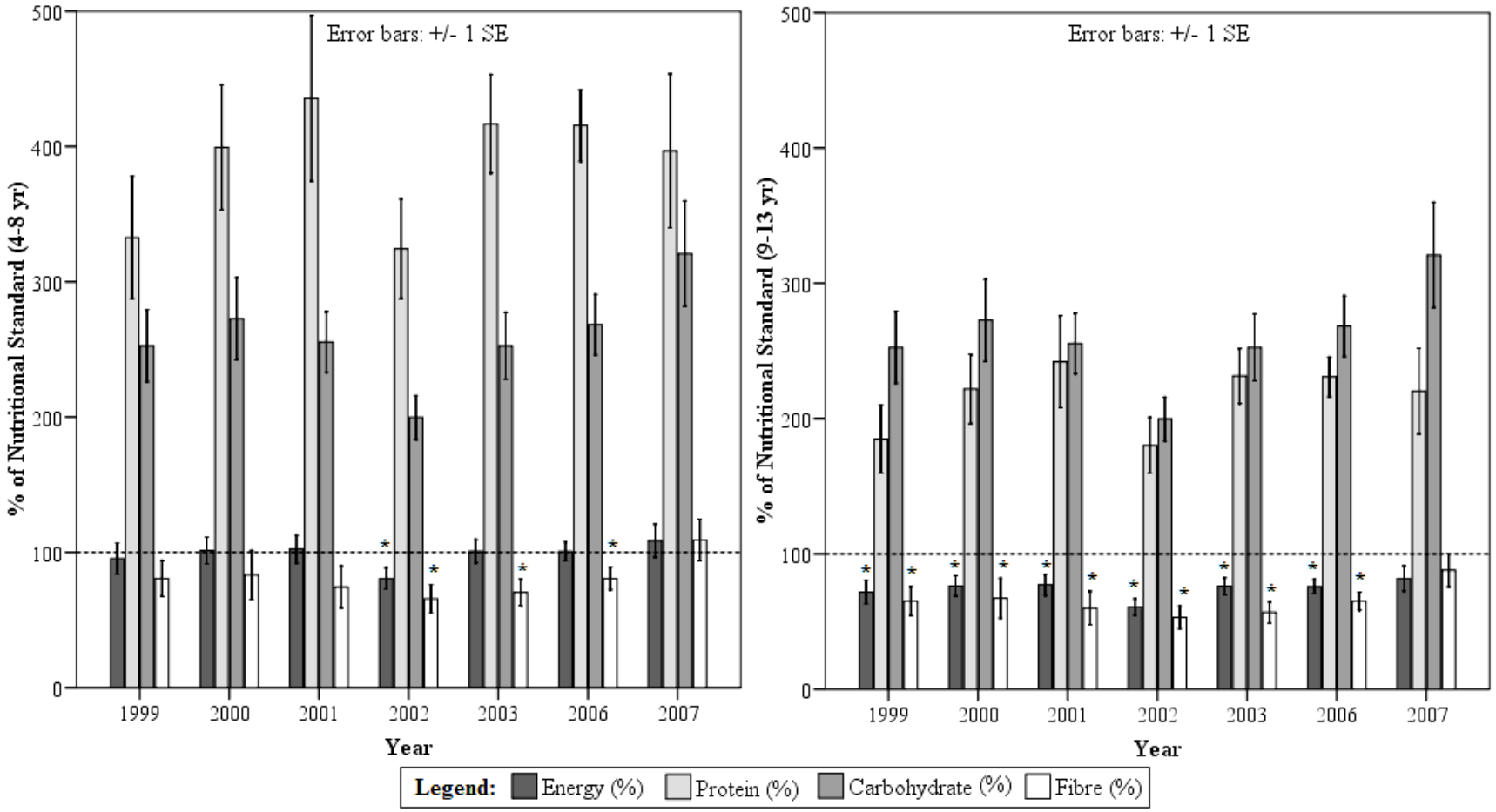

Figure 4.1 Mean percentage (%) and standard error (SE) of the nutritional standard for macronutrients (energy, protein, digestible carbohydrate, and fibre) of breakfasts according to age group, 4-8 years old (left) and 9-13 years old (right), and to studied years (1999-2007). Dashed line represents 100% of nutrient standard. *Significantly different from one-fourth Dietary Reference Intakes ($p < 0.05$).

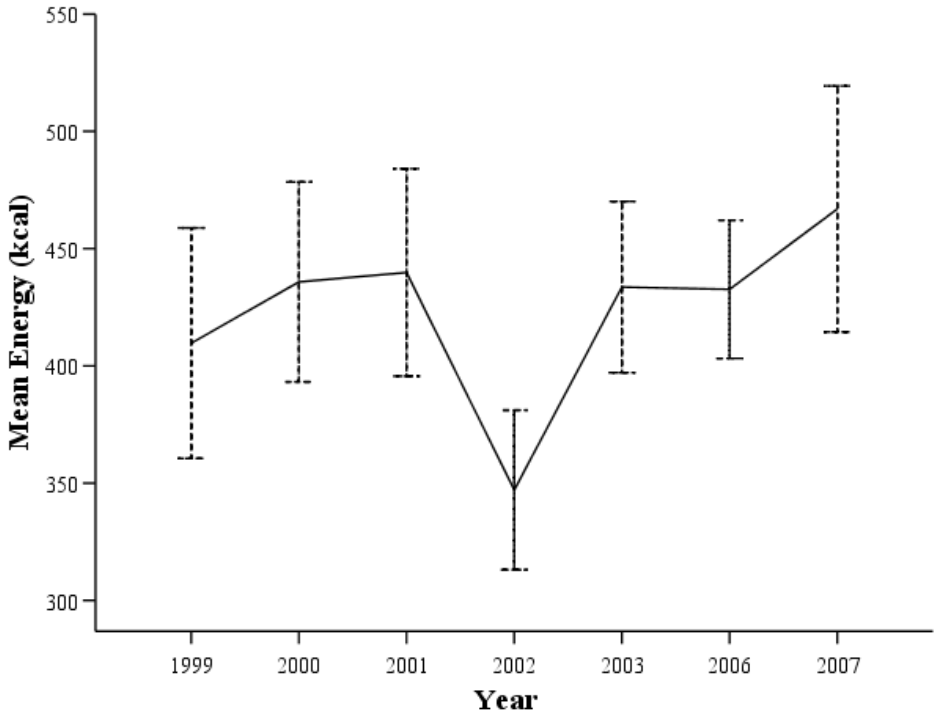

Figure 4.2 Breakfasts' mean energy (kcal) and standard error across studied years (1999-2007). No significant difference across the years was found (p>0.05).

Protein, carbohydrate, and fat. Unlike energy, protein and carbohydrate contents were above the standards in all years and for both age groups, as depicted in Figure 4.1. Dietary fat comprised an average of 23 percent of the total calories in all years. It unexpectedly decreased to 16 percent in 2007 (data not shown).

Fibre. Findings suggest that, on average, breakfasts did not offer the minimum recommended amount of fibre, i.e. one-fourth AI, in any year, but especially for older children (see Figure 4.1). As shown in Figure 4.1 and Table 4.2, the years of 2002, 2003, and 2006 differed significantly from standards for both age groups (p <0.05), and the years of 1999, 2000, and 2001 only for older children (p <0.05). In 2007, however, fibre content exceeded younger children's standard and was no longer significantly different from older children's standard, t (11) = -0.965, p = 0.355, as shown in Table 4.2.

Nonetheless, no significant change across the years was found when controlling for energy, F (6,82) = 1.080, p = 0.381, as depicted in Figure 4.3.

Table 4.2 Mean and standard error for fibre of breakfasts offered in schools participating in CHEP school nutrition program, according to studied years (1999-2007).

Years	N	Fibre (g)
1999	14	5.0 ± 0.8[b]
2000	9	5.1 ± 1.1[b]
2001	10	4.6 ± 1.0[b]
2002	15	4.1 ± 0.6[a, b]
2003	17	4.4 ± 0.6[a, b]
2006	13	5.0 ± 0.5[a, b]
2007	12	6.8 ± 1.0
Total Mean		**4.95 ± 0.3[a, b]**

[a] Significantly different (p < 0.05) from one-fourth Dietary Reference Intakes for 4 to 8 year-olds (i.e. 6.25g).
[b] Significantly different (p <0.05) from one-fourth Dietary Reference Intakes for 9 to 13 year-olds (i.e. 7.75g).

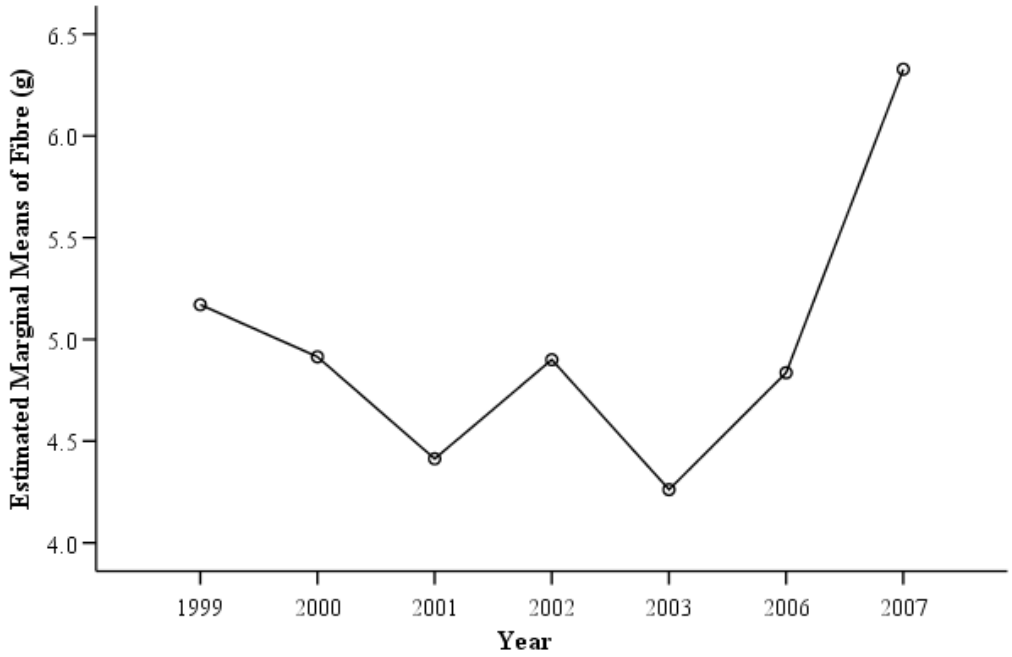

Figure 4.3 Estimated marginal means for fibre (g) of breakfasts according to studied years (1999-2007). No significant difference across years was found (p>0.05).

Vitamins

Findings suggest that breakfasts met one-fourth DRI for most, if not all, vitamins researched (A, C, D, B6, B12, folate, thiamin, riboflavin, and niacin), with very few exceptions—Table 4.3 shows breakfasts' mean content of all studied vitamins in all studied years. In 2002, folate did not differ significantly from older children's standard [t (14) = -0.720, p = 0.483], as depicted by Figure 4.4. Figure 4.4 also shows that breakfasts' vitamin E did not meet the one-fourth DRI in any year for any age group, except for younger children in 2006.

Minerals

The analysis suggested that breakfasts exceeded the one-fourth DRIs for practically all studied minerals (iron, calcium, zinc, copper, magnesium, and selenium). Table 4.4 shows the mean mineral content of meals according to studied years and which means were significantly different from the standard. Calcium fell significantly short for older children in 2002 [t (14) = -2.297, p = 0.038], as shown in Figure 4.5. Potassium appears to be significantly below standards in all years for both age groups ($p < 0.05$), except for 4-8 year-old children in 2006, t (12) = -0.865, p = 0.404, as depicted in Figure 4.5. In all years, breakfasts consisted of significant high amounts of sodium ($p < 0.05$), as shown in Figure 4.5.

Table 4.3 Mean and standard error for vitamins of breakfasts offered by schools participating in CHEP school nutrition program, according to studied years (1999-2007).

		Vitamins									
Year	**N**	**Vitamin A (IU)**	**Vitamin C (mg)**	**Vitamin D (µg)**	**Folate DFE (µg)**	**Thiamin (mg)**	**Riboflavin (mg)**	**Niacin NE (mg)**	**Vitamin B6 (mg)**	**Vitamin B12 (mg)**	**Vitamin E (mg)**
1999	14	1806 ± 1260	49 ± 15	1.6 ± 0.4	104 ± 16	0.5 ± 0.1	0.4 ± 0.1	5.7 ± 0.8	0.4 ± 0.1	0.7 ± 0.1	1.3 ± 0.4[b]
2000	9	1427 ± 514	40 ± 14	2.3 ± 0.4	83 ± 15	0.5 ± 0.1	0.6 ± 0.1	6.1 ± 0.8	0.3 ± 0.1	0.8 ± 0.1	0.6 ± 0.4[b]
2001	10	993 ± 278	38 ± 10	2.4 ± 0.3	83 ± 11	0.7 ± 0.2	0.7 ± 0.1	6.6 ± 0.7	0.5 ± 0.1	0.9 ± 0.1	0.9 ± 0.3[b]
2002	15	425 ± 42	25 ± 8	1.6 ± 0.2	58 ± 5	0.4 ± 0.1	0.4 ± 0.1	5.5 ± 0.8	0.3 ± 0.5	0.7 ± 0.1	0.9 ± 0.3[b]
2003	17	686 ± 75	37 ± 10	2.2 ± 0.2	88 ± 15	0.5 ± 0.1	0.7 ± 0.1	6.3 ± 0.7	0.4 ± 0.1	0.9 ± 0.1	0.9 ± 0.2[a,b]
2006	13	1044 ± 293	56 ± 16	2.5 ± 0.4	120 ± 19	0.5 ±0.1	0.6 ±0.1	6.0 ± 0.4	0.4 ± 0.1	0.9 ± 0.1	1.9 ± 0.8
2007	12	491 ± 74	25 ± 8	1.8 ± 0.3	71 ± 8	0.8 ± 0.2	0.5 ±0.1	5.5 ± 0.7	0.4 ± 0.0	0.8 ± 0.1	0.3 ± 0.7[a,b]
Total Mean		**951 ± 209**	**38 ± 4**	**2.0 ± 0.1**	**87 ± 5**	**0.5 ± 0.0**	**0.6 ± 0.1**	**5.9 ± 0.3**	**0.4 ± 0.0**	**0.8 ± 0.1**	**1.0 ± 0.2[a,b]**

[a] Significantly different from one-fourth Dietary Reference Intakes for 4-8 year-olds (p <0.05).
[b] Significantly different from one-fourth Dietary Reference Intakes for 9-13 year-olds (p <0.05).

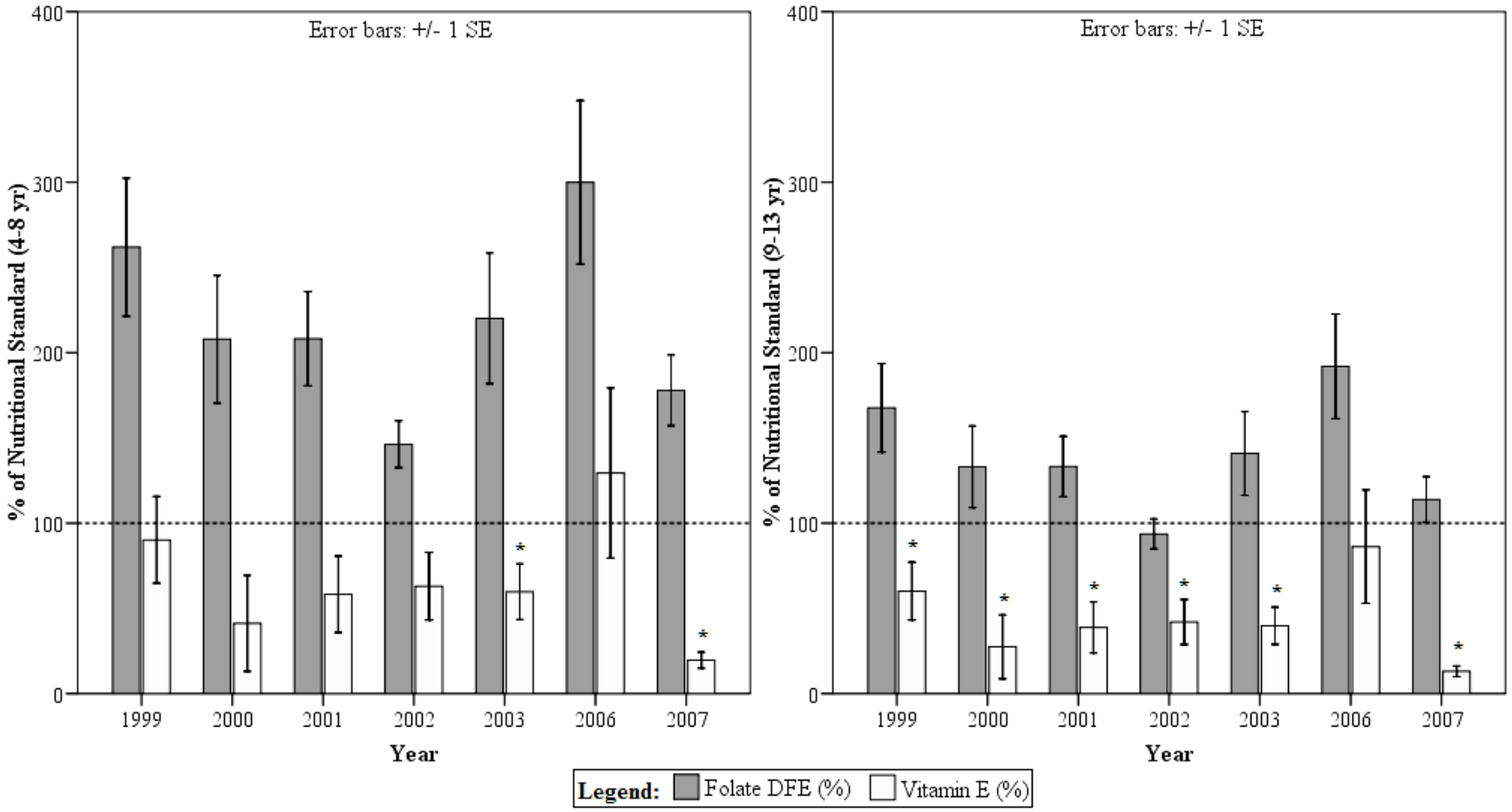

Figure 4.4 Mean percentage (%) and standard error (SE) of the nutritional standard for folate DFE and vitamin E of breakfasts according to age group, 4-8 years old (left) and 9-13 years old (right), and to studied years (1999-2007). Dashed line represents 100% of nutrient standard. * Significantly different from one-fourth Dietary Reference Intakes ($p < 0.05$).

Table 4.4 Mean and standard error for minerals of breakfasts offered by schools participating in CHEP school nutrition program, according to studied years (1999-2007).

Year	N	Minerals							
		Iron (mg)	**Calcium (mg)**	**Sodium (mg)**	**Zinc (mg)**	**Copper (mg)**	**Magnesium (mg)**	**Potassium (mg)**	**Selenium (µg)**
1999	14	3.4 ± 0.5	287 ± 45	497 ± 51[a,b]	1.8 ± 0.2	0.2 ± 0.1	71 ± 9	658 ± 70[a,b]	18.5 ± 2.2
2000	9	3.5 ± 0.4	346 ± 50	591 ± 76[a,b]	2.3 ± 0.3	0.3 ± 0.1	100 ± 16	747 ± 79[a,b]	21.6 ± 2.9
2001	10	4.7 ± 1.0	412 ± 73	641 ± 79[a,b]	2.4 ± 0.3	0.2 ± 0.1	88 ± 9	753 ± 63[a,b]	22.9 ± 2.8
2002	15	3.6 ± 0.4	250 ±32[b]	442 ± 57[a]	1.8 ± 0.2	0.2 ± 0.1	78 ± 11	577 ± 72[a,b]	19.4 ± 2.9
2003	17	3.5 ± 0.4	366 ± 25	572.4 ± 54[a,b]	2.0 ± 0.2	0.2 ± 0.1	83 ± 8	715 ± 73[a,b]	23.2 ± 2.7
2006	13	4.2 ± 0.7	393 ± 42	570.8 ± 38[a,b]	2.1 ± 0.2	0.3 ± 0.1	93 ± 8	870 ± 92[a,b]	17.4 ± 2.2
2007	12	5.4 ± 1.1	331 ± 49	543.4 ± 71[a,b]	2.1 ± 0.3	0.2 ± 0.1	88 ± 10	717 ± 88[a,b]	15.4 ± 3.7
Total Mean		**4.0 ± 0.2**	**337 ± 16**	**544.5 ± 22[a,b]**	**2.1 ± 0.1**	**0.2 ± 0.1**	**85 ± 4**	**713 ± 30[a,b]**	**19.7 ± 1.1**

[a] Significantly different from one-fourth Dietary Reference Intakes for ages 4-8 years (p <0.05).
[b] Significantly different from one-fourth Dietary Reference Intakes for ages 9-13 years (p <0.05).

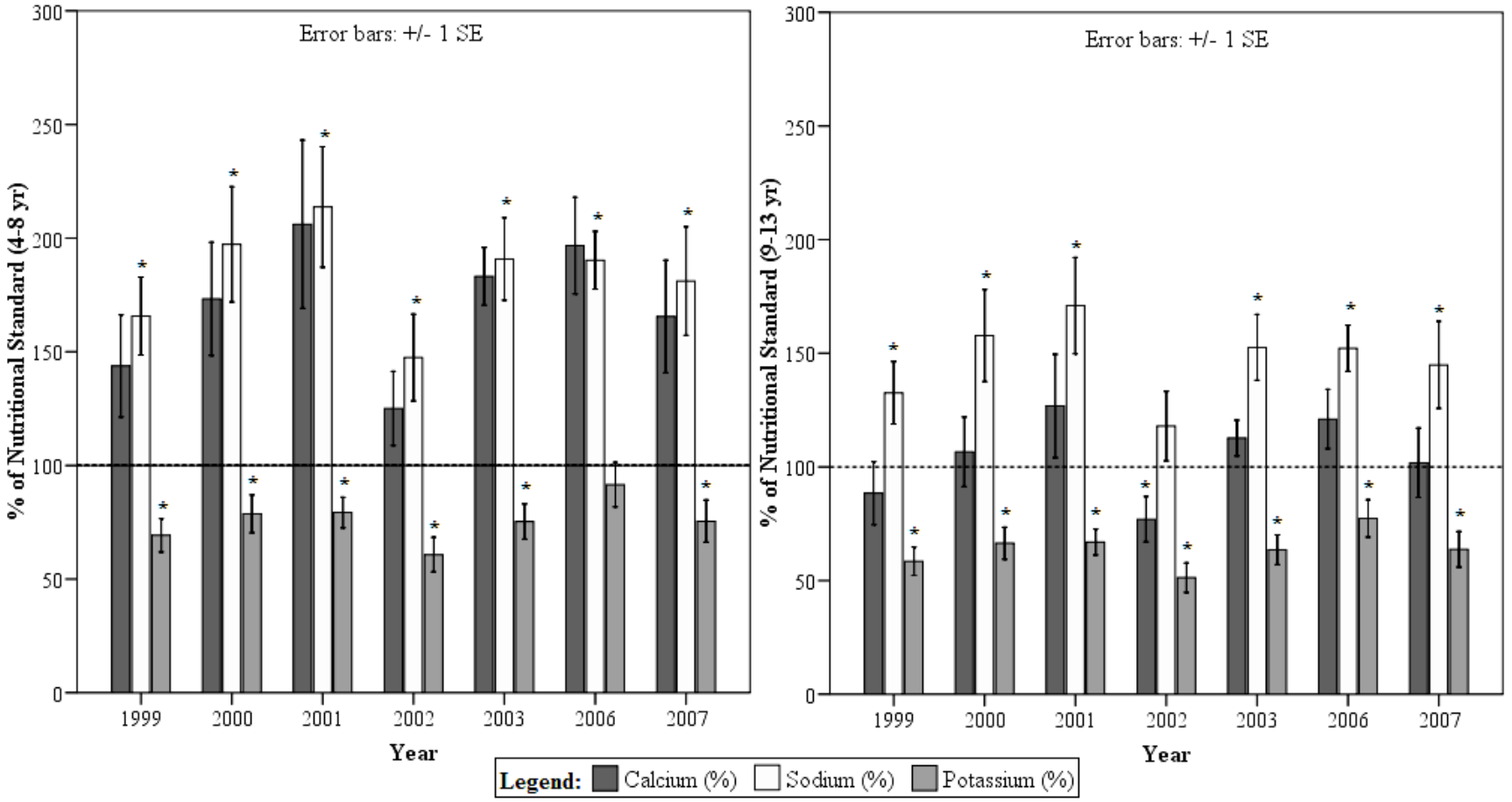

Figure 4.5 Mean percentage (%) and standard error (SE) of the nutritional standard for calcium, sodium, and potassium of breakfasts according to age group, 4-8 years old (left) and 9-13 years old (right), and to studied years (1999-2007). Dashed line represents 100% of nutrient standard. * Significantly different from one-fourth Dietary Reference Intakes ($p < 0.05$).

4.1.1.2 *Results Concerning Lunches*

Results for macro- and micronutrients content of analyzed lunches are presented in this subsection.

Macronutrients

Table 4.5 and Figure 4.6 report findings related to macronutrient content of analyzed lunches according to the age group and studied years. Table 4.5 shows the means for each year and the standard error for macronutrient content (energy, protein, carbohydrate, and total dietary fat) of lunches, as well as which of the studied years were found to be significantly below the standards. Figure 4.6 depicts to what extent macronutrients (except dietary fat) were found to be above or below the standards.

Table 4.5 Mean and standard error for macronutrients of lunches offered by schools participating in CHEP school nutrition program, according to studied years (1997-2007).

Year	N	Energy (kcal)	Protein (g)	Carbohydrate (g)		Total Fat (g)
				Total	Digestible[1]	
1997	15	456.6 ± 21.0[a,b]	15.9 ± 1.4	65.7 ± 3.2	60.4	15.8 ± 1.5
1999	17	543.0 ± 28.4[b]	18.7 ± 1.5	72.1 ± 5.3	64.9	21.5 ± 1.7
2000	18	473.3 ± 33.8[a,b]	18.4 ± 1.5	65.2 ± 5.0	58.1	17.2 ± 1.4
2001	16	511.0 ± 24.2[a,b]	23.6 ± 1.8	63.5 ± 2.7	57.6	19.6 ± 1.3
2002	26	501.7 ± 26.3[a,b]	20.2 ± 1.7	68.5 ± 3.9	62.2	17.9 ± 1.4
2003	27	553.8 ± 40.1[b]	21.2 ± 1.6	69.6 ± 4.3	63.3	22.9 ± 2.5
2006	22	501.8 ± 28.2[a,b]	23.5 ± 1.5	62.8± 3.7	56.4	19.1 ± 1.6
2007	18	519.4 ± 51.3[b]	21.6 ± 2.6	70.0 ± 6.9	63.1	18.7 ± 2.6
Total Mean		**510.5 ± 12.1[a,b]**	**20.6 ± 0.6**	**67.3 ± 1.6**	**60.7**	**19.3 ± 0.7**

[1] Digestible carbohydrate was obtained by subtracting mean of total fibre from mean of total carbohydrate.

[a] Significantly different ($p < 0.05$) from one-third of energy estimated requirements for 4 to 8 year-olds (i.e. 572.80 kcal).

[b] Significantly different ($p < 0.001$) from one-third of energy estimated requirements for 9 to 13 year-olds (i.e. 760.71 kcal).

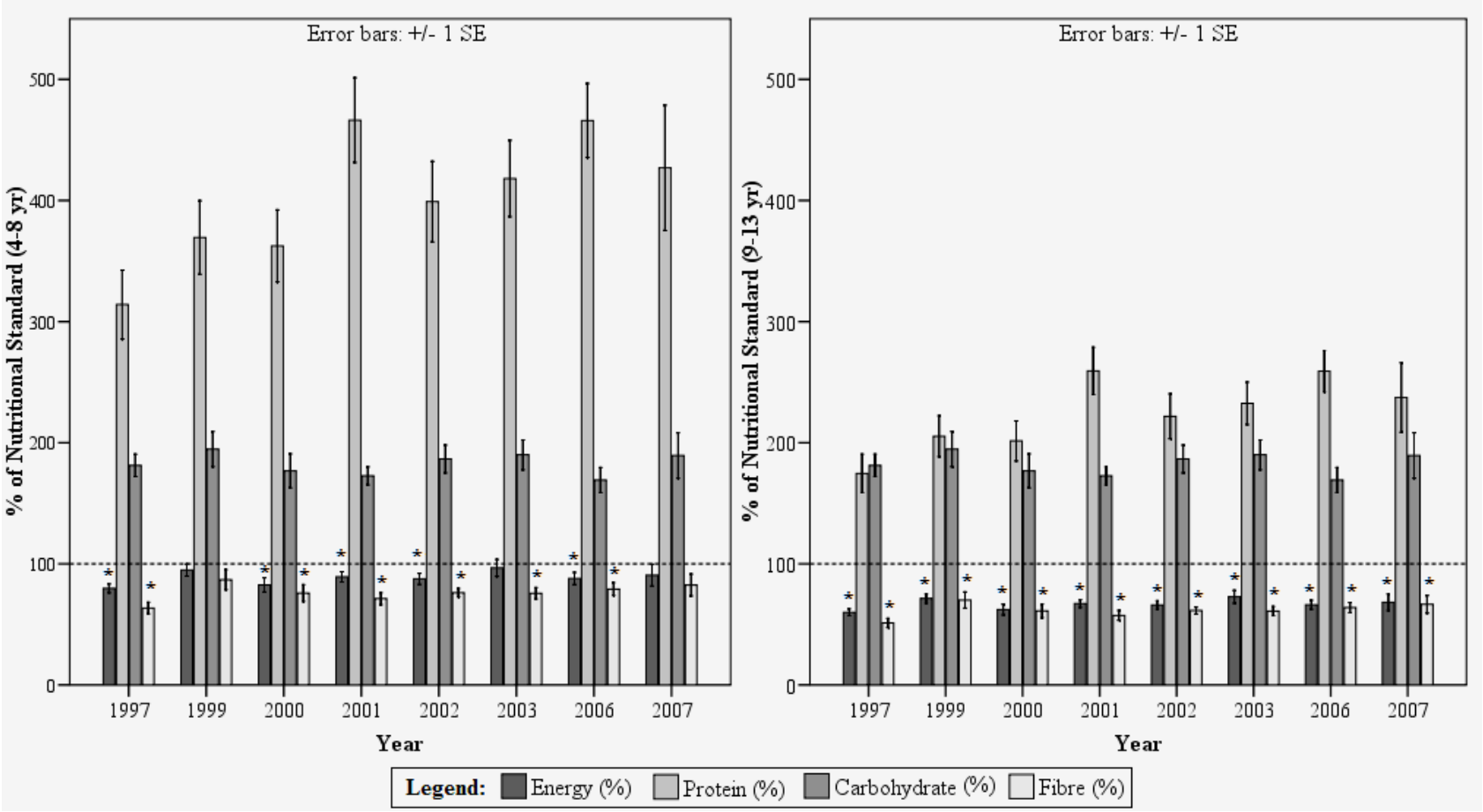

Figure 4.6 Mean percentage (%) and standard error (SE) of the nutritional standard for macronutrients (energy, protein, digestible carbohydrate, and fibre) of lunches according to age group, 4-8 years old (left) and 9-13 years old (right), and to studied years (1999-2007). Dashed line represents 100% of nutrient standard. * Significantly different from one-third Dietary Reference Intakes ($p < 0.05$).

Energy. Findings suggest that analyzed lunches fell short of the energy standard. In 1999, 2003, and 2007, their energy content did not differ significantly from younger children's one-third EER ($p > 0.05$), but there were no exceptions regarding older children ($p < 0.001$), as shown in Table 4.5 and Figure 4.6. Analysis of variance on energy (Figure 4.7) showed that energy content did not change significantly across the years, $F(7,151) = 0.865$, $p = 0.536$.

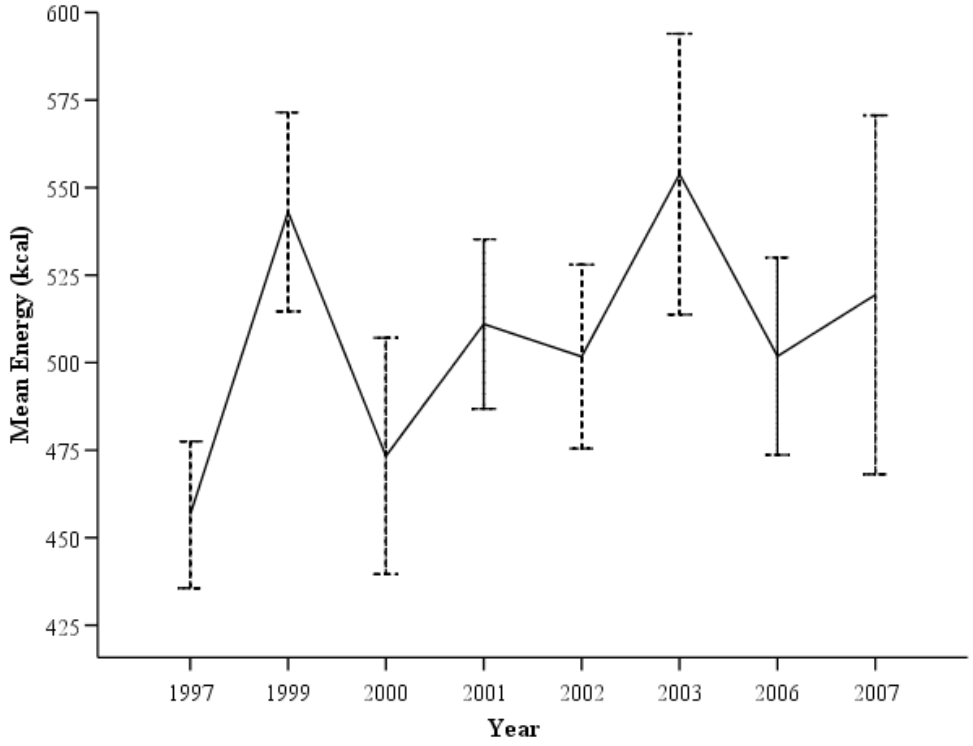

Figure 4.7 Lunches' mean energy (kcal) and standard error across studied years (1997-2007). No significant difference across years was found ($p > 0.05$).

Protein, carbohydrate, and fat. Similarly to breakfasts, lunches provided more than one-third DRI for protein and carbohydrate for both age groups in all years, as seen in Figure 4.6. And, on average, 34 percent of meals' total calories in all years came from dietary fat, and, unlike breakfast, there was no decrease in any year (data not shown).

Fibre. Lunches' fibre content fell short of the minimum standards in all studied years, younger and older children alike; finding depicted in Figure 4.6. Although stronger significance was found for the second group ($p < 0.001$), only in 1999 [t (16) = -1.586, $p = 0.132$] and 2007 [t (17) = -1.937, $p = 0.070$] fibre met the standards for younger children, as shown in Table 4.6 and Figure 4.6. Besides being low, fibre content did not change significantly across the years when controlled by energy, F (7,150) = 1.088, $p = 0.374$, depicted in Figure 4.8.

Table 4.6 Mean and standard error for fibre of lunches offered in schools participating in CHEP school nutrition program, according to studied years (1997-2007).

Years	N	Fibre (g)
1997	15	$5.3 \pm 0.4^{a,b}$
1999	17	7.2 ± 0.7^{b}
2000	18	$6.3 \pm 0.6^{a,b}$
2001	16	$5.9 \pm 0.4^{a,b}$
2002	26	$6.3 \pm 0.3^{a,b}$
2003	27	$6.3 \pm 0.4^{a,b}$
2006	22	$6.6 \pm 0.4^{a,b}$
2007	18	6.9 ± 0.7^{b}
Total Mean		**$6.4 \pm 0.2^{a,b}$**

[a] Significantly different ($p < 0.05$) from one-third Dietary Reference Intakes for 4 to 8 year-olds (i.e. 8.33g).
[b] Significantly different ($p < 0.05$) from one-third Dietary Reference Intakes for 9 to 13 year-olds (i.e. 10.33g).

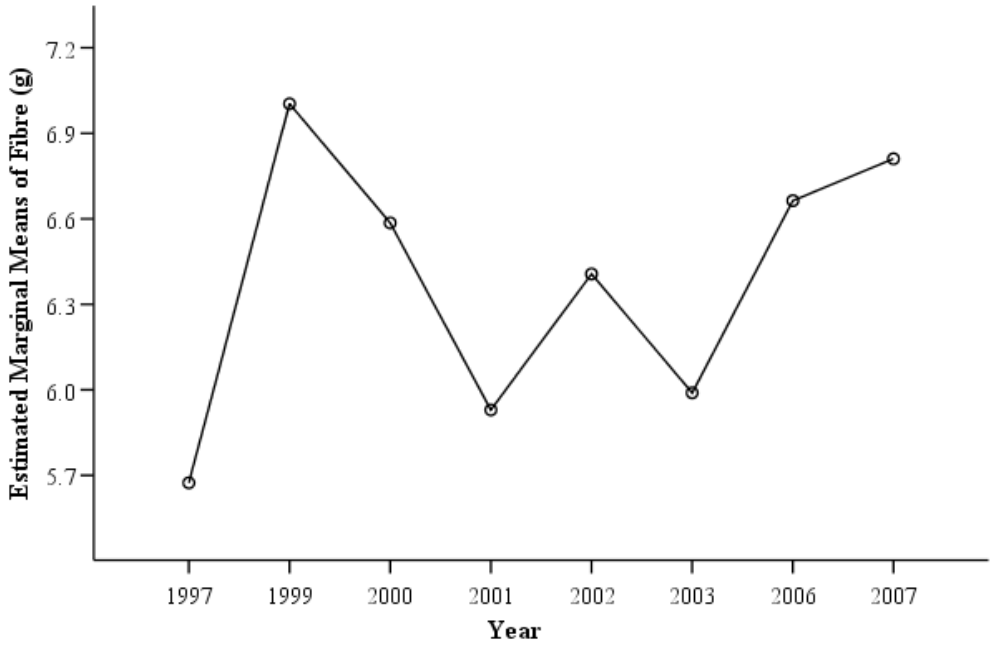

Figure 4.8 Estimated marginal means for fibre (g) of lunches, according to studied years (1997-2007). No significant difference across years was found ($p > 0.05$).

Vitamins

Analysis suggests that, overall, lunches successfully met nearly all vitamin standards; vitamins A, C, D, B6, B12, folate, thiamin, riboflavin, and niacin were much above the standards. Table 4.7 shows the mean vitamin content of lunches according to studied years. Vitamin D met the minimum standard, including in 1999 [t (16) = -0.039, $p = 0.969$] and in 2002 [t (25) = -0.323, $p > 0.749$], as shown in Table 4.7. Similarly, folate average content, shown in Figure 4.9 (page 94), met the standards, including in 1997 and 2001 for older children [t (14) = -0.697, $p = 0.497$, and t (15) = -2.128, $p = 0.050$, respectively]—data also shown in Table 4.7 (page 98). Vitamin E did not meet the standard in practically all years, being significantly lower in four out of the eight studied years regarding older children ($p < 0.05$)—shown in Table 4.7 and Figure 4.9.

Minerals

Nearly all studied minerals (iron, sodium, zinc, copper, magnesium, and selenium) were above the one-third DRI for both age groups in all years. Table 4.8 (page 100) shows the mean mineral content of lunches according to studied years. In 1997, zinc did not differ significantly from older children's standard, t (14) = -0.864, p = 0.402, as shown in Table 4.8. Figure 4.10 (page 101) shows three minerals of major concern: calcium, sodium, and potassium. Calcium met older children's standards only in 2001, 2006, and 2007 ($p > 0.05$). Sodium was significantly above standards for both ages and in all years ($p < 0.05$). And potassium was significantly below the standards for both groups in all years ($p < 0.05$).

Table 4.7 Mean and standard error for vitamins of lunches offered by schools participating in CHEP school nutrition program,according to studied years (1999-2007).

		Vitamins									
Year	**N**	**Vitamin A (IU)**	**Vitamin C (mg)**	**Vitamin D (µg)**	**Folate DFE (µg)**	**Thiamin (mg)**	**Riboflavin (mg)**	**Niacin NE (mg)**	**Vitamin B6 (mg)**	**Vitamin B12 (mg)**	**Vitamin E (mg)**
1997	15	2159 ± 746	30 ± 8	2.1 ± 0.4	78 ± 7	0.5 ± 0.1	0.5 ± 0.1	7.1 ± 0.5	0.4 ± 0.1	0.8 ± 0.1	2.0 ± 0.3[b]
1999	17	5766 ± 2456	22 ± 7	1.6 ± 0.3	107 ± 7	0.5 ± 0.1	0.5 ± 0.1	8.6 ± 0.5	0.3 ± 0.1	1.1 ± 0.2	1.8 ± 0.4[b]
2000	18	3133 ± 746	31 ± 7	2.0 ± 0.3	86 ± 11	0.6 ± 0.1	0.6 ± 0.1	8.5 ± 0.6	0.4 ± 0.1	0.9 ± 0.1	2.4 ± 0.3
2001	16	2333 ± 552	19 ± 4	2.6 ± 0.2	72 ± 5	0.6 ± 0.1	0.7 ± 0.1	9.7 ± 0.7	0.5 ± 0.1	1.4 ± 0.1	1.3 ± 0.3[a,b]
2002	26	4281 ± 712	43 ± 7	1.6 ± 0.2	93 ± 11	0.5 ± 0.1	0.6 ± 0.1	8.9 ± 0.6	0.5 ± 0.1	0.9 ± 0.1	1.9 ± 0.5
2003	27	4040 ± 648	26 ± 5	2.4 ± 0.3	111 ± 13	0.5 ± 0.1	0.6 ± 0.1	9.5 ± 0.7	0.5 ± 0.1	1.0 ± 0.1	2.9 ± 1.0
2006	22	6045 ± 1225	41 ± 8	2.0 ± 0.2	93 ± 9	0.5 ± 0.1	0.6 ± 0.1	10.1 ± 0.6	0.5 ± 0.1	1.3 ± 0.2	1.9 ± 0.3[b]
2007	18	6433 ±1235	51 ± 9	1.8 ± 0.3	140 ± 20	0.6 ± 0.1	0.7 ± 0.1	9.6 ± 1.1	0.5 ± 0.1	1.2 ± 0.4	2.4 ± 0.7
Total Mean		**4360± 405**	**33 ± 2**	**2.0 ± 0.1**	**99 ± 4**	**0.5 ± 0.1**	**0.6 ± 0.1**	**9.1 ± 0.2**	**0.5 ± 0.1**	**1.1 ± 0.1**	**2.1 ± 0.2[b]**

[a] Significantly different from one-third Dietary Reference Intakes for ages 4-8 years (p <0.05).
[b] Significantly different from one-third Dietary Reference Intakes for ages 9-13 years (p <0.05).

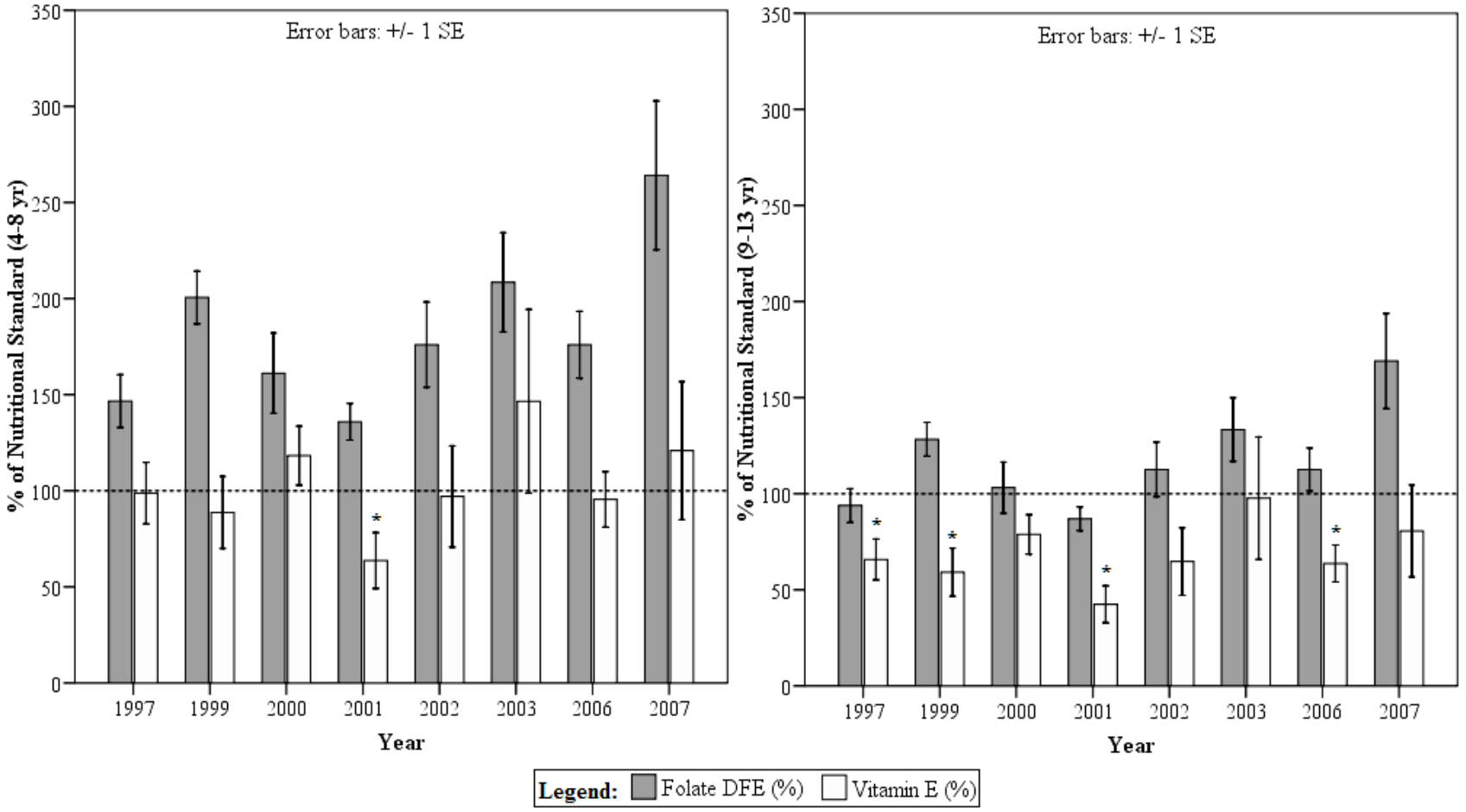

Figure 4.9 Mean percentage (%) and standard error (SE) of the nutritional standard for folate DFE and vitamin E of lunches according to age group, 4-8 years old (left) and 9-13 years old (right), and to studied years (1999-2007). Dashed line represents 100% of nutrient standard * Significantly different from one-third Dietary Reference Intakes ($p < 0.05$).

Table 4.8 Mean and standard error for minerals of lunches offered by schools participating in CHEP school nutrition program according to studied years (1997-2007).

		Minerals							
Year	**N**	**Iron (mg)**	**Calcium (mg)**	**Sodium (mg)**	**Zinc (mg)**	**Copper (mg)**	**Magnesium (mg)**	**Potassium (mg)**	**Selenium (µg)**
1997	15	2.7 ± 0.2	286 ± 38[b]	787 ± 87[a,b]	2.1 ± 0.2	0.2 ± 0.1	73.5 ± 6.4	690 ± 52[a,b]	24.0 ± 1.9
1999	17	3.6 ± 0.2	300 ± 38[b]	1182 ± 133[a,b]	2.7 ± 0.2	0.3 ± 0.1	78.9 ± 6.7	701 ± 65[a,b]	31.2 ± 2.1
2000	18	3.0 ± 0.2	311 ± 43[b]	932 ± 86[a,b]	2.7 ± 0.2	0.3 ± 0.1	90.9 ± 7.4	753 ± 57[a,b]	31.1 ± 2.2
2001	16	3.0 ± 0.2	409 ± 28	1130 ± 123[a,b]	3.4 ± 0.3	0.3 ± 0.1	100.4 ± 7.0	900 ± 51[a,b]	34.0 ± 2.2
2002	26	3.5 ± 0.2	311 ± 26[b]	1082 ± 105[a,b]	2.8 ± 0.2	0.4 ± 0.1	88.2 ± 5.0	818 ± 48[a,b]	30.0 ± 1.8
2003	27	3.4 ± 0.2	344 ± 33[b]	1001 ± 105[a,b]	3.0 ± 0.3	0.3 ± 0.1	89.1 ± 6.1	865 ± 66[a,b]	30.0 ± 2.0
2006	22	3.3 ± 0.2	356 ± 42	1020 ± 117[a,b]	3.3 ± 0.3	0.3 ± 0.1	102.0 ± 7.8	979 ± 75[a,b]	36.5 ± 2.3
2007	18	3.9 ± 0.4	362 ± 48	1023 ± 106[a,b]	2.9 ± 0.3	0.4 ± 0.1	99.0 ± 11.4	1006 ± 115[a,b]	35.1 ± 4.0
Total Mean		**3.3 ± 0.1**	**335 ± 13[b]**	**1024 ± 39[a,b]**	**2.9 ± 0.1**	**0.3 ± 0.1**	**90.6 ± 2.6**	**846 ± 25[a,b]**	**31.6 ± 0.9**

[a] Significantly different from one-third Dietary Reference Intakes for ages 4-8 years (p <0.05).
[b] Significantly different from one-third Dietary Reference Intakes for ages 9-13 years (p <0.05).

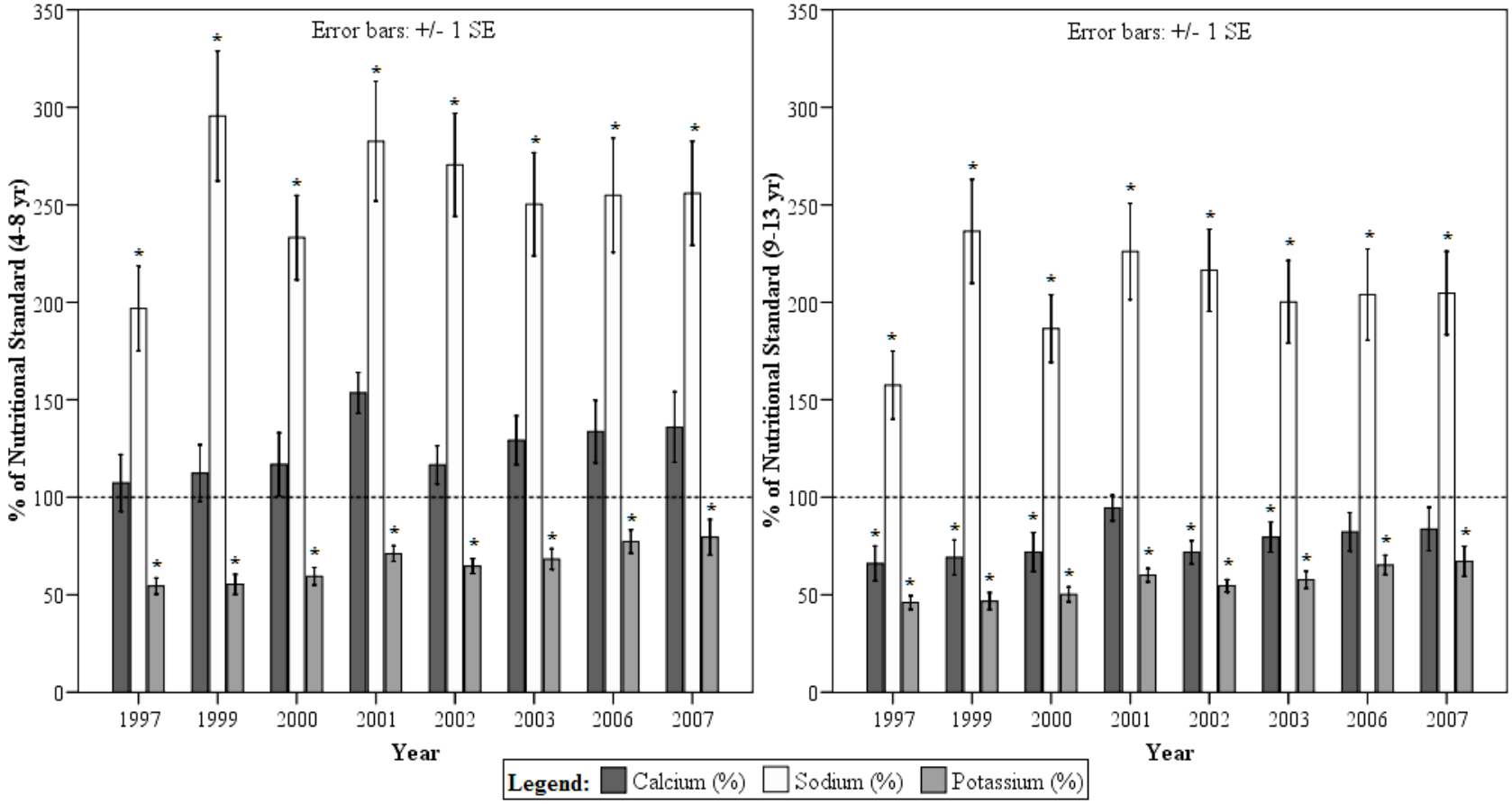

Figure 4.10 Mean percentage (%) and standard error (SE) of the nutritional standard for calcium, sodium, and potassium of lunches according to age group, 4-8 years old (left) and 9-13 years old (right), and to studied years (1999-2007). Dashed line represents 100% of nutrient standard. * Significantly different from one-third Dietary Reference Intakes ($p < 0.05$).

4.1.1.3 *Results Concerning Snacks*

Snacks had the smallest sample size in all studied years, i.e. 2001, 2002, 2003, and 2007. As detailed in chapter 3, no statistics was run for snacks.

Macronutrients

Table 4.9 and Figure 4.11 report findings related to macronutrient content of analyzed snacks according to the age group and studied years. Table 4.9 shows the means and standard error for macronutrient content (energy, protein, carbohydrate, and total dietary fat) of snacks. Figure 4.6 depicts to what extent macronutrients (except dietary fat) were found to be above or below the standards.

Table 4.9 Mean and standard error for macronutrients of snacks offered by schools participating in CHEP school nutrition program, according to studied years (2001-2007).

Year	N	Energy (kcal)	Protein (g)	Carbohydrate (g)		Total Fat (g)
				Total	Digestible[1]	
2001	3	230.4 ± 36.7	3.7 ± 0.3	44.5 ± 9.2	41.55	5.6 ± 0.1
2002	3	233.8 ± 33.8	6.9 ± 1.0	44.0 ± 9.5	41.27	4.8 ± 0.5
2003	6	217.9 ± 40.5	5.5 ± 1.2	30.2 ± 7.3	28.13	8.8 ± 2.5
2007	7	125.6 ± 23.8	2.3 ± 0.5	23.9 ± 4.9	21.62	2.8 ± 0.8
Total Mean		**188.4 ± 19.7**	**4.26 ± 0.6**	**32.3 ± 3.8**	**33.14**	**5.5 ± 1.0**

[1] Digestible carbohydrate was obtained by subtracting mean of total fibre from mean of total carbohydrate.

Energy. Snacks' energy content comprised, on average, 47 percent of younger children's and around 35 percent for older children's standards, as shown in Table 4.9 and Figure 4.11.

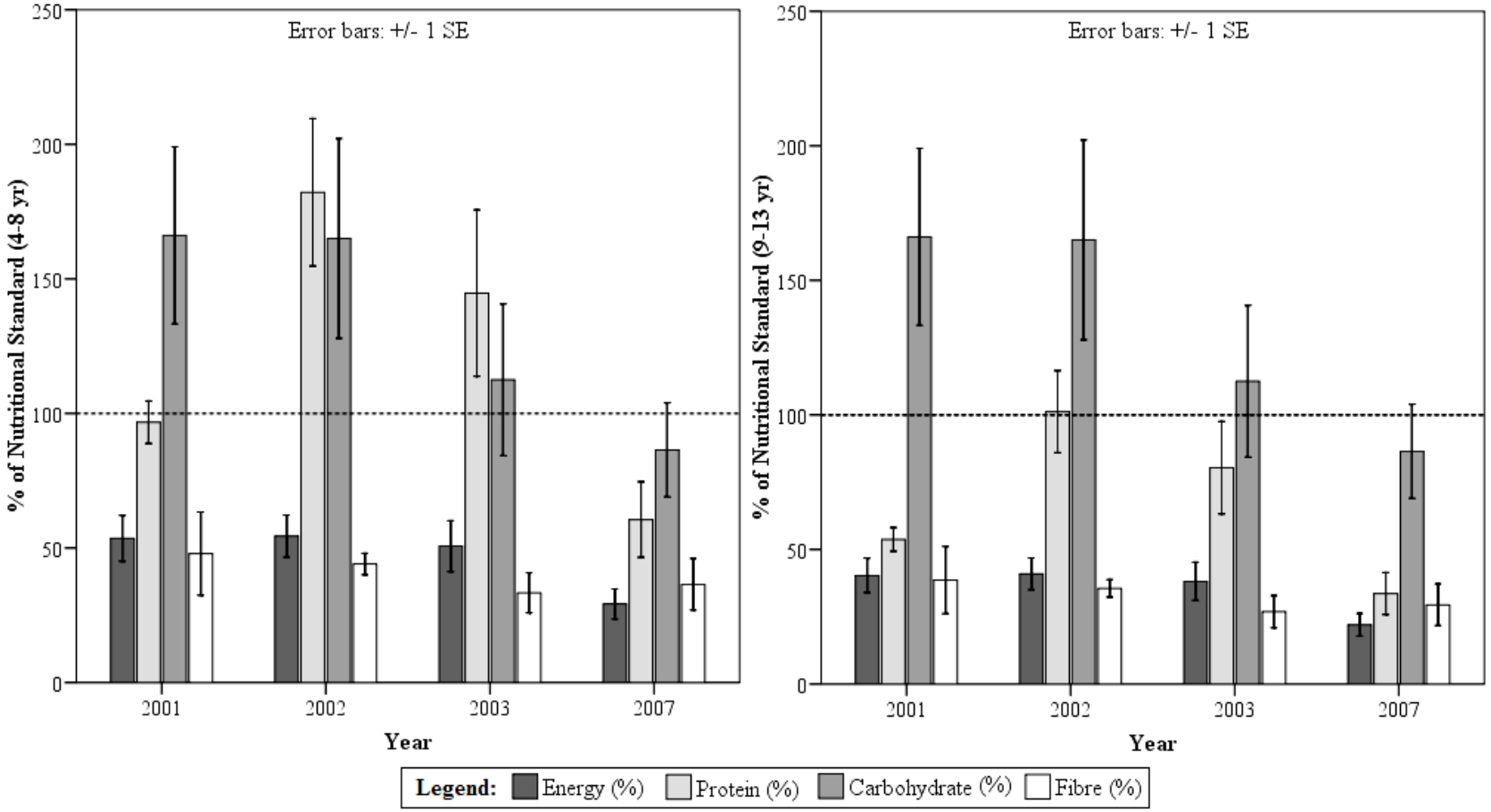

Figure 4.11 Mean percentage (%) and standard error (SE) of the nutritional standard for macronutrients (energy, protein, digestible carbohydrate, and fibre) of snacks according to age group, 4-8 years old (left) and 9-13 years old (right), and to studied years (2001-2007).

Protein, carbohydrate, and fat. As shown in Figure 4.11, protein represented about 96 percent for 4-8 year-olds and 54 percent for 9-13 year-olds in 2001 and 60 percent and 34 percent, respectively, in 2007. Carbohydrate met, in 2007, 86 percent of the standards for both groups—shown in Figure 4.11. Dietary fat comprised, on average, 26 percent of total calories in all years and reached the highest proportion in 2003, with 36 percent, and the lowest in 2002, with 18 percent (data not shown).

Fibre. Mean fibre content, shown in Table 4.10, met about 40 and 30 percent for 4-8 and 9-13 year-olds, respectively. Figure 4.11 also shows no clear visual changes in fibre content along the years.

Table 4.10 Mean and standard error for fibre of snacks offered in schools participating in CHEP school nutrition program, according to studied years (2001-2007).

Years	N	Fibre (g)
2001	3	3.0 ± 1.0
2002	3	2.7 ± 0.2
2003	6	2.1 ± 0.5
2007	7	2.3 ± 0.6
Total Mean		**2.4 ± 0.3**

Vitamins

Compared to the ¼ DRI, vitamins fell short of the standard in all studied years, except vitamin A—data shown in Table 4.11. The lowest content observed was vitamin D, which met 15 percent, on average, of the nutritional standard (except in 2002) for both age groups. Other low contents were seen for folate, vitamin B6, and vitamin B12 in respect to older children; all these three vitamins met around 60 percent of the standard (see Table 4.11). Vitamin E met approximately 30 and 20 percent of the minimum standards for younger and older children, respectively (see Table 4.11).

Table 4.11 Mean and standard error for vitamins of snacks offered by schools participating in CHEP school nutrition program and percentage of nutritional standard (one-fourth DRIs) according to age group and to studied years (2001-2007).*

Vitamins		Years				Total Mean
		2001	2002	2003	2007	
	N	3	3	6	7	
Vitamin A (IU)	**Mean**	**1208 ± 1101**	**378 ± 157**	**2150 ± 1942**	**2640 ±1522**	**1902 ± 821**
	4-8 yr	527%	165%	938%	1152%	695%
	9-13 yr	326%	102%	580%	712%	430%
Vitamin C (mg)	**Mean**	**5.3 ± 2.0**	**29.4 ± 23.5**	**14.3 ± 9.3**	**8.7 ± 4.2**	**13.2 ± 4.8**
	4-8 yr	97%	535%	259%	158%	262%
	9-13 yr	55%	302%	146%	89%	148%
Vitamin D (mcg)	**Mean**	**0.2 ± 0.1**	**1.4 ± 0.7**	**0.2 ± 0.1**	**0.2 ± 0.1**	**0.4 ± 0.1**
	4-8 yr & 9-13 yr	14%	114%	20%	13%	40%
Folate DFE(mcg)	**Mean**	**46.3 ± 7.9**	**27.5 ± 19.9**	**49.9 ± 17.0**	**30.7 ± 12.0**	**38.7 ± 7.5**
	4-8 yr	116%	69%	125%	77%	96%
	9-13 yr	74%	44%	80%	49%	62%
Thiamin (mg)	**Mean**	**0.2 ± 0.1**	**0.2 ± 0.1**	**0.1 ± 0.1**	**0.1 ± 0.1**	**0.1 ± 0.1**
	4-8 yr	131%	163%	97%	60%	113%
	9-13 yr	95%	118%	70%	43%	81%

(Continued on page 106)

(Table 4.11 continued)

Vitamins		Years				Total Mean
		2001	2002	2003	2007	
	N	3	3	6	7	
Riboflavin (mg)	**Mean**	**0.2 ± 0.1**	**0.3 ± 0.1**	**0.2 ± 0.1**	**0.1 ± 0.1**	**0.2 ± 0.1**
	4-8 yr	144%	247%	125%	54%	143%
	9-13 yr	104%	178%	90%	39%	103%
Niacin NE (mg)	**Mean**	**2.3 ± 0.2**	**2.8 ± 0.4**	**2.3 ± 0.6**	**1.2 ± 0.3**	**2.0 ± 0.2**
	4-8 yr	155%	186%	150%	79%	143%
	9-13 yr	103%	124%	100%	52%	95%
Vitamin B6 (mg)	**Mean**	**0.1 ± 0.1**	**0.2 ± 0.1**	**0.1 ± 0.1**	**0.1 ± 0.1**	**0.1 ± 0.1**
	4-8 yr	102%	150%	73%	71%	99%
	9-13 yr	66%	97%	47%	46%	64 %
Vitamin B12 (mg)	**Mean**	**0.07 ± 0.0**	**0.5 ± 0.2**	**0.2 ± 0.1**	**0.1 ± 0.1**	**0.2 ± 0.1**
	4-8 yr	26%	216%	93%	30%	91%
	9-13 yr	17%	142%	61%	20%	60%
Vitamin E (mg)	**Mean**	**0.3 ± 0.1**	**0.3 ± 0.1**	**0.9 ± 0.4**	**0.5 ± 0.1**	**0.5 ± 0.1**
	4-8 yr	23%	19%	58%	31%	33%
	9-13 yr	16%	13%	38%	20%	22%

* Legend: DRIs = Dietary Reference Intakes; 4-8yr = 4 to 8 years old; 9-13yr = 9 to 13 years old

Minerals

Snacks' mineral content met around 60 percent in average and sometimes much lower than that, e.g. 12 percent for calcium and 15 percent for potassium, both in 2007 for older children (see Table 4.12 on pages 108 and 109).

4.1.2 Food-Based Analysis

As mentioned in previous chapters, the *Saskatchewan Guidelines for School Meals* (Public Health Nutritionists of Saskatchewan Working Group, 2004) base their recommendations on number of servings from each food group of the 1992 CFGHE (fruits and vegetables, grain products, milk and alternatives, and meat and alternatives). Table 4.13 (page 110) shows the average number of servings from all four food groups that each meal (breakfast, lunch, and snack) offered in the last three studied years.

Overall analysis suggests that CHEP administered school meals have been offering the recommended number of servings from certain food groups according to the Saskatchewan guidelines, as seen in Table 4.13. Although breakfasts' fruits and vegetables content comprised an average of 0.8 serving in 2007, it was considered as one full serving. Therefore, breakfasts seemed to be offering, on average, one serving from three food groups. As shown in Table 4.13, lunches did not offer, on average, one full serving from the *meat and alternatives* group, thus they did not meet the recommendations of one serving from each of the four food groups. On average, snacks offered items from two food groups, as recommended by the guidelines, but the serving size of these items did not comprise one full serving, as shown in Table 4.13.

Table 4.12 Mean and standard error for minerals of snacks offered by schools participating in CHEP school nutrition program and percentage of nutritional standard (one-fourth DRIs) according to age group and to studied years (2001-2007).*

Minerals		Years				Total Mean
		2001	2002	2003	2007	
	N	3	3	6	7	
Iron (mg)	**Mean**	**1.8 ± 0.2**	**1.0 ± 0.6**	**1.2 ± 0.3**	**1.2 ± 0.5**	**1.3 ± 0.2**
	4-8 yr	176%	94%	118%	119%	127%
	9-13 yr	123%	66%	82%	83%	88%
Calcium (mg)	**Mean**	**100 ± 6**	**221 ± 55**	**127 ± 33**	**38 ± 8**	**105 ± 19**
	4-8 yr	50%	111%	64%	19%	61%
	9-13 yr	31%	68%	39%	12%	37%
Sodium (mg)	**Mean**	**232 ± 18**	**153 ± 31**	**373 ± 88**	**185 ± 47**	**246 ± 37**
	4-8 yr &	77%	51%	124%	62%	79%
	9-13 yr	62%	41%	99%	49%	63%
Zinc (mg)	**Mean**	**0.7 ± 0.3**	**0.8 ± 0.2**	**0.7 ± 0.2.**	**0.3 ± 0.1**	**0.6 ± 0.1**
	4-8 yr	66%	81%	75%	35%	64%
	9-13 yr	37%	46%	43%	20%	36%
Copper (mg)	**Mean**	**0.1 ± 0.1**	**0.1 ± 0.1**	**0.1 ± 0.1**	**0.1 ± 0.1**	**0.1 ± 0.1**
	4-8 yr	113%	155%	77%	86%	108%
	9-13 yr	73%	99%	50%	55%	69%

(Continued on page 109)

(Table 4.12 continued)

Minerals		Years				Total Mean
		2001	2002	2003	2007	
	N	3	3	6	7	
Magnesium (mg)	**Mean**	**25.1 ± 8.5**	**37.5 ± 5.9**	**18.8 ± 4.7**	**17.8 ± 5.5**	**22.4 ± 3.2**
	4-8 yr	91%	136%	68%	65%	90%
	9-13 yr	50%	75%	37%	36%	50%
Potassium (mg)	**Mean**	**270 ± 86**	**702 ± 197**	**209 ± 54**	**165 ± 27**	**280 ± 55**
	4-8 yr	28%	74%	22%	17%	35%
	9-13 yr	24%	62%	19%	15%	30%
Selenium (mcg)	**Mean**	**8.5 ± 0.1**	**6.5 ± 1.0**	**8.3 ± 2.5**	**5.0 ± 1.7**	**6.8 ± 1.0**
	4-8 yr	148%	113%	144%	86%	123%
	9-13 yr	97%	74%	94%	57%	81%

* Legend: DRIs = Dietary Reference Intakes; 4-8yr = 4 to 8 years old; 9-13yr = 9 to 13 years old

Table 4.13 Average number of servings offered in breakfasts (2003, 2006, and 2007), lunches (2003, 2006, and 2007), and snacks (2003 and 2006) by schools participating in CHEP school nutrition program, according to food groups[1].

	Food Groups			
Meal[2]	**Fruits & Vegetables**	**Grain Products**	**Milk & Alternatives**	**Meat & Alternatives**
Breakfast				
2003	1.0	1.4	0.9	0.2
2006	1.4	1.8	1.0	0.1
2007	0.8	2.3	1.0	0.0
Lunch				
2003	1.5	2.0	0.7	0.5
2006	2.5	1.7	0.9	0.5
2007	2.4	2.1	0.9	0.4
Snack				
2003	0.8	1.0	0.3	0.0
2007	0.6	0.7	0.0	0.0

[1] Food Groups according to the *Canada's Food Guide to Healthy Eating* (Health Canada, 2007b), displayed in average number of servings.
[2] Breakfast is expected to offer one serving from three food groups; Lunch is expected to offer at least one serving from each of the four food groups; and Snack is expected to offer one serving from at least two food groups (Public Health Nutritionists of Saskatchewan Working Group, 2004)

From Table 4.13, it also possible to infer that, compared across the years, the number of servings of fruits and vegetables in breakfasts decreased more than 0.5 serving, whilst grain products increased 0.5. The other two groups do not seem to change substantially, although meat and alternatives decreased from 0.2 serving to none (see Table 4.13). Lunches' food group content changed mainly for fruits and vegetables, which increased, on average, from 1.5 to 2.4 servings from 2003 to 2007. Even though grain products decreased in 2006, it reached practically the same number of servings again in 2007 (see Table 4.13).

Findings from Table 4.13 suggest that snack is the meal that suffered more changes. It not only had the number of fruits and vegetables and grain products decreased since 2003, but also dropped from 0.3 to none for *milk and alternatives*.

4.2 Qualitative Analyses

This section describes, first, the main findings from on-site observations, and then it presents the findings from focus group interviews.

4.2.1 On-site Observations

On-site observations of mealtime allowed the documentation of children's dietary patterns and plate waste when receiving school meals. Nutrition coordinators in all schools plan single menus for both breakfasts and lunches, i.e. consisted of one to two options from the food groups being served. The majority of schools served toast and/or cold cereal and milk for breakfast. What to spread on the toast is up to the student. Most of them chose processed cheddar cheese spread (*Cheeze Whiz*®), but, when it was the nutrition coordinator's choice, children usually had fruit jam instead. Lunches usually consisted of a sandwich, a piece of fruit, and milk; hot meals, particularly soup, were offered in very few schools. Children seemed to accept very well both types of lunches.

The nutrition coordinator may either serve the food herself, or pre-portion it, or even let children serve themselves but always with close supervision. In this last case, she just observes them but does not interfere too much in their choices. Independently of how food was served, children usually chose all options being offered. Nonetheless, when children could choose whatever pleased them, fruits and vegetables seemed the most refused. This rejection did not happen, however, when nutrition coordinators

served the children or when food was pre-portioned. These findings suggest that the actual consumption of what is offered may be linked to the nutrition coordinators' serving practices.

Surprisingly, plate waste was observed to be very little among children, independently of who is serving the food, the children themselves or the nutrition coordinator. This was true for all food groups, including fruits and vegetables. What might have contributed is that nutrition coordinators do not serve or do not allow children to serve too much food at once. Instead, nutrition coordinators serve "standard" quantities and allow children to have seconds if they want to and if there are leftovers.

4.2.2 Focus Group Interviews

This subsection describes the findings from the three focus group interviews, conducted to shed light on nutrition coordinators' knowledge and practices on issues surrounding CHEP school nutrition program. Nutrition coordinators' responses are presented in the same order that questions were posed in the interviews. The first set of questions addressed program's goals, training and education background, nutrition coordinators' knowledge of existing guidelines, and the previous studies on school menus. The second set asked about nutrition coordinators' beliefs and practices surrounding menu planning and meals' content. Then questions addressed some outstanding findings from 2007/08 school year menu analysis. Finally, nutrition coordinators were asked about potential modifications and improvements and their opinions and suggestions regarding CHEP school nutrition program.

Subjects

A total of nine nutrition coordinators were interviewed. Four of them have worked as nutrition coordinators for more than four years, four for less than two years, and only one for only four months by the date of the meeting. Five out of the nine worked in Public Schools and four, in Catholic Schools.

Program Goals

The first set of questions addressed program goals, existing guidelines, training, and previous studies on school menus—entitled by CHEP as *What is being served?* Regarding knowledge of goals, nutrition coordinators would be considered to be aware of program goals if they answered either that the goal was to offer a certain amount of nutrients of a child's daily needs—as it is specified at CHEP's website (CHEP, n.d.)—or that it was to provide a certain number of servings of food groups (specified in the Saskatchewan guidelines) in each meal. When the question was posed, the majority cited broader goals such as "to feed hungry children" or "to provide healthy food to children." One nutrition coordinator, involved in the program for relative long time, defined the goal as "to provide a good portion of the nutrients that a child requires." Another one, who has been working in the program for six years, cited the goals as they are defined in the Saskatchewan's Guidelines (Public Health Nutritionists of Saskatchewan Working Group, 2004), i.e. certain number of servings and food groups according to each type of meal.

Training and Education Background

Three out of nine had some cooking or nutrition background (college, technical school, or worked in the food industry). The majority had nearly no training besides the

ones received through CHEP, such as the *Food Safe and Handling* and the *Healthy Eating/Active Living* training (H.E.A.L.). The first is mandatory—they must take it within the first 3 to 4 months of becoming a nutrition coordinator—and has to be renewed every 2 years (R. Mireles, personal communication, March 12, 2008). Except for the newest nutrition coordinator in the group, all have taken the Food Safe course, some more than once.

Many have taken H.E.A.L. already as well, a nine-session training program that started about 10 years ago and was designed for those involved directly or indirectly with the *Children's Nutrition Programs*, *Nutrition Positive*, *Good Food Box* programs, and *Collective Kitchens* to improve their understanding of food security, health, and food. H.E.A.L. is offered annually in partnership with the Community Clinic and assisted by nutrition students from the College of Pharmacy and Nutrition from the University of Saskatchewan (CHEP, 2007).

Findings from Previous Reports Awareness and Usage

Those who are nutrition coordinators for less than two years did not participate in the last study conducted in November 2005, but they received the report, issued in 2006. When asked if it was somewhat useful, they said it was interesting to see what other schools were doing and how their school was. The participants who were either directly involved with previous studies or received the report said that they did not actually use the results and suggestions from those reports as a tool to improve their own practices.

Knowledge of Guidelines

The CFGHE was unanimously recognized by all interviewees, with no exceptions. Several expressed that the food guide is always reinforced at nutrition coordinators'

meetings. Some even added when it was shown, "that one I've got it memorized," and "we covered it in great detail." They all have an available copy for personal reference at their workplace. Interviewees also added that CHEP's trainings and monthly meetings focus extensively on the CFGHE. On the other hand, only three reluctantly asserted that they were aware of the *Saskatchewan's Guidelines for Schools* (Public Health Nutritionists of Saskatchewan Working Group, 2004). However, when participants examined the guidelines more closely, they expressed it was familiar to them: "I did [recognize] now that I see the inside, yeah. Yes, I've seen that. […] I read everything that comes through," expressed on of the participants. Others complemented that they had seen the topics in some CHEP trainings, such as H.E.A.L.—"[…] it is very similar to what's in the H.E.A.L. workbook which we get"—, so participants believed that the materials used in the training were based on those particular guidelines.

Nutrition Coordinators' Beliefs and Practices Regarding Program Delivery

The second set of questions tried to assess their beliefs and practices surrounding menu planning.

Nutrition coordinators unanimously assured that they are the ones entirely responsible for planning the menus, and the CFGHE is their main reference for both serving sizes and food groups: "I do them [the menus] myself," "I plan all the meals and figure out what to make," and "Yeah, we do plan the meals" illustrate some of the responses.

The planned menu can be followed most of the times mainly because they plan ahead accordingly to the school calendar (holidays, field trips, etc.). What usually prevent them from following the menu are unexpected large donations, which are not uncommon in some schools.

Even though they were not fully aware of the *Saskatchewan's Guidelines for Schools* (Public Health Nutritionists of Saskatchewan Working Group, 2004), all are pretty confident that their meals are meeting the guidelines' goals, first, because they plan according to the CFGHE, trying to offer as much variety as possible, second, because, as they stated, they pay attention to the quality of the meals they serve.

It seems that this confidence was reached through the efforts towards meals' improvements and certain changes they have made across the years since they started in the program, in particular the more experienced ones. The main changes they cited were the use solely of whole wheat bread—a couple of years ago meals offered only white bread—, the use of less sugared breakfast cereals, the inclusion of more fresh fruits and vegetables, the inclusion of hot meals some days of the week in some schools, the increase in variety of food items and dishes instead of only simple sandwiches of jam, peanut butter, or *Cheeze Whiz*®, for example, and the increasing efforts to include milk in every meal. To illustrate this, one explained, "since I started […], there have been quite a few changes. No more hotdogs. We cut out a lot of trans-fats when it comes to the margarine. So we got rid of [those large square tubs]. Lots of fresh veggies in our school now, [which] seemed to be a treat before […] now they're just a natural thing to have: the sliced tomato, the lettuce for the sandwiches, and whenever we can the fresh carrots and celery if we can get that." The nutrient analysis clearly shows these changes that happened along the years. Table 4.7, for example, depicts a considerable increase in vitamin A and C since 1997. As well as fibre content in breakfasts, as shown in Table 4.2 and Figure 4.3.

According to nutrition coordinators' perceptions, all these improvements were very well welcomed by the entire school, both staff and students. However, some difficulties are still encountered, being financial issues, children's preference, and school personnel's and families' beliefs pointed as the major ones. One participant explained, "[the changes] were welcomed at least the changes I made […]. At least I felt that anyway. Well, because of the hot meals offered and not just a *Cheeze Whiz*® sandwich, you know. And there was one time when […] I was 'forced' to make *Cheeze Whiz*® sandwiches. That choked me: the kids loved them! But I guess you can't do that all the time… But they welcomed the changes […]." This barrier related to children's choices can also be seen in other responses: "My barrier is [… that] if you don't make a good meal choice [the children] won't eat it. So that is what I feel is my biggest barrier because why won't they eat that tuna sandwich […]" and "I would rather [offer what] they eat too. I mean, I used to make tuna sandwiches on a regular basis and after having to give them all away or it gets thrown out because you can't give it to anybody, then it's a waste of money and it's a waste of time." Another one mentioned the school personnel being a barrier for her, mainly at the beginning of the changes. Although she felt that the changes were welcomed, some school personnel were impressed that she was spending on stew meat, for example, but they would not be impressed if she were to spend the same amount of money on *Cheeze Whiz*®, she exemplified. She blamed this reaction to the school personnel's unawareness about the cost and benefits of certain types of foods.

Main Findings from 2007/08 School Year

The next set of questions probed knowledge and practices relating some findings from this 2007/08 school year study. Questions were directed mainly on shortcomings

on *meat and alternatives* group in lunches, energy and fibre contents in both breakfasts and lunches, and macronutrients and micronutrients in snacks.

Meat and Alternatives Food Group. Concerning the *meat and alternatives* group during lunchtime, participants explained that serving one full serving of *meat and alternatives* at lunch within their current budget is nearly unfeasible: "because the protein was the next expensive thing [after milk] and partly because I could use peanut butter three days a week and [if I used] then my budget would be wonderful […]. But you can't do that either because we can't have nuts in our school. Plus, why would you keep giving kids peanut butter three times a week? Just because you could afford it?" explained one of them. Hence, the short budget appears to be the major problem. According to the interviewees, meat is the most expensive item in the menu. Consequently, they tend to serve more varieties from other food groups to "stretch the budget," as they said, as much as they can.

Participants acknowledged that processed meat such as bologna and sausages are not the healthiest option for *meat and alternatives* serving, but some of them still include some type of deli such as turkey or chicken breasts deli. These quotes illustrate this awareness: "I go buy my bologna once a month, and that's it. Or if it's not bologna, it's hotdogs. It's just that's their treat. But otherwise, always I buy real chicken, real turkey, real roast beef, and real pork. And […] I do sausage once a month […] with the pancakes. And then, when I cut that sausage for those kids, I feel it in my heart that I am not doing them a service" (sic) and "it is very hard with the meat… it doesn't need to be too much. It's about the quality of the meat that you put in."

Many schools are "peanut free schools," so they cannot serve peanut butter as alternative. Eggs are not very well accepted by most children, according to the interviewees, and the waste is usually much greater when egg dishes are served. Fish could be another possibility to fulfill the standard, but it is also not feasible because it is expensive and, in most cases, not well accepted by all children. In sum, participants categorically asserted that they would rather spend the short budget on milk and fresh fruits and vegetables than on meat.

Energy. When asked about the low energy content by comparing to the standards, nutrition coordinators promptly said, "we don't count calories." They argued that they pretty much follow what is outlined in the CFGHE and "trust that it got everything right." They explained that their concern lies on food variety and quality, not on numbers such as calories: "it's not about all those calories; it's about the quality, about the minerals, the vitamins… If they want all those calories, they're going to have those big fat, huge kids that they already have" and "I can tell you why I don't count calories, I just know what I serve and basically the portion control, I don't sit and say 'okay this tuna salad will give them about this much calories,' and that's not a bad thing. It's not that I'm adverse to counting the calories, I go by what we feel is adequate […]." As illustrated by the first quote, the increased obesity was also brought to the discussion. Others claimed that if they were to boost meals' energetic content, they would have to resort to more carbohydrate or fat, and this would lead to "not-so-healthy" meals. Moreover, few participants justified that, in their school, the size of the portion is usually different for older and for younger children. But, as mentioned throughout the interviews, this separation does not happen in all schools and did not seem to be the case in the

schools observed. Finally, nutrition coordinators claimed that they never deny food if children want to have seconds if there are leftovers, or they can get something else: "anybody who needs seconds or who got missed in the original count can come and get a sandwich." Another participant added, "we have someone who goes around […] asking [the children] who is taking lunches that day and if they want two sandwiches or two fruits or two milks; they say so at the time that they are placing their order. But even at that, any child at any time can come into the kitchen and get an extra; there's always food for somebody who wants something extra," because, "after a while, the nutrition coordinator knows who really needs that snack and who doesn't," added another participant.

Fibre. When nutrition coordinators were questioned about breakfasts' and lunches' fibre content, they argued that they do not count grams of fibre when planning the meals; they worry about what is being served, not about grams and calories. A few asserted that the required amount of fibre is not easily achievable, that to meet the requirement they would need to spend more on expensive items, such as bran breakfast cereals and fruits, and yet the acceptance among children would not be guaranteed.

Snacks. Four out of the nine interviewees indicated that they offer snacks for grades above kindergarten. Lack of time and money was the main justification for the shortcomings on snacks' nutrient content. If a school offers snack, most likely it offers breakfast and lunch as well, leaving the nutrition coordinator with very short time to prepare a big snack. Also the expenses have to include snack items besides breakfast and lunch items. Hence, to serve better breakfasts and lunches, snacks have to be somewhat "basic," as nutrition coordinators referred. The most common items served for

snacks were starches (crackers, for instance) and/or a piece of fruit (e.g. apple) or vegetable (e.g. sticks of celery or carrots). Nutrition coordinators also commented that they would rather offer something, even if very simple, than "leave children with an empty stomach", as said one participant.

Future Changes and Suggestions

The final set of questions were related to potential modifications and improvements to the meals and requested participating nutrition coordinators' opinions and suggestions regarding CHEP administered school nutrition program.

When asked about future changes, nutrition coordinators were unanimous that they could only foresee more changes to the meals served (e.g. menu items and serving sizes) if more funding is provided. One added, "last year we went into our budget for this year [of 2008] because of all the fresh vegetables and fruits and wonderful whole grain breads, and things… it is just too much for the budget."

When asked about the benefits they see of the school meal program, participating nutrition coordinators mentioned their social and educational role in children's and families' life: "we are also a teaching place to show others," "[…] when [children] are full, they learn better, and their behaviour is better, [and, thus, the program] has a big bearing. And it makes it a lot easier on the teacher themselves [than] if kids are hungry and they're fidgeting and they are not concentrating. So I think [the program] overall fills a big void there for a lot of families." Several mentioned that they teach life skills to children, good eating habits, and nutrition awareness that may be passed on to next generation. One said, "and what a good habit is, we are teaching them, you know, like life skills: this is what you need to eat, this is how it is…" And other agreed, "absolutely.

And I have my Canada's Food Guide posted, and [children] are there for breakfast. And, when [they] were helping, we're talking about portion sizes, and I'm showing them the Canada Food Guide… getting them to realize what they need to have in a day… It's a learning thing for a lot of them as well." Some also said that they teach children the practical side of good nutrition taught in the classrooms.

Participants were asked for suggestions for future training. The most common suggestion was on how to deal socially with children who live under certain difficult circumstances such as family violence. They also suggested a basic level course for those who are starting in the program. This would equal them in minimum required knowledge and practices to do better their job. Mireles (personal communication, March 12, 2008) informed that "there is a basis 'new coordinator' package that was created several years ago. It includes nutritional needs of children, sample menus and recipes, food safely, working with children, creating a healthy food atmosphere" (sic). But findings suggest that this package did not reach the new coordinator present in the interview.

Volunteers were also a common issue in one of the groups. Nutrition coordinators recognize the great help they are in delivering a better nutrition program at school. However, some of the volunteers do not know the procedures and expectations on them, so they commonly apply at school what they do at home—what very often is not the best for a school environment. Therefore, some training, such as a workshop, for those who want to volunteer would be the best way to teach them how they can greatly contribute in the school cafeteria. One school is already developing this training after a lot of deceptions.

It was also suggested some nutrition education for parents, as an attempt to raise nutrition awareness and to solidify good personal beliefs towards better food habits.

CHAPTER 5
DISCUSSION

In this chapter 5, findings from the study are discussed and comparisons are made with the literature and other resources. First, findings from the quantitative analysis, i.e. the comparisons of studied school meals against both nutrient-based and food-based standards, are discussed. Since breakfasts' and lunches' results had very similar nutritional profile, the discussion on the nutritional content of both meals will be combined unless specified otherwise. Snacks' nutritional content is discussed separately since the results showed a singular nutritional profile. Following the discussion about the nutrient analysis, findings related to the comparison against food-based standards and the trend analysis are discussed in respect to all three meals.

The qualitative analyses, which include the on-site observations and focus groups interviews, are presented in a second section in this chapter 5. Lastly, suggestions for future nutrient standards and for the current food standards, as well as the study's limitations and strengths, are discussed.

5.1 Nutritional Content of the Meals

As indicated previously, evaluations are essential to improve the quality of the service to assure the potential contribution the service may have to promoting the health and well-being of schoolchildren (Pérez-Rodrigo et al., 2001). It is indispensable to follow the progress towards the major goals and to use the obtained results to encourage and enhance strategies, shaping a framework for action (Harper & Wells, 2007; Pérez-

Rodrigo & Aranceta, 2003). Apart from framing actions, formal evaluations conducted regularly can increase parent and community support for school programs and support grant applications for enhancing the program (CDC, 1996). By evaluating which nutrients should be increased/decreased, which are accepted to be low/high, and which should be looked at for being demonstrated to be a concern in the meals' content, we can derive suggestions for feasible and achievable nutritional standards, as well as what should be changed in the offered menus in order to achieve a better nutritional profile.

5.1.1 Comparison against Nutrient-based Standards

Overall, findings suggest that analyzed school meals have a good nutrient profile: protein, carbohydrate, and nearly all micronutrients seem to meet and, in some cases, exceed the standards. One exception was calories (energy) for breakfasts and lunches. This result suggests that analyzed meals offered low energy dense food yet with good nutritional content.

Energy

Energy requirements are designed to maintain health, promote optimal growth and maturation, and support a desirable level of physical activity. Limited energy intake in children can result in reduced growth rates and thus limit ultimate adult growth. Energy intakes that are higher than energy needs may lead to weight gain, which, in the long-term, can increase chronic disease risk, such as risk of type II diabetes, hypertension, coronary heart disease, and some cancer types (Edelstein, 2006; IOM, 2006). Findings suggest that meals served by participating schools had energy content below the recommendations of one-third and one-fourth DRIs, especially concerning children aged 9 to 13. These results should be interpreted, however, with caution, given that the study col-

lected only one day of food provision, just one day of collection and subsequent averaging may have contributed differently to the assessment outcome. Nonetheless, findings provide a reasonable idea of the school meals' energy profile for participating schools.

Breakfasts seemed less likely to fall short of meeting the recommendations than lunches. This was also observed by the School Nutrition Dietary Assessment study III (SNDA-III), in which, the majority of breakfasts met the *School Meals Initiative for Healthy Children* (SMI) standards—presented in Chapter 2 (literature review)—, including energy. In that study, offered lunches met the SMI energy standards in 71 percent of the schools, but only half of the children actually consumed the amount established by the standards (Gordon & Fox, 2007). In addition, a study in Ontario (Evers & Russel, 2005) analyzed 40 two-week menus from breakfast and snack programs across the province and reported that breakfasts had an averaged content of 364 kcal. This was lower than the 420 kcal that breakfasts offered by CHEP administered programs.

Before advocating for drastic increases in energy content for breakfasts and lunches, one should consider three main points: children's food intakes, their nutritional status, and the current nutrients recommendations. As shown by the last Canadian Community Health Survey (CCHS), cycle 2.2, children are acquiring too many empty calories from snacks and other unhealthy choices. The survey revealed that the "other foods" category, which the CFGHE recommends to be consumed in moderation, was the second greatest provider of energy for children (and adults), supplying 22 percent of total daily calories (Garriguet, 2004). Granted that the mean energy intake of Saskatchewan children, in 2004, was 1930 kcal for both boys and girls aged 4 to 8, and 2457 kcal for boys and 2076 kcal for girls aged 9 to 13 (Health Canada, 2004c), analyzed break-

fasts and lunches could have supplied, in 2007, for example, from 19 to 27 percent of a Saskatchewan child's daily average energy intake, depending on child's age. Breakfasts and lunches would have supplied not only nearly the same proportion of calories as "other foods" category (22 percent, according to the CHSS), but also more vitamins and minerals than that food category, as suggested by our findings. Gordon & Fox (2007) compared the nutritional intake of students participating in the National School Lunch Program (NSLP) and those who do not. They observed that participants had significantly higher usual intakes of energy than nonparticipants, which the researchers attributed simply to the consumption of lunch—some of the nonparticipants did not consume a lunch at all. This higher energy intake among participants might also be true for CHEP administered school nutrition program; more research is needed to evaluate how school meals impact the diet of children participating in the school meal program.

The second point worth of considering before advocating for increases in energy content is obesity. It is recognized as a major chronic disease and is rapidly worsening as a public health problem rivalling smoking as cause of illness and premature death (Le Petit & Berthelot, 2006). As mentioned previously, in Canada, the rates of childhood obesity nearly tripled in 25 years; 36 percent of children aged 2 to 11 are overweight (CIHI, 2004; Public Health Agency of Canada, 2007). Schools become essential in preventing obesity and related diseases through different means, and offering an adequate meal is one of them (Budd & Volpe, 2006; Pérez-Rodrigo et al., 2001). An increase in energy content of breakfasts and lunches offered in schools would mean increased obesity risk, especially for those children who are inactive. In fact, studies have advocated for decreased energy standards in school meal offered and have encouraged the use of

foods high in nutrients rather than high in energy. Researchers seem convinced that most children will not eat more than 500 kcal at breakfast (Bell & Swinburn, 2004; Friedman & Hurd-Crixell, 1999). It is possible to infer from our findings that breakfasts and lunches served by participant schools were less energy dense and more nutrient dense to a level that many nutrients were above the minimum standards, what is very desirable after considering these presented aspects.

The third point to be considered is the nutrient standards used for comparison in this study. These standards, i.e., one-third and one-fourth of the DRIs, were drawn from the literature, based on well established national programs such as in the United States and England. The reality of child nutrition programs in Saskatchewan is much closer to those programs studied in the Atlantic Canada (McIntyre & Dayle, 1992; McIntyre et al., 1999) and other provincial programs such as the study conducted in Ontario by Evers and Russel (2005). These Canadian programs seem to aim not at high energy content, but at offering good and healthy food to children, particularly poverty-stricken children.

Dietary Fat

Dietary fat is a major source of energy for the body and aids in the absorption of fat-soluble vitamins (A, D, E, K) and other food components (e.g. carotenoids). The recommended dietary intakes for total fat are not determinable after 1 year of age (IOM, 2006). Thus recommendations are usually set in percent of energy from fat, which are commonly between 30 and 35 percent (Gordon & Fox, 2007; DfES, 2006; Crawley, 2005b). In this study, the standard limited that calories from fat could not comprise more than 30 percent of the total calories of the meal. On average, breakfasts met this stan-

dard with a mean of 23 percent of calories from fat. Analyzed breakfasts in Ontario had an average of 26 percent (Evers & Russel, 2005), which is very close to our findings. Lunches, one the other hand, were quite higher, 34 percent, than the standard of 30 percent of total calories.

Although the average Canadian fat intake was, in 2004, about 31 percent of total calories (Garriguet, 2004), which is within the acceptable macronutrient distribution range of 25 to 35 percent (IOM, 2006), seven percent of the children aged 4 to 8 and 11 percent of the children aged 9 to 13 had intakes higher than 35 percent (Garriguet, 2004). Children tended to often consume high-fat food, such as chips and french fries (Breakfast for Learning, 2007; Garriguet, 2004). It would be recommended that school meals implement actions to decrease meals' fat content to below 30 percent of total energy.

Fibre

Fibre is described, in general terms, as plants' carbohydrate and lignin that are not digested and absorbed in the small intestine. It has different properties that result in different physiological effects, including laxation, attenuation of blood glucose levels, and normalization of serum cholesterol levels (IOM, 2006). Dietary fibre in childhood may help in preventing and treating obesity and also lowering blood cholesterol levels, both of which may help reduce the risk of future cardiovascular disease (Williams, 2006).

Research demonstrates that children are not consuming enough fibre to maintain good health and prevent diseases (Hampl, Betts, & Benes, 1998; Williams, 2006). The average fibre intake is 13.5 g for Canadian children aged 4 to 8, and 16.5 g for boys and

14.4 g for girls aged 9 to 13 (Health Canada, 2004c), which is much lower than the recommended 25 g, 31 g, and 26 g, respectively (IOM, 2006).

The fibre content of breakfasts and, particularly, lunches analyzed were below standards in practically all years for participating schools; literature corroborates with this finding (Friedman & Hurd-Crixell, 1999; Gatenby, 2007; Preston, Rodriguez, & Gomez Flores, 1997). The study conducted in Ontario's breakfast programs obtained an average fibre content of 2.2 g (Evers & Russel, 2005); in our study, breakfasts' average fibre was twice as great—about 5 g in all years' average and 6.8 g in 2007. As shown in Table 5.1, breakfasts and lunches could comprise about three quarters of children's average fibre intake, and practically 100 percent if analyzed snacks were also to be consumed. Furthermore, fibre content seems to be slightly increasing for both breakfast and lunches since 1997. This increase may be explained, first, by the offer of exclusively whole wheat bread and, second, by the increase of fruits and vegetables frequency, as suggested by the nutrition coordinators interviewed. Whole grains and vegetables are some of the best sources of fibre and were, in fact, the main contributors in the intake of fibre in the diet of many Canadians studied (Garriguet, 2004; Phillips, Starkey, & Gray-Donald, 2004; Stephen & Reeder, 2001).

Vitamins

The overall vitamin content of both breakfasts and lunches was quite good except for vitamin E. In our body, vitamin E functions mainly as antioxidant and its major sources are nuts, seeds, and oils (IOM, 2006). Nuts usually represent a problem in schools due to food allergies. Seeds are difficult to offer and they are usually served with salt, what, in turn, may increase sodium consumption. Increase oil would also not

be a desirable practice, especially in lunches whose fat content contributed with more than 30 percent to the total calories. The SNDA-III revealed that inadequate usual daily intake of vitamins and minerals were rare among elementary school students, except for vitamin E (Gordon & Fox, 2007). The authors noted that there is limitation of both the data used to establish the EAR for this vitamin and the data used to assess its intakes. Thus, despite the high prevalence of inadequate intakes of vitamin E, deficiency is rare (Gordon & Fox, 2007). Therefore, it might be the case that addressing vitamin E in establishing nutrient standards would not be as important as other nutrients.

It is noteworthy to comment that some years with higher mean of vitamin E content differed significantly from the standards, whereas those with lower content did not, such as for breakfasts in 2000 (41 percent of the standard), 2002 (58 percent), and 2003 (60 percent)—refer to Table 4.3 and Figure 4.4 as examples. Outliers might explain this observation, since they may influence the overall data. In fact, when potential outliers were excluded from 2000 and 2002 data, for example, the difference between those years' mean and the standard was significant ($p < 0.001$). Moreover, the small number of samples decreases the degrees of freedom and, consequently, the power of the test (Vincent, 2005).

Folate. Folate (or "folic acid" if from artificial sources) functions as coenzyme in the metabolism of nucleic and amino acids. Food sources rich in folate include fortified grain products, dark green vegetables, and beans and legumes (IOM, 2006). Ready-to-eat cereals are also great sources of folate (IOM, 2006), what might have contributed to the better folate content in breakfasts, whilst the main source of folate in lunches was

probably bread, which is compulsorily fortified with folic acid in Canada; the other main sources were rarely offered.

Chronic low intakes of folate may ultimately lead to macrocytic anaemia, which may cause weakness, fatigue, difficulty in concentrating, and irritability. Fortification does improve DFE folate intakes, but the main concern on low intakes lies on pregnant women and women at child-bearing age, due to its well-proved effects on proper neural tube formation (Dietrich, Brown, & Block, 2005; Hertrampf et al., 2003; IOM, 2006). More research is needed to evaluate folate intake among school children and the impact of school meals in the intake of this vitamin in their diets. This would allow better judgment for setting nutrient standards.

Minerals

Similarly to vitamins, many of the minerals analyzed were above the standards, except potassium, which was quite low in all years for the two age groups, both breakfast and lunch. Along with potassium, sodium and calcium are discussed.

Sodium. Sodium is a concern not only in school meals (Addison et al., 2006; Gatenby, 2007; Gordon & Fox, 2007), but in people's diet in general (Cook, 2008; Garriguet, 2004). Some sodium is needed to control blood volume and to help cells function properly (IOM, 2006), but the main adverse effect of high sodium intakes is very well established: high blood pressure that, if not treated, may lead to cardiovascular diseases and stroke (Cook, 2008; IOM, 2006).

Canadians consume large amounts of sodium, regardless of their age. According to the 2004 CCHS, the average daily intake of sodium was far beyond the recommended UL (IOM, 2006). Saskatchewan ranked the forth province in average sodium intake (av-

erage of 3 181 mg). Among 4 to 8 year-olds, Saskatchewan daily intake averaged 2 787 mg, more than the UL of 1 900 mg (IOM, 2006). By age 9, however, children began to adopt the adult habit of adding salt to their food, increasing considerably the average sodium consumption by Saskatchewan children aged 9 to 13—3 754 mg for boys and 3 235 mg for girls (Guarriguet, 2004; Health Canada, 2004c). The UL is 2 200 mg (IOM, 2006). Findings from this study suggested high sodium content in school breakfasts and lunches analyzed, which could supply nearly half of Saskatchewan children's average intakes (Health Canada, 2004c). Although the decrease in sodium content would be desirable, studied meals already showed low frequency of processed and canned food. Standards on sodium should be kept low as an attempt to limit the offer of high sodium food items.

Potassium. Like sodium, potassium is required for normal cellular function and is considered the major cation in the body. Fruits and vegetables, particularly leafy greens, vine fruit (e.g. tomatoes, cucumbers, zucchini, eggplant, and pumpkin), and root vegetables are the richest sources of potassium (IOM, 2006). Studies in both children and adults have observed inverse associations between potassium intake and blood pressure. Thus there seems to have a link between high intakes of potassium and decreased incidence of stroke (Ding & Mozaffarian, 2006).

Despite the lack of scientific data on Canadian consumption of potassium, available studies may suggest that it is not as high as sodium, since fruits and vegetables are not a major component of Canadians' diet, particularly children's (Garriguet, 2004; Breakfast for Learning, 2007). The SNDA-III showed that overall and among elemen-

tary school students, mean usual daily potassium intakes were significantly higher for SBP participants than for nonparticipants (Gordon & Fox, 2007).

Findings from this study showed a high offer of fruits and vegetables, which are the main source of potassium. Standards on potassium should be kept as used in this study, as an attempt to maintain high offer of these items. Nutrition education for parents and students is essential to guarantee adequate intake of potassium outside the school meals.

Calcium. Calcium is involved not only in vascular, neuromuscular, and glandular functions but mainly in bone health and formation. Adequate intakes of calcium during childhood (and adolescence) are extremely important for the development of bone mineral density and content, as it may attenuate the effects and incidence of osteoporosis later in life (IOM, 2006; Ondrak & Morgan, 2007). In 2004, Saskatchewan children consumed an average of 944 mg among the 4 to 8 year-olds, and 1 110 mg boys and 1 010 mg girls aged 9 to 13 (Health Canada, 2004c). Younger children consumed above the AI value of 800 mg, but older children fell behind in meeting the 1 300 mg (IOM, 2006).

Breakfast programs participating in this study provide fluid milk as part of the daily menu without any costs for the children. Although the majority the lunch programs also provide milk at no cost, a few others offer milk at a subsidized cost, i.e., milk was available during lunchtime but had to be purchased for a small price. In these lunch programs, as by protocol, milk was not collected as a food item because it was assumed that some children might not the necessary financial means to purchase the milk. Therefore, this subsidized milk would be excluded from the analysis. This choice of protocol may

have contributed to the findings on low lunches' calcium content. Even so, the dairy products offered in breakfast and lunch in 2007 could have contributed, each, with one-third or so of a Saskatchewan child's average daily intake of calcium (Health Canada, 2004c).

Snacks

Snacks as nutrition education. The average energy intake for the Canadian population comprises more calories from snacks (food and beverage consumed between meals) than from breakfasts: 27 percent against 18 percent, respectively, for children. And more than 40 percent of these calories come from the "other foods" category of the CFGHE (Garriguet, 2004). If children receiving snacks consumed the full serving, one snack would provide about 6 percent of their average daily energy intake (Health Canada, 2004c). Though snacks in participant schools were low in nearly all analyzed nutrients, it might have provided more nutrients than those reported for the average Canadian (Garriguet, 2004). There is a need for nutrition education on what comprises a healthy snack, which can be in part achieved by offering healthier snacks in schools. Therefore, even though snacks were far below the set standards, they would be a good resource for nutrition education for offering foods from other food groups, instead of the common "other foods" category.

The Ontario study (Evers & Russel, 2005) found that snack programs offered a mean energy of 205 kcal, 22 percent of energy from fat, and 2.1 g of fibre. In our study, snacks offered an average of 226 kcal, dropping to 125 kcal in 2007, an overall of 26 percent of energy from fat, and 2.4 g of fibre. These figures are very close to Ontario's findings, possibly indicating that snacks in Canadian programs are not designed to offer

large amounts of nutrients; instead, they would be intended to keep children fed during class time with foods of reasonable nutritional quality. In fact, in our study, snacks comprised mainly pieces of fruits and vegetables. Snacks might also help those students who do not have breakfast before going to school (Friedman & Hurd-Crixell, 1999).

5.1.2 Comparison against Food-based Standards

The food-based analysis designed the food content of served meals across the years. When compared to the *Saskatchewan's Guidelines for Schools* (Public Health Nutritionists of Saskatchewan Working Group, 2004), participating schools offered breakfasts that provided one serving from three food groups. Snacks were offering nearly half serving from two food groups, whilst they should offer a full serving from two food groups—neither *milk and alternatives* nor *meat and alternatives* category comprised one full serving in 2007. Ontario's study on breakfast and snack programs observed that nearly 90 percent of participants served three and two servings, breakfasts and snacks respectively, of the CFGHE's food groups (Evers & Russel, 2005). These data corroborates with our results although snacks, in average, are not meeting the full two servings.

On the other hand, our findings suggest that, in overall, analyzed lunches are not providing one full serving of *meat and alternatives* deemed that they are expected to provide at least one serving from each of the four food groups of the CFGHE.

All these three studied meals are discussed according to each food group as to evaluate the current food-based standards (Public Health Nutritionists of Saskatchewan Working Group, 2004) and to allow suggestions for future modifications.

“Fruits and Vegetables” Group

Studied breakfasts offered one or more full servings of fruits and vegetables in 2003 and 2006. Servings dropped to 0.8 in 2007, which is still very close to one full serving. Lunches provided 2.5 servings in both 2006 and 2007, an increase of one full serving since 2003, in which an average of 1.5 serving was provided. Snacks comprised 0.6 serving in 2007, a slightly decrease of 0.2 serving since 2003.

In Canada, fruits and vegetables consumption tends to be higher among seniors than among younger people. Canadians of lower socio-economic status are at greater risk of low frequency of fruits and vegetables consumption compared with people of higher socio-economic status {Perez, 2002}. In 2004, 70 percent of children aged 4 to 8, 62 percent of girls and 68 percent of boys at ages 9 to 13 had less than five servings of fruits and vegetables per day (Garriguet, 2004). The new CFGHE recommends a minimum of five and six servings daily for 4 to 8 year-olds, and 9 to 13 year-olds, respectively (Health Canada, 2007b).

The school meals analyzed might have contributed to children’s fruits and vegetables consumption. As an illustration, if a child had had the servings of 0.8 and 2.4 altogether from breakfast and lunch, respectively, he/she would have consumed more than three servings from this food group. If a serving from snack were to be added, this total would comprise nearly four servings. Even though these servings would be mainly fruits since only lunches tended to offer more vegetables (e.g. carrot, celery, tomato, lettuce), the nutrition education factor should also be considered as an ally. It might be strongly possible that the meals could have contributed to children’s fruits and vegetables intake and nutrition education, but more research on this matter ought to be conducted.

Findings from the nutrient analyses showed low potassium content in all meals. Large fruits and vegetables intake is linked with high potassium intake (IOM, 2004). Although increasing servings of fruits and vegetables in school meals could increase potassium content, fruits and vegetables are very expensive menu items, especially in the winter. As a nutrition coordinator pointed out in the interview, "last year we went into our budget for this year [of 2008] because of all the fresh vegetables and fruits and wonderful whole grain breads and things it's just too much for the budget." As discussed later in this chapter, funding has become a major problem for program expansion and adding more healthy items to the menu. Improve fruits and vegetables intake—and potassium—cannot be relied on school meals alone; raising awareness among parents and family members is also necessary in order to provide children with more food from this group. Once again children's nutrition education becomes an essential tool to teach them the importance of fruits and vegetables in their diet, and, consequently, increasing the odds of better potassium and fibre intake, among other nutrients.

"Grain Products" Group

Researched breakfasts and lunches not only met the standard for "grain products" category, but they may also have contributed to children's intake of whole grain foods. The 2004 CCHS observed that more than a quarter of children aged 4 to 8 eat less than five servings of grain products daily (Garriguet, 2004). The current Canada's Food Guide to Healthy Eating recommends four servings of grain products for children from 4 to 8 years old and six for children from 9 to 13 years old, preferably as whole grain. In 2007, breakfast's and lunch's grain products summed nearly 4.5 servings, which is more

than the recommendation for younger children (i.e. four servings) and a little lower for older children (six servings). Snacks would add 0.7 serving.

Given that grain products provided by the studied meals were mainly whole wheat bread, besides contributing to improve children's daily grain products intake, the meals might be a good opportunity to educate children nutritionally towards the consumption of whole wheat food.

"Milk and Alternatives" Group

The 2004 CCHS revealed insufficient intakes of dairy products by children; one in three did not consume the minimum recommended by the 1992 CFGHE (Garriguet, 2004). On the other hand, another 2007 study (Breakfast for Learning, 2007) interviewed parents about their schoolchildren's food habits, compared the findings with the current CFGHE recommendations, and observed that 92 percent of participants in all age groups (from 4 to 18 years old) are consuming the minimum number of servings of dairy everyday (Breakfast for Learning, 2007). Breakfasts and lunches analyzed comprised together an average of 2.0 servings of dairy products, which is the number of servings recommended for younger children and nearly half of the three to four servings recommended for older children.

"Meat and Alternatives" Group

The *Saskatchewan Guidelines for Schools* (Public Health Nutritionists of Saskatchewan Working Group, 2004) recommend one full serving from *meat and alternatives* group at lunches. This recommendation, however, was not met in any studied year, where the average was half of a serving (0.5 serving). In the 2007 samples, less processed meat such as deli turkey/chicken breasts were the most common meat selection,

whilst food items as bologna and sausage were more present in the past studied years. The inclusion of processed meats may account for the high sodium content of the meals analyzed.

Meat is an important source of B vitamins, iron, and protein. Findings suggest that meals offered met and, in most cases, exceeded the minimum standards for all these nutrients in practically all years for both age groups. The cost of meat may be a contributor to the amount of meat served at any given lunch also. A number of nutrition coordinators expressed that the healthier types of lean chicken or beef is often difficult to purchase due to budget constraints. The inclusion of highly processed meats may also contribute to the high fat content of the meals reported in chapter 4.

5.1.3 Trends of Energy and Fibre (1997–2007)

Analysis of variance of the overall meals analyzed from 1997–2007 suggested that neither energy nor fibre content changed significantly over the years for both breakfasts and lunches analyzed. Visual analysis of other nutrients did not show any outstanding trends either.

This lack of or very small trends is also observed in larger programs such as the NSLP, in the United States, corroborating with the findings in this study. The SNDA study evaluates how lunches and breakfasts are complying with the SMI standards. Three SNDAs were conducted to date: 1991/92, 1998/99, and 2004/05. Although the second showed some significant improvements compared to the first one, the last did not show the improvement expected. In all three studies, selected nutrients (protein, vitamins A and C, calcium, and iron) have been meeting the standards; the main concerns lie on total fat, saturated fat, sodium, and, in some cases, calorie contents. Breakfasts

seemed to have better nutrient profiles than lunches, as well as meals from primary schools were better than secondary schools (Burghardt et al., 1995; Fox et al., 2001; Gordon & Fox, 2007). This shows that the nutritional profile of school meals in the United States has improved over the past fifteen years but is not yet what it should be, particularly lunches.

5.2 On-site Observations

The themes observed from the field notes taken during the observations and are described in this section. Two breakfast and two lunch programs were observed. Observed schools had a large meal program, serving around 100 or more students, contributing to a better empirical assess of plate waste among children.

Findings suggest that children usually eat the offered servings with little waste. This low waste might be attributed to nutrition coordinators' practices and knowledge of children's preferences. In most cases, nutrition coordinators would serve the children. Observations also indicate that the longer nutrition coordinators work in the school, the better they know what children would accept more, resulting in less waste. It seemed also that how much food children ate depended on gender, peer pressure, and eating time allowed which was, on average, 15 minutes. Peer influence was very strong. To illustrate this influence, in one observed school, a group of children was choosing cold cereals, but when one child chose to have toast, many after him chose toast as well. Time constraints also seemed to influence waste. Children often left their food uneaten because they had to return to class or wanted to go play before classes resumed. These observations corroborate with findings from other programs in Atlantic Canada (Dayle et al., 2000).

In the United States, the best national estimate available indicates that about 12 percent of calories from food served to students under the NSLP go uneaten. In fact, three out of four cafeteria managers perceived plate waste as little or no problem, although elementary schools seemed more likely to perceive waste as a problem than middle or high schools. Seventy-eight percent of the managers cited students' attention being on recess, free time, or socializing rather than eating as the main reasons for waste (Buzby & Guthrie, 2002; United States General Accounting Office, 1996).

Other possible causes of plate waste include wide variation in student appetites and energy needs, differences between meals served and student preferences, scheduling constraints that interfere with meal consumption or result in meals being served when children are less hungry, and availability of substitute foods from competing sources (Buzby & Guthrie, 2002). However, some plate waste is inevitable. Reducing plate waste could make program operations more efficient and lower costs (Buzby & Guthrie, 2002).

Additionally, because CHEP administered school nutrition programs are based on a single menu offer, the meals might contribute to healthier choices by students. Studies have shown that when varied food choices are offered, students tend to choose the least healthy options (Addison et al., 2006; Gould et al., 2006). Gordon and Fox (2007) noted that what children serve is very close to what is offered to them.

Findings from the site observations also direct attention to the important role that nutrition education plays in encouraging healthy choices. Many students, especially younger ones, go to the lunchroom at least once a day to eat. Nutrition coordinators are in direct contact with children. Through the meals they serve, nutrition coordinators

have the opportunity to influence children's eating habits and to support classroom messages on nutrition and health.

5.3 Focus Groups

The following sections discuss findings from the interviews of nutrition coordinators' perception and knowledge of the programs' goals and guidelines, menu planning practices, and training needs. Findings from the current 2007/08's nutritional analyses of menus are also discussed in relation to knowledge of practice. The final section reflects comments on various issues that were highlighted by the nutrition coordinators during the interview process.

5.3.1 Program's Goals and Guidelines

When asked what, to their knowledge, the program's goals were, nutrition coordinators were unanimous in their answers: to feed hungry children and offer them healthy food. Few articulated the goal of "providing one third of a child's daily nutrition needs at each meal" (CHEP, n.d.). Most claimed that they were not aware of the *Saskatchewan Guidelines for School Meals* (Public Health Nutritionists of Saskatchewan Working Group, 2004) but claimed they recognized some of its content after a close examination.

This finding is important as awareness of guidelines and standards is generally linked to improved nutritional quality of meals (Nelson et al., 2006). Setting clear goals and standards is not only important for programs themselves but for people who are involved in program delivery. Goals tend to dictate the boundaries, function, and strategies of the program, as well as what guidelines and standards should be set in order to

achieve those goals. Consequently, the present and future direction of a program is tightly associated with participants' clear knowledge of the goals and guidelines.

5.3.2 Menu Planning and Training

Written menu plans helps to ensure that adequate nutrients are provided. Guidance from the public health nutritionist is strongly recommended. To be successful, the menu planner is expected to use up-to-date guidelines and standards to guide the preparation and delivery of menu offerings for health promotion and disease prevention and to ensure that targeted recommended needs are met (Bartrina & Pérez-Rodrigo, 2006; Kaufman, 2007).

The majority of nutrition coordinators explained that they themselves plan ahead the meals served. In some cases, planned menus are adjusted to accommodate foods available during daily or weekly purchases, such as food items on sale. Most indicate that CFGHE is the main guidelines used for menu planning, while taking into consideration the budget and seasonal items. This finding of using the CFGHE for meal planning is congruent with findings from other programs. In Manitoba, 77 percent of participants who followed some guidelines used the CFGHE as the main resource to plan the meals (Government of Manitoba, 2006), and, in British Columbia, a smaller number do so: nine out of the 36 researched programs (McCuaig, 2005).

Concerning education and training, only one-third of the interviewed nutrition coordinators expressed that they had some kind of nutrition or food service background. Researchers note that a lack of nutritional knowledge and training can be a barrier in offering healthy meals, implementing nutrition policies, or carrying out interventions (Briggs et al., 2003; Cho & Nadow, 2004; Department of Education of New Brunswick,

2002; Martin, 1996; Murton, 2004). Since the position of nutrition coordinator is not a recognized paid employment position (Henry et al., 2005) in Saskatchewan, there are no minimum requirements for hiring; many are simply concerned mothers or grandmothers interested in serving food to children. CHEP provides some training through monthly meetings and other in-service opportunities. These opportunities include a *Food Safe and Handling* course and the Health Eating/ Active Living (H.E.A.L.) training, as well as emphasis on menu planning, recipe modification, food preparation and delivery, for example. The Food Safe and Handling course is mandatory not only to the nutrition co-ordinators, but to all food service handlers in Saskatchewan. Barriers to these nutrition courses and training include funding, availability of appropriate material resources, and the nutrition coordinators' time availability. Nonetheless, participating nutrition coordinators demonstrated interest in seeking out continued training to improve technical and social skills.

There is an increasing need to recognize these school food providers as established employment positions. Like Saskatoon, few nutrition coordinators are paid staff in Atlantic Canada. These people aspired, however, to a more professional management framework (Dayle et al., 2000; Henry et al., 2005).

5.3.3 Nutrition Coordinators' Comments on the 2007/08 Nutritional Analysis of Meals

Nutrition coordinators were asked to comment on few recent 2007/2008 findings that were below the standards—the majority of studied nutrients met or exceeded the standards. In respect to the observed low energy and fibre, nutrition coordinators noted that they were not worried about counting calories or grams of fibre. They said that they

followed the CFGHE and, therefore, were surprised to hear that energy and fibre were low according to the nutrient standards. In fact, the food-based analysis showed appropriate food content when compared to the CFGHE. It may be important to emphasize more the nutritional content of meals and how they are linked with the use of the CFGHE in the training of nutrition coordinators. This emphasis would provide them with necessary knowledge to address more specifically some shortcomings on nutrient content suggested by this study's findings.

Findings from the SNDAs, in the United States, illustrate the need of teaching nutrient content of food to school meal providers. Meals served in the NSLP and SBP are high in fat and cholesterol since the first evaluation study in 1995 (Burghardt et al., 1995; Fox et al., 2001; Gordon & Fox, 2007). Pannell (1995) notes that school food service directors have been educated to plan menus to meet the RDAs; they have not, in general, been trained to meet goals for fat and cholesterol. The lack of training on the nutritional content of meals will continually lead to meals that are high in fat and cholesterol as school meal providers do not have enough preparation and background to address the issues directly, in other words, they do not know what to do to decrease fat and cholesterol content. This fact may have implications for our study; if nutrition coordinators do not know how about foods that are high in potassium, for instance, meals are likely to be continually low in potassium, as observed in this study through trend analysis, discussed earlier.

Nutrition coordinators should not only acquire the knowledge of linking nutrient content to the foods they serve, but also be provided with practical means to evaluate the nutrient content of their menus. The USA's NSLP and SBP provide food service staff

two options for planning meals: food-based and nutrient-based—done through computer software—, but both follow nutrient standards (Gordon & Fox, 2007; Team Nutrition, n.d.).

5.3.4 Barriers to Meal Service Delivery

Nutrition coordinators were also asked to comments on the barriers they face in delivering consistent quality meal services. A number of barriers were articulated, which included funding, meeting children's food preference, parental and community involvement, and families' nutrition/ dietary beliefs and practices. Concerning funding, our findings corroborated with findings from a previous 2005 study of CHEP's nutrition coordinators (Henry et al, 2005): funding remains an important barrier to service. At times, nutrition coordinators indicated, for instance, that they would like to increase the offer of fruits and vegetables, whole grain products, and milk but were hampered by budgetary restrictions. The literature supports that funding is indeed the main issue in several school food program delivery (Cho & Nadow, 2004; Government of New Brunswick, 2002; McIntyre & Dayle, 1992; Murton, 2004). In fact, a study conducted by Dayle et al. (2000) noted that many participant school meal providers felt that they had to reduce food quality and choices because of limited funds and increasing overall costs.

Children's food preferences, parent and community participation, and families' nutrition beliefs were also identified as common barriers in other Canadian studies conducted (Henry et al., 2005; Cho & Nadow, 2004; Government of New Brunswick, 2002; Murton, 2004). Being part of the school system, e.g. as teaching assistant, was said to facilitate nutrition coordinators' work as it provided opportunity for easier involvement

with/of parents and teachers. In fact, the literature points that this integration between food staff and school is essential for improving nutrition education and for establishing the roots for a comprehensive school health program (CDC, 1996; Pérez-Rodrigo & Aranceta, 2003; Bartrina & Pérez-Rodrigo, 2006).

Nutrition coordinators interviewed expressed that, while they would like to see more parent and community involvement, they themselves did not seem to know how to engage other stakeholders such as parents and community members. To illustrate, some mentioned that they do not take part into parent council meetings, although they would be allowed to attend. Participation in the school board and council meetings would be a great opportunity to explain and spread the program among school personnel and in the community.

Volunteering was also a common topic among the participant nutrition coordinators. Some nutrition coordinators who work with volunteers recognized them as a valuable help and thus proposed that volunteers should receive appropriate training. Interviewees explained that volunteers not always comply with proper food handling techniques, neither with certain student equity rules when serving food in the school. These mentioned concerns can be turned into opportunities for nutrition coordinators to be involved with the school and the community. Organizing training or information sessions, for instance, for those willing to volunteer would be a good opportunity to get involved with the community and to stimulate engagement from both school and families. Encouraging parent and community participation, as well as participation of other stakeholders (e.g. students, teachers, school board), is of great importance to maintain the focus of the program on the needs of the community the school serves (McIntyre et al.,

2001). Moreover, this engagement would also become an opportunity for nutrition coordinators to teach good nutrition to volunteers, which they indeed recognized in Henry's et al. (2005) study.

Lastly, another common issue was certain donations. Donations are tangible measure of community support (McIntyre & Dayle, 1992). However, nutrition coordinators' major concern lies on some companies that donate their unsold food items to the school programs. These donations are not always healthy choices and comprise mainly high-fat muffins and doughnuts. CHEP staff instructs nutrition coordinators not to accept these types of food; the budget is small, but it does allow healthy food to be purchased and not to depend on unhealthy donations (R. Mireles, personal communication, October 16, 2007). Some of them do refuse, others do not like wasting those foods especially when there are hungry children in the school, yet, others try to refuse, but some volunteers do not acknowledge the need of prioritizing healthy foods and accept the donations.

5.4 Setting Standards

As guidance for program delivers and evaluators, the Saskatchewan's nutrition standards (Public Health Nutritionists of Saskatchewan Working Group, 2004) should be more age specific and combine nutrient- and food-based guidelines. Our findings provide some scientific support to establish—or to improve—standards and nutrition policies for programs carrying similar context and framework as CHEP administered school nutrition program. This section concludes the discussions made earlier by gathering baseline recommendations for school meals standards in Saskatchewan. These rec-

ommendations should be improved as further research on school nutrition programs and policies in Canada is conducted.

Food-based Standards

The *Saskatchewan Guidelines for Schools* (Public Health Nutritionists of Saskatchewan Working Group, 2004) is the current food-based standards for meals served in schools. Our findings suggest that the guidelines should focus on number of servings that are age-appropriate and should specify the food groups the meals are expected to provide. Granted the findings and discussion on the food-based analysis, the food-based standard could better accommodate children's need and school meals provision capacities by recommending 1) one serving of fruits and vegetables at breakfast for both younger and older children, and two to three servings for both age groups at lunches; 2) one serving of milk at breakfasts for both age groups, and increase half or one full serving for older children at lunches; 3) two servings of grain products at breakfasts for both age groups, and increase to two and a half servings for older children at lunches; and 4) decrease to half serving of *meat and alternatives* group. The decrease in *Meat and Alternatives* from one full serving to half serving is due to observations from both the nutrient analysis, i.e., lunches were adequate in protein, iron, and vitamin B complex, and the interviews, in which nutrition coordinators explained the difficulty in offering one full serving of meat. Regarding snacks, the current standard could remain as it is, and nutrition coordinators should acknowledge that increases in the current serving size could offer more nutrients and would continuously be a nutrition education opportunity for a healthier snack. Table 5.1 depicts these suggestions.

Table 5.1. Recommendations on number of servings for food-based standards.

Meal	Age group	Food Groups			
		Fruits & Vegetables	**Milk & Alterna-tives**	**Grain Products**	**Meat & Alterna-tives**
Breakfast	4–8 years	1	1	2	–
	9–13 years	1	1	2	–
Lunch	4–8 years	2	1	2	0.5
	9–13 years	2-3	1.5-2	2.5	0.5
Snacks	4–8 years & 9–13 years	At least one serving from two of the four food groups.			

Nutrient-based Standards

Nutrient-based standards are important to address specific nutrients, so nutrient standards for school meals could address iron deficiency, for example, if nutritional assessment of local children showed that it is a concern in that particular community, address the community needs as they must to. However, being accurately evaluated only through computer software is a constraint of nutrient-based standards (Crawley, 2005b).

The standard of one-fourth of the EARs and AIs for breakfasts and one-third for lunches could be set for energy, protein, carbohydrate, and fibre, and they can be achievable, as shown by our results. The selection of micronutrients for setting nutrient standards should combine both the ones shown to be of major concern—folate, sodium, potassium, and calcium—and the results from future nutritional assessment of children receiving these meals. This combination would better address the population's needs. Limiting fat content to 30 percent of total calories, which was in fact the standard in this study, would also be desirable and can be achievable.

Regarding snacks, the one-fourth EAR might never be achieved. If larger snacks were to be offered, changes in the whole school environment would have to occur such as more time for snacking, more funding, improved facilities, and more nutrition staff and/or volunteers to share the work. Therefore, snacks should provide healthy foods as much as possible and attain to the recommended one serving from two food groups of the CFGHE. More research on snacks should be conducted for setting realistic nutrient standards.

5.5 Limitations and Strengths

In this section, the main limitations of this study are described. These include samples collected and the nutrient analysis software. The main strengths of the study are also described; importantly, consistency in the use of data collection method was seen as a strength of this research.

Sample size

Because this study focused solely on schools running CHEP administered school nutrition program and offering full meals, the sample size had to be limited to these schools. In addition, participation was voluntary, giving room for decreasing the number of schools participating. However, key findings from this study were corroborated by a number of studies (Addison et al., 2006; Dayle et al., 2000; Evers & Russell, 2005; Gordon & Fox, 2007; Government of Manitoba, 2006; Henry et al., 2005; McIntyre & Dayle, 1992; New Brunswick, 2002).

One-day sample

For both the previous reports and the 2007/08 school year analyses, just one-day sample of schools' menu could be collected. This limitation was counteracted by mak-

ing visits randomly to avoid systematic bias and by having just the main researcher collecting and analyzing all the data. Moreover, although one day of the week does not tell the week average of the meals, it does provide some insight into what foods tend to be offered most frequently to students by the schools. One-day sample was also used by the Government of Manitoba (2006) in its last survey.

Serving sizes

The study assumed portion sizes to be static. Some schools pre-portioned the food, whilst others served along the mealtime. Also, samples comprised one standard serving even for those few schools that differentiate portions for older children.

Limitations of the Dietary Recommended Intakes

The DRIs have their own limitations, which reflect on their use. Some of them is that the DRIs consider one nutrient at a time and are based primarily on short-term studies, and the requirements are determined for a single, specified function (IOM, 2006).

Nutrient Analysis Software

Limitations of the nutrient databases relate to the variability of the composition of foods and the incomplete coverage of all the foods that make up the human diet (Southgate, 2004). ESHA Food Processor, used to obtain the meals' nutrient content, has the advantage of providing the 1997 Canadian nutrient database. It limits, however, the options of types of food, does not provide Canadian food groups data, and lacks some nutrient information for many food items.

Variations were reduced as much as possible by inputting recipes with ingredients and weights. Variation in the vitamin content of foods is generally much greater than that for macronutrients (Gatenby, 2007). Because all previous reports detailed the foods

and serving sizes offered in each participant school, it was possible to reanalyze the nutritional information from this original data provided, giving the study more consistency in its results. Even though analysis can never be exact due to individual food variations, it does provide a guide to average provisions.

For practically all Canadian foods, folate and vitamin E data were missing. Thus, after exporting each menu's information from ESHA Food Processor to a spreadsheet, folate and vitamin content for all menus was obtained by accessing the World Wide Web (www) version of the Canadian Nutrient File (Health Canada, 2007c) and calculating through MS Excel the amount in each food item. This procedure was very time-consuming and opened room for human error.

The majority of menu's data in the previous reports were described in household measures. For some Canadian items, ESHA Food Processor specifies only weight and/or volume for inclusion and no option in household measures. In this case, the equivalence in grams was done in one of the following two ways: 1) first, by referring to the online Canadian Nutrient File (Health Canada, 2007c), which presents the household measure and the equivalence in grams for all food items; or, 2) the amount in household measure was converted into grams or millilitres through a conversion tool available at Nutrition Data (Nutrition Data, 2008) if the serving specified in the menu was different from those provided in the Canadian Nutrient File.

In respect to the food-based analyses, ESHA Food Processor reports number of servings from different food groups that a particular menu contains. It is based, however, on the American pyramid food guide. Hence, in order to accord with the CFGHE, the number of servings from each food group was calculated by consulting the on-line

Canadian Nutrient File (Health Canada, 2007c). The file specifies how much is considered to be one serving in the food guide, except if the food belongs to the "other foods" category. This was another manual time-consuming procedure that opens margin for human error.

CHAPTER 6
CONCLUSION AND FINAL RECOMMENDATIONS

This final chapter begins with a review of the research questions addressed in this thesis, followed by a presentation of the main conclusions. The final section considers implications arising from the study and suggestions for future studies.

Evaluation studies are essential to improve the quality of the service provided and, this way, assuring the potential contribution that the service may have to promoting the health and well-being of schoolchildren (Pérez-Rodrigo et al, 2001). Evaluation studies also provide scientific basis for policy-making (Kaufman, 2007). This study provides, for the first time, a formal evaluation of the nutritional quality of meals offered in some Saskatoon schools administered by CHEP's *Children's Nutrition Program* (CHEP, n.d.), using data gathered for school years 1997 to 2006 and 2007/08. The study sought to address three research questions: 1) To what extent do meals (breakfast/snack/lunch) offered by some elementary schools in Saskatoon meet the recommended guidelines of one-third of the DRIs for specific nutrients for lunch and one-fourth for breakfast and snacks?; 2) What are the trends in food/ nutrient quality for meals served in selected Saskatoon schools? How do meal compare along the years?; and 3) What are the perceptions of nutrition coordinators concerning menu planning and service practices, and adherence to nutrition standards/ guidelines? This study provides, for the first time, a picture of the nutritional quality of meals offered in selected Saskatoon schools.

Findings suggested that school meals seem to have, overall, a good nutrient profile. Breakfasts and lunches are meeting or exceeding the standards for almost all stud-

ied nutrients in practically all evaluated years, except for energy, fibre, vitamin E, potassium, and, for children aged 9 to 13 years, calcium. Sodium was found to be above the standards in all years, as well as dietary fat in lunches. Snacks' nutrient content was below the standard in all studied years. The food-based analysis showed that breakfasts and lunches are meeting or exceeding the Saskatchewan's *Nutrition Guidelines for Schools* (Public Health Nutritionists of Saskatchewan Working Group, 2004), with the exception of "meat and alternatives" group for lunches evaluated in the last three. Snacks did not offer one full serving from at least two food groups of the Canada's Food Guide for Healthy Eating, but they can be an opportunity for nutrition education.

Trend analysis on breakfasts' and lunches' energy and fibre contents showed no significant changes along the studied years (1997–2007). Breakfasts' fibre, however, increased two grams from 2006 to 2007.

Length of time in the job and level of nutrition/food service training appeared to influence the menu planning and food service practice of nutrition coordinators. Programs such as the US National School Meal Program provide training to their food service staff on nutrient-based and food-based standards/guidelines (Team Nutrition, n.d.). Nutrition coordinators interviewed may also benefit from a similar training to help enhance their own understanding of menu planning and practices, thereby building greater awareness of the importance of meeting selected nutrient requirements in menu planning. The results of this study are limited because of the small number of schools involved in the study. However, the principles outlined in the discussion are valid. In addition, the method described for evaluating the nutritional content of school meals is one which could be applied usefully elsewhere.

Lastly, the school environment can strongly influence children's eating behaviours. In addition to making progress in offering nutritious meals, schools should have a variety of efforts to encourage healthy eating among children. Nutrition education, whether through the examples provided by school staff, other adults, or the food served in the lunchroom, servery or cafeteria is one way to promote healthy eating. Schools that adopt a comprehensive approach include also evidence of school nutrition policy/guidelines and means to monitor effectiveness in meeting the nutritional needs of students (Briggs, et al., 2003; CDC, 1996; Cho & Nadow, 2004). This study highlights the importance of providing a healthy school environment to reinforce and encourage students to make healthy choices.

6.1 Implications

Findings from this study permitted us to draw some final suggestions, which are categorized into implications for practice, policy, and future research.

6.1.1 Implications for practice

It is essential to improved nutrition coordinators' knowledge, i.e., to ensure that nutrition coordinators are trained and aware of current guidelines for achieving current nutrition standards, both nutrient-based and food-based. Nutrition coordinators interviewed were not always aware of the current nutrition standards and guidelines. Formal training would not only build capacities but shape nutrition coordinators' activities towards meeting the standards and following the guidelines. More nutrition education could be emphasized, as well as the importance of nutrients and age-appropriate portion

sizes. It is important also to provide resources such as appropriate funding to complement training.

6.1.2 Implications for policy

Detailed guidelines and achievable standards are needed to better guide nutrition program providers in their work. This study may provide a base for future development of nutrient-based standards through the emphasis on certain key nutrients. Training in healthful catering and how to meet the nutrient- and food-standards would be crucial for improvement of the service and the meals.

6.1.3 Implications for future research

This study has provided a base for continued evaluation of the program. As indicated in chapter 1, CHEP has, over the years, made various attempts at monitoring the nutritional quality of meals served, and, in doing so, it continues to assess progress towards meeting program's standards and goals. The partnership with the College of Pharmacy and Nutrition of the University of Saskatchewan has been instrumental in helping to ensure continued monitoring of meals served.

To date, evaluations have focused primarily on meals offered. Future research activities may also focus on the actual intake of students to gain an understanding of the impact of the meals served on children's daily intake. Details of a 24-hour dietary intake, for instance, could provide a compelling insight into how school mealtime intake affects children's overall dietary pattern and could also enable the assessment of the importance of balanced school meals in relation to food consumed at other times of the day. Besides evaluating the impact of school meals on children's diet, the nutritional

status of children served by the program could also be an interesting research topic. A nutritional assessment could provide scientific evidence for focusing in certain nutrients when establishing standards for school meals. Monitoring children's nutritional status could also evidence positive nutritional effects of a program in a population (Kaufman, 2007). The results from the contribution of meals on children's diet combined with nutritional assessment would give excellent scientific basis to shape community-driven school meals standards.

This present study did not include the CFGHE's "other foods" category in the food-based analysis. It would be interesting to evaluate how much this food group contributes in the meals offered, which could also unlock opportunities for future interventions. This study could be done by using the same database used in this study.

It would be also worth investigating how meals from one foodservice provider such as CHEP compare with other meals services offered to children in Saskatchewan schools. Students also obtain meals from a variety of service providers, including the individual schools. This comparison may shed further light on the nutrient quality of meals offered or served to students given that there is no national or provincial school meal standard or guidelines.

Finally, in most elementary schools in Canada, students bring their lunches from home. It would be of interest to asses how do meals brought from home compare nutritionally to meals served at schools. A comparative assessment of home-packed lunches to school meals would provide an insight into the nutritional differences between the foods provided in school and foods brought from home.

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APPENDIX A
FIELD NOTES GUIDE FOR FOOD AND BEVERAGE CONSUMPTION, AND FOOD WASTE OBSERVATIONS

Date: ___ / ____ / ____	Time: _____ h _____ min	School: _____
Meal served: ☐ breakfast ☐ lunch ☐ snack	Place of observation: ☐ cafeteria ☐ classroom ☐ Other: _____	

FIELD NOTES:

- specific facts, numbers, and details;
- sensory impressions;
- personal response to the act of recording fieldnotes and how others watch the researcher as she watch them;
- specific words, phrases, summaries of conversations or quotations, and insider language;
- questions about people or behaviour…

APPENDIX B
INTERVIEW GUIDE FOR FOCUS GROUPS

I. Introduction

- Welcome everyone. As you probably know, my name is Laura and today we will chat a little bit about your work as a nutrition coordinator.
- Purpose: The main purpose of our meeting is to gain some insight in your daily practice, and experiences and knowledge as a nutrition coordinator.
- Before we start, I would like to go through the consent letter, so that you know in details how the procedures for this meeting are.

(DO NOT READ: Give each a copy of the consent letter and read aloud. At the end, ask them if they agree to participate. Ask those who agreed to sign the consent form, at the last page. After signing, tell them to return the second copy of the letter, which is the researcher's, and the signed form to you).

- Presence and contact list*:* In order to be able to keep contact with you, in case any clarification is needed, to send a copy of the transcribed interview, and to re-ceive CHEP's honorarium, I would, kindly, ask you to sign, this presence list. Please, fill out your name, phone number, full address, e-mail, if applicable, and then you sign. Please, give it to me after everybody has signed.
- Introductions*:* Now, that you already know me. I am sure that we want to know each other. So, I would like everyone said:
  - Your first name
  - How long you have been working as a NC and
  - The school in which you are a NC currently.

II. Warm-up Discussion

- CHEP Guidelines, Training & Surveys
  - To your knowledge, what are the goals set by CHEP for school meal planning and delivery?

  (DO NOT READ: If they don't know, probe by asking "*Why?*". If they know but tell it wrongly, ask "*How or where did you learn it?*")

- Have you received any training from outside sources (not CHEP), i.e. that was NOT promoted by CHEP?
  - Yes … [listen & probe – *Could you, please, describe, in general lines, the training(s)? When was the last one you took?*]
  - No … [continue]

- Have you received any training from CHEP, i.e. that was promoted by it?
  - Yes … [listen & probe – *What kind of training? Could you, please, describe, in general lines, the training(s)? When was the last one you took?*]
  - No … [continue]

- Have you participated in the previous "What's being served" surveys?
  - Yes … [listen & probe – *How many before this one? Did you receive any of the reports?*]
  - No … [listen & probe – *Why not?*]

- If you participated, did the results of those previous surveys benefit you in your work as a nutrition coordinator?
  - Yes … [listen & probe – *How did they help you?*]
  - No … [continue]

- <u>Nutrition Guidelines</u>
  - Are you aware of the Saskatchewan's Guidelines for School Meals? …[show the guidelines]
    - Yes … [listen & probe – *Have you had a chance to read it?*]
    - No … [continue]

  - If you read, would you be able to cite some key points of the Saskatchewan Guidelines for School Meals?
    - Yes … [listen]
    - No … [continue]

  - Are you aware of Canada's Food Guide for Healthy Eating? … [show]

- Yes … [listen & probe – *Have you had a chance to read it?*]
- No … [continue]

- Is there a copy available of any of these guidelines in your facility?
  - Yes … [listen & probe – *Which one?*]
  - No … [continue]

- To what extent do you participate in the planning of the menus? … [listen & probe]
  - You are responsible for planning all menus
  - CHEP is responsible for planning all menus
  - Other … [specify] (DO NOT READ: Other may be a mixture of CHEP and the NC in planning the menus. Do they know that CHEP is responsible for giving support and they have plan the menu by themselves?)

- Which of the above two guidelines do you refer to in planning or serving meals?
  - Saskatchewan Guidelines for School Meals … [listen & probe – *How often? Which aspect you check the most?*]
  - Canada's Food Guide for Healthy Eating … [listen & probe – *How often? Which aspect you check the most?*]
  - Other … [specify]

- If you plan a menu, how often is it possible to follow the planned menu for the meal(s) you are responsible for? … [listen]

  (DO NOT READ – but cite as examples if they appear to be confused – *Always? Around twice a week? Only for breakfasts? Only for lunches? Try to make them specify times?*]

- If you do not plan the menu, what are the most common things that prevent you from planning a menu for the meal (s) for which you are responsible? …[listen]

III. Discussion

- **Meals' Content**

[DO NOT READ: If the group is not aware of the Saskatchewan Guidelines for School Meals, read the guidelines: **BREAKFAST** - means 1 serving from each of 3 food groups; **SNACK** - means 1 serving from each of 2 or more food groups; **LUNCH** - means at least 1 serving from each of the 4 food groups]

- From your experience, could you describe for me a meal you served that you believe has met the goals of the Saskatchewan Guidelines for School Meals?
  - Yes … [listen & probe – ask for examples]
  - No … [continue]

- To your knowledge, do you think the meals served are, in average, meeting the Saskatchewan Guidelines for School Meals' recommendation?
  - Yes … [listen & probe – *Why?*]
  - No … [listen & probe – *Why?*]

- From your experience, have you made any changes in the meals you serve?
  - Yes … [listen & probe:
    - ✓ *What kind of changes?*

      (DO NOT READ: Do they seem to focus on food quality/nutrition content or on food quantity?)
      - Included more fruits and vegetables
      - Decreased fat rich foods
      - Followed menus
      - Cut/increased portions
      - Other: _____
    - ✓ *Did you face any problems or barriers while trying to implement those changes?*]

      (DO NOT READ, just mark for future reference)
      - Financial issues
      - School's administration
      - Children's preferences
      - Work force
      - Other: _____
  - No … [listen & probe – *Why?*]

IV. "What's being served 2007" results

Firstly, I have to congratulate all of you. The content of the meals were very, very good. I just would like to discuss with you some of the findings and get a better and clearer insight of some of them.

Breakfasts and lunches:

- Practically all the menus analyzed met the recommendations for vitamins and minerals, with very few exceptions. In your opinion, what contributed for these findings? …[listen]

  … [After listening, PROBE:]

  - To your knowledge and experience, what food item(s) or menu planning practices may have contributed to these findings? …[listen]

    (DO NOT READ: Example: try to probe if there is any tentative of including fruits and vegetables for fibre content, milk for calcium, etc.)

- According to the Saskatchewan's Guidelines for School Meals, it is expected that <u>lunches</u> offer at least 1 serving from each Canada's Food Guide group, including one from "*meat & alternatives*" group, but they are falling behind in this aspect. From your experience and in your opinion, why do you think this has happened? … [listen]

  (DO NOT READ, just mark for future reference)

  - ✓ Meat is the most expensive ingredient, and, thus, it's hard to include it everyday
  - ✓ Since it is expensive, we try to offer protein through milk, instead of meat
  - ✓ Meat usually takes more time to be prepared
  - ✓ Health safety issues – meat is harder to storage, requires more careful handling
  - ✓ Other: specify_____

- Generally each menu is planned to meet a particular energy requirement, for example Breakfast 430 to 570 kcal (1800 to 2385 kJ), lunches 570 to 760 kcal (2385 to 3180 kJ). It seems that, on average, breakfasts and, in particular, lunches are falling behind in meeting the total amount of calories, especially when it comes to older children (9 to 13 years old). In your opinion, why do you think this is contributing? … [listen]

- The same situation happened in regard to fibre. In all studied years, the amount of fibre was not enough to meet the recommendations (i.e. breakfasts from 6.25 to 7.75g, and lunches from 8.33 to 10.33g). In your opinion, why do you think this is contributing? … [listen]

Snacks

- Conversely, snacks served did not seem to meet the goals for vitamins, nor for minerals. The CHEP's guidelines for snacks are one-third of a child's daily need or, according to the Saskatchewan's guideline, at least one serving from at least 2 food groups from Canada's Food Guide. In our study, we used guidelines based on the scientific literature, which is one-fourth of a child's daily need to analyze the snacks. Yet, they did not meet the one-forth recommendations. In your opinion, what were the main aspects from snacks you served (if you serve any) that contributed to these findings? … [listen]

(DO NOT READ, just mark for future reference)

- ✓ Children have a very short time to eat their snack, so we cannot offer too many options
- ✓ Snacks are taken to the classrooms, so the variety to be offered is shortened
- ✓ Only very few children eat snacks
- ✓ Snacks are time-consuming
- ✓ Other:

_____

- Facing these findings, if you were asked to make changes to improve the meals, what changes would you make? … [listen]

V. Future work

- Do you expect any significant changes/improvements in your work from now on?
  - ➢ Yes … [listen & probe – *Such what? Why do you think these changes would be important in your work?*]
  - ➢ No … [continue]
- I am sure you have thoughts about what the program does well or could do better.

Can you tell me what you like about the Nutrition Program? …[listen]

What things would you like to see changed about the program? …[listen]

(DO NOT READ: serving portions? Food quality? Food variety? The time? Location of meal service? How the program is administered / run / organized? Etc)

- What further kinds of training would you like to see happen, if any? … [listen]

VI. Closure

- My questions are done. Do you have any questions for me?
  - Yes … [listen & answer]
  - No … [continue]

If you think of a question later you can reach either my supervisor or me using the contact information provided in your letter of consent. Your participation today was very much appreciated. Thank you very much and have a nice weekend.

APPENDIX C
LETTER TO SCHOOL DIVISIONS

{Person in charge in the School Division, Address, Contact}

RE: Nutritional analysis of school meals in Saskatoon

Dear […]:

My name is Laura Gougeon and I am a graduate student at the College of Pharmacy and Nutrition, University of Saskatchewan. For my Masters of Science thesis in Nutrition, I am requesting permission to conduct a study within the Greater Saskatoon Catholic School Division "Nutritional Analysis of School Meals in Saskatoon". The goal of the study is to gain an understanding of the nutritional content of the meals served in schools supported by CHEP Good Food Inc. Each year CHEP has conducted a nutritional analysis of meals served to children in Saskatoon schools. Findings from this analysis have provided valuable information about the quality and quantity of meals served and has served to influence policies and practices regarding the delivery of nutritious school meals. We are writing to request your permission to contact the schools to carry out the study. There are about 22 schools that are currently supported by CHEP Good Food Inc. Each school will be invited to participate in the study.

Visits to the schools will involve: 1) collection of samples of food served at meals and 2) observation of meals consumed by the children. A third component of this study relates to interview of nutrition coordinators.

The collection of food samples is scheduled to take place during three to four weeks in September/October, 2007, when the researcher will visit the participant schools once to collect a sample of food from each meal served in those schools (breakfast/ snack, lunch where served). Each sample will be weighed and codified for analysis of their nutritional content using a appropriate computer software. The procedures used for food sample collection is similar to that used by CHEP in previous years.

Following the collection of samples, the researcher will observe children in selected schools during meal times for portions of meals offered and consumed. Please note that this is only an observation no attempt will be made to speak with the children regarding meals consumed.

The third and final component of data collection will be interviews with the Nutrition Coordinators in focus groups (attachment B). In advance, the procedure will be explained and they will be requested to give their consent of participation. Through the interviews, we expect to gain a broader insight into Nutrition Coordinators' perception regarding the quality and quality of school meals served.

Nutrition coordinators at each participating school will be invited to participate in the study. Those who consent to the interview (attachment C) will participate in a single focus group interview of seven or eight persons (based on availability and location). It is anticipated that 2-3 such focus groups will be conducted. It should be noted that these

interviews will not affect school meal delivery as they will be conducted during off duty times.

We anticipate conducting these interviews following the analysis of the meals (exact date TBA). With the participant's permission, the meeting will be audio taped and hand written notes will be taken. Written transcripts will be prepared and participant will be given an opportunity to review the transcript of their participation in the group and will be invited to make additional comments or change if desired. They will also be asked to sign a consent form for release of transcriptions (attachment D). Each participant and the school division will received a summary of the written report following the completion of the study. Precautions will be taken to keep both the school and participant identity confidential.

Participation in this study is voluntary. Any participant (or school) may decline to participate or withdraw at any time with no effect on the school's relationship with the University of Saskatchewan or the researchers. This study has been approved by the University of Saskatchewan Behavioural Research Ethics Board on May 23rd, 2007 (enclosed). Please, address any questions or concerns about the study to Dr. Carol J. Henry (research supervisor), (306) 966-5833, or through the e-mail address cj.henry@usask.ca; or Laura A. R. Gougeon (primary researcher), (306) 966-6346, laura.gougeon@usask.ca, College of Pharmacy and Nutrition, University of Saskatchewan.

Thank you for your attention to this request.

Sincerely,

Carol J. Henry, PhD. RD.
Assistant Professor/Research Supervisor
College of Pharmacy and Nutrition
University of Saskatchewan

Laura A. R. Gougeon, MSc. Candidate
Primary Researcher
College of Pharmacy and Nutrition
University of Saskatchewan

APPENDIX D
LETTER TO PRINCIPALS

{Principal's name and contact}

RE: Nutritional analysis of school meals in Saskatoon

Dear [Principal]:

We would like your assistance in a study that is being carried out at the College of Pharmacy and Nutrition, University of Saskatchewan, entitled "Nutritional Analysis of School Meals in Saskatoon". The goal of the study is to gain an understanding of the nutritional content of the meals served in schools supported by CHEP Good Food Inc. Each year CHEP has conducted a nutritional analysis of meals served to children in Saskatoon schools. Findings from this analysis have provided valuable information about the quality and quantity of meals served and has influenced policies and practices regarding the delivery of nutritious school meals. Dr. Brendan Bitz has given us permission to contact you (see letter attached). We are writing to request your permission to visit your school to carry out the study.

Visits to the schools will involve: 1) collection of samples of food served at meals and 2) observation of meals consumed by the children. A third component of this study relates to interview of nutrition coordinators. The collection of food samples is scheduled to take place during three to four weeks in October, 2007, when the researcher will visit the participant schools once to collect a sample of food from each meal served in those schools (breakfast/ snack, lunch where served). Each sample will be weighed and codified for analysis of their nutritional content using appropriate computer software. The procedures used for food sample collection is similar to that used by CHEP in previous years.

Following the collection of samples, the researcher will observe children in selected schools during meal times for portions of meals offered and consumed. Please note that this is only an observation and no attempt will be made to speak to the children regarding meals consumed. The third and final component of data collection will be interviews with the Nutrition Coordinators in focus groups. In advance, the procedure will be explained and they will be requested to give their consent of participation. Through the interviews, we expect to gain a broader insight into Nutrition Coordinators' perception regarding the quality and quantity of school meals served.

Nutrition coordinators at each participating school will be invited to participate in the study. Those who consent to the interview will participate in a single focus group interview of seven or eight persons (based on availability and location). It is anticipated to conduct 2-3 such focus groups. It should be noted that these interviews will not affect school meals delivery as they will be conducted during off duty times. We anticipate conducting these interviews following the analysis of the meals November - December, 2007. With the participant's permission, the meeting will be audio taped and hand writ-

ten notes will be taken. Written transcripts will be prepared and participant will be given an opportunity to review the transcript of their participation in the group and will be invited to make additional comments or change if desired. They will also be asked to sign a consent form for release of transcriptions. Each participant and the school division will received a summary of the written report following the completion of the study. Precautions will be taken to keep both the school and participant identity confidential.

Participation in this study is voluntary. Any participant (or school) may decline to participate or withdraw at any time with no effect on the school's relationship with the University of Saskatchewan or the researchers. This study has been approved by the University of Saskatchewan Behavioural Research Ethics Board on May 23rd, 2007, and by the School Division of your school in September, 2007. Please, address any questions or concerns about the study to Dr. Carol J. Henry (research supervisor), (306) 966-5833, or through the e-mail address cj.henry@usask.ca; or Laura A. R. Gougeon (primary researcher), (306) 966-6346, laura.gougeon@usask.ca, College of Pharmacy and Nutrition, University of Saskatchewan.

Thank you for your attention to this request.

Sincerely,

Carol J. Henry, PhD. RD. Assistant Professor/Research Supervisor College of Pharmacy and Nutrition University of Saskatchewan	Laura A. R. Gougeon, MSc. Candidate Primary Researcher College of Pharmacy and Nutrition University of Saskatchewan

APPENDIX E
LETTER OF INFORMATION TO NUTRITION COORDINATORS

{Nutrition Coordinator's name and contact}

RE: Nutritional analysis of school meals in Saskatoon

Dear [Nutrition Coordinator]:

We would like your assistance in a study that is being carried out at the College of Pharmacy and Nutrition, University of Saskatchewan, entitled "Nutritional Analysis of School Meals in Saskatoon". The goal of the study is to gain an understanding of the nutritional content of the meals served in schools supported by CHEP Good Food Inc. Each year CHEP has conducted a nutritional analysis of meals served to children in Saskatoon schools. Findings from this analysis have provided valuable information about the quality and quantity of meals served and has influenced policies and practices regarding the delivery of nutritious school meals. We are writing to inform you about the research and its outlines.

Visits to the schools will involve: 1) collection of samples of food served at meals and 2) observation of meals consumed by the children. A third component of this study relates to interview of nutrition coordinators. The collection of food samples is scheduled to take place during three to four weeks in October, 2007, when the researcher will visit the participant schools once to collect a sample of food from each meal served in those schools (breakfast/ snack, lunch where served). Each sample will be weighed and codified for analysis of their nutritional content using appropriate computer software. The procedures used for food sample collection is similar to that used by CHEP in previous years.

Following the collection of samples, the researcher will observe children in selected schools during meal times for portions of meals offered and consumed. Please note that this is only an observation and no attempt will be made to speak to the children regarding meals consumed. The third and final component of data collection will be interviews with the Nutrition Coordinators in focus groups. In advance, the procedure will be explained and they will be requested to give their consent of participation. Through the interviews, we expect to gain a broader insight into Nutrition Coordinators' perception regarding the quality and quantity of school meals served.

Nutrition coordinators at each participating school will be invited to participate in the study. Those who consent to the interview will participate in a single focus group interview of seven or eight persons (based on availability and location). It should be noted that these interviews will not affect school meals delivery as they will be conducted during off duty times. We anticipate conducting these interviews following the analysis of the meals, probably November – December, 2007. With the participant's permission, the meeting will be audio taped and hand written notes will be taken. Written transcripts will be prepared and participant will be given an opportunity to review

the transcript of their participation in the group and will be invited to make additional comments or change if desired. They will also be asked to sign a consent form for release of transcriptions. Each participant and the school division will received a summary of the written report following the completion of the study. Precautions will be taken to keep both the school and participant identity confidential.

Participation in this study is voluntary. Any participant (or school) may decline to participate or withdraw at any time with no effect on the school's relationship with the University of Saskatchewan or the researchers. This study has been approved by the University of Saskatchewan Behavioural Research Ethics Board on May 23rd, 2007, and by the School Division in September, 2007. Please, address any questions or concerns about the study to Dr. Carol J. Henry (research supervisor), (306) 966-5833, or through the e-mail address cj.henry@usask.ca; or Laura A. R. Gougeon (primary researcher), (306) 966-6346, laura.gougeon@usask.ca, College of Pharmacy and Nutrition, University of Saskatchewan.

Thank you for your attention.

Sincerely,

Carol J. Henry, PhD. RD.
Assistant Professor/Research Supervisor
College of Pharmacy and Nutrition
University of Saskatchewan

Laura A. R. Gougeon, MSc. Candidate
Primary Researcher
College of Pharmacy and Nutrition
University of Saskatchewan

APPENDIX F
LETTER OF CONSENT FOR PARTICIPATING IN THE FOCUS GROUP

You are invited to be a participant in the focus group as part of a major study for evaluating school meals called *Nutritional Analysis of School Meals in Saskatoon*. The purpose of this focus group is to explore the reasons, motives and barriers that induced observing certain trends in the school meals offered by schools enrolled with CHEP, according to previous and current data. In order to protect the interests of the participants, I will adhere to the following guidelines

1. The researcher will ask some open-ended questions in one single meeting to discuss your perceptions of school meals content or the changes you have observed, your efforts toward changes, and the main barriers to preparing and delivering quality meals.

2. The group will last for about 1 hour to 1 hour and a half and will be audio-recorded. Participants are free to answer only those questions with which they are comfortable. The researcher will acknowledge that you can withdraw at any time during the study without penalty or loss of services. If you withdraw, the data collected from your participation will not be published in our study results.

3. The tape will be transcribed and analyzed to discover the patterns and themes discussed. You will be given a narrative version of the transcripts with false starts, repetitions, and paralinguistic utterances (um, eh etc) removed to make it more readable. You can add, delete or change information to reflect what you want to say. You will be asked to sign a Letter of Consent for Release of Transcripts following your satisfactory review of the transcript. You will be able to receive a summary copy of the study following its completion.

4. The researcher will undertake to safeguard the confidentiality of the discussion, but cannot guarantee that other members of the group will do so. Please respect the confidentiality of the group by not disclosing the contents of this discussion outside the group, and be aware that others may not respect your confidentiality.

5. The data collected from you will be kept in a secure place and will be held at the University of Saskatchewan with the researcher's supervisor, Dr. Carol J. Henry, for five years according to the University of Saskatchewan guidelines.

6. The results of the study will be used for a master's thesis. The confidentiality and anonymity of the participants will be protected through the use of pseudonyms.

If you have any questions about your participation or your rights as a participant in this study, you may contact the Ethics Office at the University of Saskatchewan (966-2084) or you can contact me, Laura Gougeon, at 966-6346, or my supervisor, Dr. Carol J. Henry, College of Pharmacy and Nutrition, 966-5833.

Consent of Participation in the Focus Group

I, _____ (please print), understand that this research project has been approved by the University of Saskatchewan Behavioural Research Ethics Board on May 23rd, 2007 and I agree to participate. I am aware of the nature of the study and understand what is expected of me and I also understand that I am free to withdraw at any time throughout the study. A copy of the above letter has been given to me for my records and at the end of the study I may receive a copy of the report upon my request.

_____

Date

_____

_____

_____

Participant's signature

Researcher's signature
(Laura A. R. Gougeon)

APPENDIX G
LETTER OF CONSENT FOR RELEASE OF TRANSCRIPTS

I appreciate your participation in the research study: Nutritional Analysis of School Meals in Saskatoon. I am returning the transcripts of your audio-taped interviews for your perusal and the release of confidential information. I will adhere to the following guidelines which are designed to protect your anonymity, confidentiality and interests in the study.

1. Would you please read and recheck the transcripts for accuracy of information. You may add or clarify the transcripts to say what you intended to mean or include additional comments that will be your words. You may also delete any information that you may not want to be quoted in the study.

2. The interpretations from this study will be used in a master's thesis. Except for the researcher in the study, your participation has remained confidential. Your name or any identifying descriptors will not be used in the final report or in any scholarly articles or presentations if you do not wish to have it used.

3. In accordance with the University of Saskatchewan Behavioural Research Ethics Board, the tape recordings, writing samples, and transcriptions made during the study will be kept with the supervisor in a locked file until the study if finished. After completion of the study, the tapes and other data will be kept for five years at the University of Saskatchewan and then destroyed.

4. Participation in the study is voluntary, and you may withdraw at any time without penalty. If this happens, all information collected from your participation will be disregard and will not be use for any other purpose.

I, , (participant's name) understand the guidelines above and agree to release the revised transcripts to the researcher.
A copy of the transcript release form is provided for your records.

Date_____ Researcher's Signature_____

*As a research participant in this study, you may contact the Office of Research Services at the University of Saskatchewan (966-2084) if you have any questions about the study or you can reach me, Laura Gougeon at: 966-6346 or my supervisor, Dr. Carol J. Henry, College of Pharmacy and Nutrition, 966-5833.