Investigation of Milk and Alternatives Intake and the Impact of School Nutrition Programs in First Nations Schoolchildren

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Objectives: To assess the intake of milk and alternatives, calcium, and vitamin D in on-reserve First Nations youth in Ontario, Canada; and the relationship of these nutrients to body mass index. To assess the impact of a simple food provision program on the intakes of milk and alternatives among First Nations youth in Kashechewan First Nation and Attawapiskat First Nation, Ontario, Canada. To assess the process of implementing a comprehensive school nutrition education program, as well as its effects on the intake of milk and alternatives, as well as knowledge, intentions, and self-efficacy among First Nations youth in Fort Albany First Nation, Ontario.

Methods: Twenty-four hour diet recall data collected by web-based survey between November 2003 and June 2010 (including pre- and post-program) were used to assess intakes. Milk and alternatives, calcium, and vitamin D intakes were described and compared to food and nutrition standards and to intakes in the general population (CCHS cycle 2.2), and related to BMI. Data collected in different years for the same community and season were used to assess yearly effects on milk and alternatives intake (four communities). Data collected in the same year and season but from different communities were used to assess latitudinal effects on milk and alternatives intake (four community pairs). Paired change in intakes was evaluated one week-post snack program implementation in Kashechewan and Attawapiskat, as well as one year post-program in Kashechewan. Change in intakes as well as knowledge, self-efficacy, and intentions were evaluated in Fort Albany after the completion of a comprehensive school-based program. Student (grades 6-8), teacher (from grades K-8), and parent impressions were collected via questionnaires and focus groups.

Results: Mean intakes of milk and alternatives, calcium, and vitamin D were below recommendations and levels seen in the general population. No relationship between body mass index and milk and alternatives, calcium, or vitamin D intake was detected. Latitudinal and yearly variation in intakes was detected in the communities under study. Pilot school food provision programs improved intakes in the short-term under close to ideal circumstances, including adequate dedicated personnel and resource support. After one week, calcium intake increased in Kashechewan ($p=0.044$), while milk and alternatives ($p=0.034$) and vitamin D ($p=0.022$) intakes increased in Attawapiskat. Multiple logistical barriers meant that these improvements were not sustained in the long-term. A comprehensive program in Fort Albany was successful in increasing knowledge ($p=0.050$) and intentions ($p=0.010$) towards milk and alternatives intake. Students were generally grateful for the snack programs, and especially enjoyed the hands-on lessons in Fort Albany. Teachers in Kashechewan thought that the snack program was very valuable for students and helped with their alertness and attentiveness. In Fort Albany, teachers noted that it was helpful to have an outside person who could devote all of their time to teaching the students about nutrition; they thought that the students gained a whole new perspective about nutrition via the program. Parents in Fort Albany were enthusiastic about the school nutrition program, but noted availability and cost as major barriers to healthy eating.

Conclusions: The low milk and alternatives, calcium, and vitamin D intakes seen in the study population parallel results seen in studies of other Canadian Aboriginal populations. Further study is needed to clarify the relationship between milk & alternatives intake and BMI in this population. Latitudinal and yearly variations in intake were identified, and therefore should be accounted for when tailoring interventions to specific First Nations; the needs, opportunities, and barriers in each case may differ significantly. This study demonstrated that school food provision programs were valued by students, parents, and teachers; and were efficacious in improving short-term intakes. Comprehensive programs were shown to improve student knowledge and intentions to make healthy food choices. In order to support long-term effectiveness, the barriers identified through this research, including the need for adequate and sustainable resources, must be addressed.

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1.0 Chapter 1: Introduction

1.1 Background and Statement of Problem

Historically, Aboriginal people were nomads who subsisted on the land, obtaining food by foraging, gathering, hunting, and fishing. Such activities demanded high levels of energy expenditure, and Aboriginal people were well adapted to their feast or famine way of life. The foods that they ate and their levels of physical activity supported good physical health. After their contact with “Western” society at the turn of the twentieth century, and more markedly in the past 50 years, Aboriginal populations have been expected to adapt to the dominant culture in which they now live. Secondary to colonization and acculturation, many Aboriginal populations have lost their traditional lifestyles. In these Aboriginal populations today, market foods that are less nutritious than traditional foods account for most of the energy consumed, and low levels of physical activity are commonplace.

The massive change in lifestyle that Aboriginal people have experienced in the past 50 years has regrettably left them with dramatically poorer health than the general Canadian population. Food insecurity is a widespread problem, and rates of chronic disease far outnumber what is seen in the general population. Prevalences of obesity, metabolic syndrome, cardiovascular disease and type 2 diabetes have reached epidemic proportions. This is a multi-factorial problem, with the environment and genetic susceptibility likely playing roles.

What is most concerning is that this increased prevalence of chronic disease is also affecting today’s Aboriginal youth. While this is a problem of great concern, it also presents the unique opportunity for interventions aimed at altering eating patterns, physical activity levels, and consequently rates of overweight and obesity – traits that are known to track into adulthood – at a time of the lifecycle when such interventions are likely to make a great impact. Results of nutrition interventions will improve knowledge of the current situation and allow for the recommendation of next steps, empowering community members to bring change to their own community.

This thesis aims to provide a better understanding of the eating habits of Aboriginal people living in the northern, remote communities of the Mushkegowuk territory, Ontario (western coast of James Bay and Hudson Bay), with an emphasis on the intake of milk and alternatives. Also, it aims to evaluate the effects of simple food provision programs in Kasechewan and Attawapiskat First Nations, Ontario; as well as the process of implementing a comprehensive school nutrition program and its impact on dietary intakes, knowledge, self-efficacy, and intentions in Fort Albany First Nation, Ontario.

1.2 Study Rationale

Worldwide, the prevalence of overweight and obesity has increased significantly in the past 25 years (Sheilds & Tjempkema, 2006). In Canadian Aboriginal communities, rates of overweight and obesity are far greater than the general population (Garriguet, 2008). Obesity is a known risk factor for type 2 diabetes, which is also on the rise in Aboriginal communities (Tremblay, Perez, Ardern, 2005). There are multiple reasons for the increasing burden of obesity and type 2 diabetes seen in Aboriginal communities, including physical inactivity, poor diets (high energy density foods), genetic susceptibility, physical and social environments (Swinburn, Caterson, Seidell, James, 2004), as well as the rapid nutrition and lifestyle transition that has occurred over the past 50 years (Kuhnlein, Receveur, Soueida, Egeland, 2004). Also, Aboriginal populations have higher fracture rates than the general population (Leslie, Metge, Weiler, Doupe, Wood Steiman, O'Neill, 2006; Leslie, Derksen, Metge, Lix, Salamon, Wood Steiman, et al., 2005; Leslie, Derksen, Metge, Lix, Salamon, Wood Steiman, et al., 2004). The reasons for this are multifactorial, including living in northern latitudes, darker skin pigmentation, low dietary intakes of calcium and vitamin D, and obesity (Schwalfenberg, 2007). Poor dietary intakes may be related to lesser intakes of traditional foods (bone soup, bannock, fish with bones, animal liver) in recent times. Further, it has been reported that "most" North American Aboriginal people are lactose intolerant, since milk was not part of their traditional diet (Born, 2007). This may discourage milk product intake. However, fermented milk products and milk alternatives can usually be consumed by individuals with lactose intolerance.

Modifiable risk factors contributing to the problem include poor quality diets and a sedentary lifestyle. It has been shown that the diets of Aboriginal youth in Canada are poor, often being low in iron, folate, calcium, vitamin D, vitamin A, fibre, fruits and vegetables; while being high in sugar and fat (Willows, 2005b). Diets typically include inadequate vegetables, fruits, and milk and alternatives (Taylor, Timmons, Larsen, Walton, Bryanton, Critchley, et al., 2007; Downs, Arnold, Marshall, McCargar, Raine, Willows, 2009). Intake of "other foods" is high, including excess sugar-sweetened beverages and snack foods like French fries, contributing undue sugar, fat, and salt (Taylor et al., 2007; Willows 2005b; Di Noia, Schinke, Contento, 2005; Trifonopoulos, Kuhnlein, Receveur, 1998). Low milk and alternatives, calcium, and vitamin D intake is of concern due to the impact on bone health and the association that exists between adequate milk intake and the maintenance of a healthy body weight (Heaney, 2003; Teergarden, 2003). Adolescence is also known to be an important time for bone development, since bone mineral stores expand significantly during adolescence, with peak bone mass being attained by the late twenties (Rizzoli, 2008). After this, bone mass tends to decrease with age. Sufficient calcium and vitamin D, among other nutrients, is critical to the attainment of peak bone mass, and increasing calcium intake has been associated with greater bone mass accretion in adolescence and therefore higher peak bone mass (Bonjour, Carrie, Ferarri, Clavien, Slosman, Theintz, et al., 1997). The low intake of milk and alternatives among children in general has been noted as a public health concern (Malik, Shulze, Hu, 2006). With adolescence being an important time for the development of healthy and unhealthy lifestyles that tend to track into adulthood, a comprehensive school nutrition program seems to be a viable approach to influencing a change in eating habits among Aboriginal youth.

Due to their geographical, cultural, and historical differences, Aboriginal communities are very diverse, each with their own set of challenges and circumstances contributing to the problems of obesity and type 2 diabetes that are seen today. Because of this many communities, including those of the Mushkegowuk Territory, lack the information about the specific food and physical activity behaviors that are contributing to the problem in their specific community. Twenty-four hour dietary recall data have been obtained from the communities of Attawapiskat, Christian Island, Fort Albany, Georgina Island, Kashechewan, Moose Factory, and Peawanuck between November 2003 and June 2010. In addition, pre- and post-school nutrition (food provision) program surveys have been obtained in Attawapiskat and Kashechewan. Data have been collected pre- and post- a comprehensive school-based nutrition program emphasizing milk and alternatives in Fort Albany; knowledge, self-efficacy, and intentions were also assessed at these times, using a questionnaire. Using this information, one can gain insight into the determinants of the health problems seen today, with an emphasis on milk and alternatives intake. Further, the challenges faced when trying to implement school nutrition programs in geographically remote, isolated communities will be better understood, and this knowledge can be used in the implementation of future programs. The dissemination of this information to individual communities can empower them to take the necessary action to improve the current situation.

2.0 Chapter 2: Literature Review

2.1 Population Information and Nutritional Context

2.1.1 Population Demographics

In Canada, the term "Aboriginal" is used to describe North American Indian (First Nations), Métis, and Inuit people. The Aboriginal population is growing rapidly; between 2001 and 2006, the Canadian Aboriginal population surpassed the one-million mark, with 1 172 790 Canadians reporting Aboriginal identity in 2006, representing 3.8% of the total population (Health Canada, 2006). Between 2001 and 2006, the Aboriginal population increased by 45%, which is a much faster growth rate than the general population, and can be partly attributed to high birth rates (Health Canada, 2006). This also means that the Aboriginal population is much younger than the general population in Canada, with a median age of 27 years compared to a median age of 40 years in the general population (Health Canada, 2006). The Aboriginal population is youngest in Nunavut, with a median age of 20 years (Health Canada, 2006). Aboriginal youth under the age of 24 years made up 48% of the population in 2006, compared to 31% of the general population.

The greatest numbers of Aboriginal people live in Ontario and the Western provinces. Of the 1 172 790 Aboriginal Canadians reported in 2006, 242 495 resided in Ontario, 196 075 in British Columbia, 188 365 in Alberta, and 175 395 in Manitoba (Health Canada, 2006). Lesser numbers are found in Saskatchewan and Quebec, with far fewer residing in the Maritime provinces and the territories (Health Canada, 2006). In Nunavut and the Northwest Territories, those of Aboriginal identity make up the majority of the population, representing 85.0% and 50.3% of citizens, respectively (Health Canada, 2006). Aboriginal people make up 25.1% of the population in Yukon Territory, and about 15% of the population in both Saskatchewan and Alberta (Health Canada, 2006). The rest of Canada shows a far lower concentration of Aboriginal peoples (Health Canada, 2006).

In Ontario, the majority (70%) of First Nations people lived off-reserve in 2006 (Health Canada, 2006). This is also the case in British Columbia and Alberta (Health Canada, 2006). Census data (2006) have shown that 76% of off-reserve First Nations people lived in urban areas, while 21% of the Aboriginal population lived in census metropolitan areas, making up only a small proportion of the population in these cities (Health Canada, 2006). Health Canada notes significant "undercoverage" among Aboriginal people in the 2006 census (Health Canada, 2006). This is related to the lack of enumeration for 22 Aboriginal reserves (Health Canada, 2006). Much of the data collected on the health of Canadians does not include on-reserve Aboriginal people. Canadian

Census and Canadian Community Health Survey data only include the off-reserve Aboriginal population, who as previously described, tend to make up only a small proportion of the population in census metropolitan areas. The 2002-2003 First Nations and Inuit Regional Longitudinal Health Survey was the first assessment of the health of Aboriginal people living on-reserve. It is clear that further investigation of the health of on-reserve Aboriginal people would be of added value in painting an accurate picture of the health of Canadian Aboriginal populations.

Aboriginal peoples have experienced notable health disparities in comparison to the general population. In 2000, the life expectancy for First Nations males was 68.9 years and 76.6 years for females (Health Canada, 2001). This represents a life expectancy that is 8.1 and 5.5 years lower than the Canadian average as reported by 2001 census data for males and females, respectively (Health Canada, 2001). Aboriginal peoples, especially those living on-reserve, also experience a disproportionate prevalence of chronic diseases, notably diabetes and obesity, which are growing problems. Similarly, rates of hypertension, heart disease, and metabolic syndrome remain higher than the general population. This is likely reflective of a combination of environmental and genetic factors. A comparison of the 2002-2003 First Nations and Inuit Regional Longitudinal Health Survey and the 2001 Canadian Census showed that Aboriginal peoples are less likely than other Canadians to report good or excellent health, and are less likely to have access to primary care than non-Aboriginal peoples (Health Canada, 2001). Education and income also continue to lag far behind the rest of Canada (Health Canada, 2001). The health of children is of utmost concern, with rates of obesity and type 2 diabetes increasing rapidly. The implementation of comprehensive school-based nutrition programs may be a viable strategy for improving the health and future of this population.

2.1.2 The Nutrition Transition

Traditional diets of Aboriginal peoples in Canada contain foods that have been described as those taken from animal and plant species harvested from the local environment (Kuhnlein & Receveur, 1996). Traditionally nomads, Aboriginal people obtained this food via foraging, hunting, fishing, and gathering. Prior to the 20th century, Aboriginal peoples derived the majority of their dietary energy from traditional foods (Kuhnlein & Receveur, 1996). At this time, the establishment of the Hudson's Bay Company near James Bay in Ontario led to the possibility of trading and eventually purchasing of food and other items (Kuhlein & Receveur, 1996). Colonization and the settlement of Aboriginal peoples into reserves led to a situation of acculturation, where

Aboriginal populations having unique social, cultural, and health needs were expected to adapt to the larger and more dominant societies of which they were also a part (Kuhnlein et al., 2004; Kuhnlein & Receveur, 1996). Market foods, described as those that are shipped from the South and sold in stores (Kuhnlein & Receveur, 1996), began to dominate the diets of Aboriginal peoples, while traditional foods and activities became less common.

With time, the use of traditional foods has declined greatly, especially in the younger population, having failed to preserve the traditional cultural values of their elders. A 1996 study of the Déné/Métis, Yukon First Nations, and Inuit communities of the Canadian Arctic showed that adults consumed only 10-36% of energy from traditional food sources (Kuhnlein & Receveur, 1996). More recently, it has been noted that individuals >40 years consume significantly more traditional foods than do younger age groups (Kuhnlein et al., 2004). The decision to choose market or traditional foods includes the balancing of societal, individual, socioeconomic/food security, and environmental (contamination) factors (Willows, 2005a). The proximity and accessibility of roads and urban areas and Northern latitudes have been associated with traditional food use, with less isolated and more Southern communities being less likely to consume traditional foods (Kuhnlein, Receveur, Chan, 2001; Receveur, Boulay, Kuhnlein, 1997).

2.1.3 Current Eating Patterns

The deleterious health consequences resulting from the loss of their traditional food systems and activities are visible in Aboriginal peoples across Canada. Compared to previously, modern lifestyles are much less active and food choices tend to be poor. A literature review documenting the eating habits of Aboriginal peoples in Canada has revealed that current diets are low in iron, folate, calcium, vitamin D, vitamin A, fibre, vegetables and fruits, while being high in added sugar and fat (Willows, 2005a). This has been explained by the fact that the kinds of market foods that are used in the Canadian Arctic are generally low-cost sources of energy, and of low nutrient density (Kuhnlein et al., 2004). It has been found that the consumption of traditional foods leads to a superior intake of protein and most micronutrients (Kuhnlein et al., 2004). It is noted that, on days where no traditional foods are consumed, carbohydrate, fat and sucrose (sugar) intakes are significantly higher (Kuhnlein et al., 2004).

As Aboriginal populations stray further from their traditional food systems, it is the diets of children that are most severely affected, as they tend to consume higher proportions of market foods than do older generations

(Kuhlein et al., 2004). Recent data suggest that Aboriginal children in Canada are failing to meet even the basic requirements of a healthy diet. A 2009 study of Aboriginal children living in northern Quebec found that only 19.1% consumed at least two servings of milk and alternatives per day as recommended by Canada's Food Guide, while an astounding 98.5% failed to meet the recommended five servings of vegetables and fruit (Downs et al., 2009). Similarly, analysis of data from the Active Kids Project in the same region found that 83.7% of children consumed fewer than three servings of vegetables and fruit daily (Downs, Marshall, Ng, Willows, 2008). A study of the Prince Edward Island Mi'kmaq found that only one of the 55 children studied consumed adequate vegetables and fruit (Taylor, Timmons, Larsen, Walton, Bryanton, Critchley, et al., 2007). Further, 24-hour dietary recalls from Mohawk children in Quebec revealed that the most frequently consumed vegetable was French fries, with the second most frequently reported food item being table sugar (Trifonopoulos, Kuhnlein, Receveur, 1998).

Perhaps even more troubling than the apparent dietary inadequacies are the foods and beverages that have been used to replace healthy choices. Both Canadian and American data have demonstrated frequent consumption of snack foods and beverages that are high in fat, sugar, and salt (Taylor et al., 2007; Di Noia et al., 2005). These include things like soda and other sweetened beverages, potato chips, smoked and pickled foods, and fast food items. In comparing Aboriginal children to the general non-Aboriginal population, Aboriginal youth tend to have higher intakes of "other foods" (Taylor et al., 2007; Di Noia et al., 2005), or foods that do not belong to any of the food groups of Canada's Food Guide and generally have a low nutritional value while providing undue sugar, fat, and salt. This is found to be especially the case for on-reserve youth.

In the past, calcium may have been supplied by eating foods containing bones (such as fish bone soup) and from traditional plant foods. Vitamin D may have been supplied by animal liver. Traditional diets tend to include a great enough variety of plant and animal foods to ensure adequate micronutrient intakes (Kuhnlein & Receveur, 1996). Still, when looking at the Dené/Métis of the Canadian Arctic, it has been shown that market foods contribute most to calcium intake (compared to traditional food) (Kuhnlein & Receveur, 1996). Milk is known to be a very good dietary source of both micronutrients, and consumption of milk and alternatives could be a positive effect of the nutrition transition in terms of adequacy of calcium and vitamin D intakes among First Nations populations. Kuhnlein and Receveur (1996) have noted that a shift to market food intake can be concurrent with good nutritional status if the right conditions exist (availability and accessibility of a variety of healthy foods). Milk intake has the potential to improve vitamin D status among Aboriginal populations. Rickets (vitamin D deficiency) still occurs in Canada, with the highest rates seen in the north, where sun exposure (used to produce endogenous vitamin D) is low (Ward, Gaboury, Ladhan, Zlotkins, 2007). Unfortunately, the low intakes of milk and alternatives seen today are not sufficient to necessarily ensure bone health. It has been said that the dire present situation demonstrates a need for health promotion and education programs to increase the intake of milk and alternatives and vegetables and fruit food groups, while reducing the intake of high fat and energy foods (Taylor et al., 2007).

2.2 Challenges Faced by Aboriginal Populations

2.2.1 Health Disparities

Because of the diversity of Aboriginal populations in Canada, health status can vary greatly across and even within communities (Kmetic, Reading, Estey, 2008). This section will therefore discuss the general condition of disparity in health between Aboriginal and non-Aboriginal populations in Canada. Here, extensive disparity has been described in rates of morbidity and mortality (Young, 2003). It is suggested that this discrepancy stems directly from the long history of oppression, systematic racism, and discrimination that Aboriginal people across Canada have experienced as a result of colonialism and acculturation (Kmetic et al., 2008; Frolich, Ross, Richmond, 2006). Ethnicity and poverty are often key health determinants in such populations (Kuhnlein et al., 2004). The history of Aboriginal peoples has regrettably included unequal access to resources such as primary health care and social services; less chances for education, training, and employment; and limited control over land and resources (Frolich et al., 2006).

The health disparity described means that while the rates of some chronic diseases have been decreasing in the general Canadian population, these have been shown to be an escalating cause of morbidity and mortality in Aboriginal and other marginalized populations (Smeja & Brassard, 2000). In fact, the health of Aboriginal peoples in Canada has been compared by some to that of those living in developing nations (Cooke, Beavon, McHardy, 2004). To elaborate, in 2000 the life expectancy for First Nations males was 68.9 years and 76.6 years for females (Health Canada, 2001). This represents a life expectancy that is 8.1 and 5.5 years lower than the Canadian average as reported by 2001 census data for males and females, respectively (Health Canada, 2001). In a comparison of data from the 2002-2003 First Nations Regional Longitudinal Health Survey (on-reserve) and

2003 Canadian Community Health Survey (off-reserve) data, further inequalities in health can be perceived (Health Canada, 2006). The age-standardized prevalence of type 2 diabetes in on-reserve Aboriginal populations is almost four times that of the general population (19.7% vs. 5.2%), with hypertension and heart disease also being more prevalent (20.4% vs. 16.4% and 7.0% vs. 5.0%, respectively). Seventy-three percent of on-reserve Aboriginal people are overweight or obese, compared to 48% of the general population. Self-rated health also suggests a lower quality of life in terms of physical health among Aboriginal people, with 79.7% of those on-reserve reporting good or excellent health, compared to a rate of 88% in the general population.

It has also been said that many of the risk factors for chronic disease stem from the longstanding effects of colonialism, as noted earlier (Kmetic et al., 2008). Among these, rates of daily smoking and heavy drinking in on-reserve Aboriginal populations are more than double that of the general Canadian population (58.8% vs. 24.2% and 16.0% vs. 7.9%, respectively) (Health Canada, 2006). As a result of discrepancies in access to services, training, and job availability, in 2000 the median income for Aboriginals on reserve was $11 643 lower than the general population (Health Canada, 2001). Further, almost 50% of those living on reserve have less than a high school diploma, compared to 22.5% of the Canadian population (Health Canada, 2006). All of these factors leave Aboriginal peoples with unequal chances for optimal health and wellbeing compared to the rest of Canada.

2.2.2 Food Insecurity

The World Food Summit (1996) defined food security as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life" (World Health Organization, 2010). The concept is built on three pillars: food availability (having enough food available on a consistent basis), food access (having the resources needed to obtain nutritious foods), and food use (having adequate water, sanitation, and knowledge of basic nutrition to appropriately use food) (World Health Organization, 2010). At this point in time, food insecurity remains a barrier to healthy eating for Aboriginal peoples in Canada. The 2004 Canadian Community Health Survey (CCHS) revealed that Aboriginal households were more likely to have risk factors for food insecurity than non-Aboriginal households, and that Aboriginal households had a 2.6 times greater odds of being food insecure, even when possessing the same risk factors as non-Aboriginal households (Willows, Veugelers, Raine, Kuhle, 2008). More specifically, one-third of off-reserve Aboriginal households were food insecure, compared to 9% of non-Aboriginal ones (Willows et al., 2008). Of the food insecure households, 19% experienced moderate food insecurity (reporting problems with food access); while 14% experienced severe food insecurity (reporting problems with food access accompanied by disrupted eating patterns and reduced intake) (Willows et al., 2008). This is compared to rates of 6% and 3% of moderate and severe food insecurity in the general population, respectively (Willows et al., 2008).

The rationale behind the higher prevalence of food insecurity among Aboriginal populations is complex and could be related to low income, lower levels of education, and reduced access to and availability of nutritious foods. It is speculated that a major reason for the greater prevalence of food insecurity in Aboriginal households is the greater depth of poverty among this population as compared to the rest of Canada (Willows et al., 2008). For example, 2004 CCHS data show that 17.9% of Aboriginal households receive social assistance, which is significantly greater than the overall rate of 2.5% for the Canadian population (Willows et al., 2008). This, coupled with the extravagant costs of nutritious food in northern remote communities, leaves Aboriginal peoples at a disadvantage. From personal experience in geographically remote communities in northern Ontario, the availability of nutritious foods (fresh produce, milk and alternatives, whole grains) is scarce, and the quality and freshness of available food items is often questionable. In Fort Albany, Ontario, high cost and poor availability, quality, and variety of food items have been noted as barriers to healthy eating (Skinner, Hanning, Tsuji, 2006).

2.2.3 Cultural Food Insecurity

It can be argued that "cultural food security" as described by Power (2008) is also important for Aboriginal people. This relates to the idea that the harvesting, sharing, and consumption of traditional foods are an important part of the cultural identity, health, and survival of Aboriginal people (Power, 2008). Power has assembled a list of threats to the provision of traditional foods; these include the lack of access to land, loss of animal species, change in migratory patterns of existing animal species, decreased knowledge transfer to younger generations resulting in loss of taste for traditional foods, abundance of market foods, lack of funds for hunting expenses, etc. (Power, 2008). Further, problems with environmental contamination and changing ecosystems are threatening the supply and safety of traditional foods (Guyot, Dickson, Paci, Furgal, Chan, 2006; Kuhnlein & Chan, 2000; Wein & Wein, 1995). Looking at this evidence, it can be deduced that cultural food security is likely to be in jeopardy for many First Nations communities.

2.3 Chronic Disease in Aboriginal Populations

2.3.1 Overweight and Obesity

Obesity is generally determined by body mass index (BMI), which is a number that is calculated by dividing a person's weight in kilograms by the square of their height in meters. According to the United States Centers for Disease Control (CDC), it is one of the best ways to assess overweight and obesity in populations (CDC, 2009a). According to CDC standards; normal, overweight, and obesity are characterized by BMIs of 18.5-24.9, 25.0-29.9, and ≥30.0, respectively (CDC, 2009a). According to the World Health Organization (WHO), the worldwide prevalence of overweight and obesity has reached epidemic proportions over the past 25 years (Sheilds & Tjempkema, 2006). In Canada, the prevalence of overweight and obesity among Aboriginals is much higher than the general population (Tjempkema, 2006; Tremblay et al., 2005). Thirty-seven percent of on-reserve Aboriginals are classified as being obese, compared to 15% of the general population. This is a problem that is not unique to Canada; Garriguet (2008) reports similar demographics in the USA, New Zealand, Australia, and the Pacific Islands. The nutrition transition described earlier is presumed to play a role in the current statistics. The situation is best described by Kuhnlein et al. (2004): "When traditional food is lost and low-cost but high-energy market food is substituted, the basis for developing obesity exists". Traditional memories and associations are also postulated to be playing a role. For example, for the Ojibway-Cree of Northern Ontario a larger body size is preferred by older adults as a sign of robustness, while thinness is associated with the infectious diseases that were common in the past (Gittelsohn, Harris, Thorne-Lyman, Hanley, Barnie, Zinman, 1996).

Garriguet has conducted an extensive analysis of the 2004 CCHS data (only includes those living off-reserve). This is worth describing as it paints a comprehensive picture of the existing problem. The self-identification of Aboriginal ancestry was indeed tied to obesity, and Aboriginal people overall were found to have a two-and-a-half times greater odds of being obese that non-Aboriginals. It was found that in Ontario, the higher rates of obesity and overweight among Aboriginal people were mostly attributable to significantly higher rates of obesity among females (Garriguet, 2008). Compared to women in the general population who had an overweight/obesity rate of 47%, the prevalence in Aboriginal women was found to be 17% higher at 64% (Garriguet, 2008). This could be explained by the excess intake of 359 kcal per day in Aboriginal women as compared to a general female population with similar energy expenditures (Garriguet, 2008). Interestingly, it was found that 90% of this higher energy intake could be attributed to "other foods", foods that are not found in any of the food groups of Canada's Food Guide and are often high in fat, sugar, and salt. As would be expected, physical inactivity was tied to overweight/obesity, but this association was found to be stronger for off-reserve Aboriginal populations than non-Aboriginal ones (Garriguet, 2008). According to the First Nations Regional Longitudinal Health Survey (FNRHS) 2002/2003, only about one fifth of on-reserve Aboriginal people engage in adequate daily exercise, with the most common activities being walking, berry picking, and fishing (FNRHS, 2003a). This has been related to substantial decrease in traditional subsistence physical activities (hunting, gathering) and an environment that favors the use of motorized vehicles (FNRHS, 2003a). A final fascinating finding was that in contrast to trends in the general population, Aboriginal people living in lower education households were actually less likely to be overweight or obese than those with higher levels of education (Garriguet, 2008). It is possible (hopefully) those with lower education levels are more likely to engage in traditional hunting and gathering practices, protecting them against the food insecurity they might experience as a result of being unable to purchase market foods. However, seeing as hunting practices can be very expensive, this could also be related to hunger. Finally, food insecurity may also play a role in obesity in Aboriginal populations. As noted earlier, food insecurity is more common in the Aboriginal population as compared to the general population (Willows, 2005a). Because of this, the health value of purchased foods may be a less important determinant of choice than food price in this population (Willows, 2005a).

2.3.1.1 Childhood Obesity

Body Mass Index (BMI) is used as a screening tool to identify weight problems in children and adolescents, but not to classify children or adolescents by weight status, since growth patterns dictate that the usual adult BMI cut-offs would be inappropriate in this population (CDC, 2009b). Internationally acceptable standards have been developed to define overweight and obesity in children (Table 2.1) (Cole, Bellizi, Flegal, Dietz, 2000).

Table 2.1. Childhood overweight and obesity BMI cutoffs (Cole et al., 2000)

Age (years)	BMI equivalent to 25 kg/m^2 (overweight)		BMI equivalent to 30 kg/m^2 (obese)	
	Males	Females	Males	Females
9	19.1	19.1	22.8	22.8
9.5	19.5	19.5	23.4	23.5
10	19.8	19.9	24.0	24.1
10.5	20.2	20.3	24.6	24.8
11	20.6	20.7	25.1	25.4
11.5	20.9	21.2	25.6	26.1
12	21.2	21.7	26.0	26.7
12.5	21.6	22.1	26.4	27.2
13	21.9	22.6	26.8	27.8
13.5	22.3	23.0	27.2	28.2
14	22.6	23.3	27.6	28.6
14.5	23.0	23.7	28.0	28.9
15	23.3	23.9	28.3	29.1
15.5	23.6	24.2	28.6	29.1
16	23.9	24.4	28.9	29.4
16.5	24.2	24.5	29.1	29.6
17	24.5	24.7	29.4	29.7
17.5	24.7	24.8	29.7	29.8
18	25.0	25.0	30.0	30.0

Childhood overweight and obesity are also mounting problems in Canada, with First Nations children demonstrating higher rates than children from other ethnic groups (Willows, 2005b; Story, Stevens, Himes, Stone, Rock, Ethelbah, Davis, et al., 2003). A recent study of Aboriginal children in Northern Quebec illustrates the extent of the problem; in this study, 29.9% of children were found to be overweight, while 34.3% were found to be obese (Downs et al., 2009). In an analysis of the 2004 CCHS data, it is noted that the prevalence of overweight and obesity were 18% and 8% (overall 26%) in the general population aged 2 to 17 years, as compared to 21% and 20% (overall 41%) in the Aboriginal population of the same age group (Sheilds, 2005). With childhood obesity and eating habits known to track into adulthood, this is a frightening situation. It is suggested that the increased prevalence of obesity in Aboriginal children is a multi-factorial problem; physical inactivity, dietary intake, genetic susceptibility, and physical and social environments play a role (Swinburn et al., 2004). The loss of traditional lifestyles with a transition to market foods of low nutritional quality and high energy density is a major contributor to the problem (Kuhnlein et al., 2004; Swinburn et al., 2004).

As described earlier, the intake of "other foods" is problematic in Aboriginal children, with these displacing healthier choices. These foods are likely to contribute to weight gain and can easily be consumed in excess due to their high palatability. As part of the Kahnawake School Diabetes Prevention Project, there was an attempt to determine whether the intake of specific food items could be associated with being overweight or obese. While the analysis was unable to identify foods that could be linked directly to obesity, the authors were able to hypothesize that passive over-consumption could explain the 4 lb (~1.8 kg) per year excess weight gain seen in the subjects (Receveur, Morou, Gray-Donald, Macaulay, 2008). This represents an excess of only 50 kcal per day, which would be easily obtained from high energy density foods such as French fries (5kcal/g) or chips (15kcal/g), which were commonly consumed by children in the study (Receveur et al., 2008). Addressing the problem of obesity is essential because it is a recognized risk factor for type 2 diabetes and cardiovascular disease, both of which are prevalent in Aboriginal populations (Garriguet, 2008).

2.3.2 Metabolic Syndrome

In 2009, a joint statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity reconciled international differences in the clinical definition of the metabolic syndrome (Alberti, Eckel, Grundy, Zimmet, Cleeman, Donato, et al., 2009). The metabolic syndrome is therefore defined as a clustering of interrelated risk factors for cardiovascular disease and type 2 diabetes mellitus (Alberti et al., 2009). These risk factors include an elevated waist circumference (abdominal adiposity), elevated triglycerides, reduced high-density lipoprotein cholesterol (HDL-C), elevated blood pressure, and elevated fasting blood glucose (Alberti et al., 2009). A combination of any three risk factors indicates a diagnosis of metabolic syndrome, with waist circumference being a useful primary screening tool (Alberti et al., 2009).

It is suggested that the recent increased prevalence of metabolic syndrome is related to lifestyle (an imbalance in energy intake and expenditure favoring weight gain) and genetic factors (Pollex, Hanley, Zinman, Harris, Kahn, Hegele, 2006). In the Aboriginal population, genetics, an environmental component, and the dramatic change in lifestyle that has occurred over the past 50 years have been attributed to the problem (Hegele, Zinman, Hanley, Harris, Barrett, Cao, 2003; Triggs-Raine, Kirkpatrick, Kelly, Norquay, 2002; Hegele, Cao, Harris, Hanley, Zinman, 1999a).

The Oji-Cree of Sandy Lake, Ontario are of interest because of the remarkably high occurrence of metabolic syndrome in their community. Pollex et al. (2006) found an adult prevalence of metabolic syndrome of 29.9%, which is among the highest prevalence seen in any subpopulation. Interestingly, the occurrence of metabolic syndrome was much higher among females (33.9%) as compared to males (24.6%) (Pollex et al., 2006).

Of the risk factors for metabolic syndrome possessed in this population, abdominal adiposity was the most common (57.7%), followed by reduced HDL-C (48.0%), elevated triglycerides (32.8%), and elevated fasting glucose (31.1%) (Pollex et al., 2006). Distinct from other populations, the Oji-Cree of Sandy Lake were found to have a low prevalence of hypertension (10.1%), despite quite high rates of metabolic syndrome (Pollex et al., 2006). Also, females were more likely to have abdominal obesity and reduced HDL-C levels than males (Pollex et al., 2006)

Data suggest that a high waist circumference is the primary predictor and most useful screening tool for metabolic syndrome (Kaler, Ralph-Campbell, Pohar, King, Laboucan, Toth, 2006; Daniel, Marion, Shaps, Hertzman, Gamble, 1999). Further, a large prospective study following 2 739 women for 6.8 years found that when waist circumference and BMI were considered simultaneously, elevated waist circumference was associated with greater mortality (Kanaya, Vittinghoff, Shlipak, Resnick, Visser, Grady, et al., 2003). This is of particular relevance to Aboriginal populations, as data demonstrate that Aboriginal populations show a preferential accumulation of truncal fat mass (increased waist circumference); and this is particularly the case in women (Gallo, Schell, Akwesasne Task Force on the Environment, 2007; Leslie, Weiler, Nyomba, 2007). In Australian Aboriginal populations, increased waist circumference has also been associated with other measures of cardiovascular risk such as hypertension, elevated total cholesterol, elevated triglycerides, low HDL-C, and type 2 diabetes mellitus (Wang & Hoy, 2004c). This suggests that cardiovascular events and coronary heart disease may be independently related to waist circumference in this population (Wang & Hoy, 2004c; Shah, Hux, Zinman, 2000).

2.3.2.1 Childhood Metabolic Syndrome

The tendency towards high waist circumferences has been seen in children as well. Based on skinfold thickness, Cree school children have been found to have a high prevalence of truncal adiposity (Ng, Marshall, Willows, 2006), and strong correlations have been found between waist circumference and BMI z-scores in Aboriginal youth (Downs et al., 2008). Data from Sandy Lake, Ontario have shown that about half of Oji-Cree adolescents already had at least one risk factor for metabolic syndrome (Pollex et al., 2006). As with adults, the occurrence of risk factors was more prevalent in girls, of whom two-thirds had at least one risk factor for metabolic syndrome, compared to one-quarter of boys. Interestingly, in the adolescent population, hypertension was the most common risk factor, the opposite of the distribution seen in adults (Pollex et al., 2006). Knowing the damage that can be done by longstanding elevated blood pressure, the tendency towards abdominal adiposity, and the prevalence of metabolic syndrome risk factors, it is clear that Aboriginal youth face an uncertain health future. This is especially the case knowing that type 2 diabetes rates are on the rise in children (Tremblay et al., 2005).

2.3.3 Type 2 Diabetes Mellitus

Type 2 diabetes mellitus is a condition where the body cannot effectively use the blood-glucose-lowering hormone, insulin (Canadian Diabetes Assocation [CDA], 2009a), which is produced in the pancreas and allows blood glucose to be utilized by body tissues. This is known as insulin resistance. Overweight and obesity, as well as physical inactivity (related to weight gain), are known risk factors for the development of type 2 diabetes, due to their contribution to insulin resistance (CDA, 2009a). The Canadian Diabetes Association estimates that 80-90% of those diagnosed with type 2 diabetes are obese (CDA, 2009b). The 2008 CDA clinical practice guidelines indicate that modest weight loss and moderate to high levels of physical activity can greatly improve insulin sensitivity and reduce morbidity and mortality (CDA, 2009a). As a direct result of insulin resistance, poorly controlled type 2 diabetes leads to a condition of chronic hyperglycemia (high blood glucose), which over the long-term is linked to serious deleterious health outcomes, including the damage, dysfunction, and failure of various organs, notably the nerves and small blood vessels (CDA, 2009b). The long-term complications of type 2 diabetes therefore include neuropathy, nephropathy, retinopathy, and cardiovascular disease. All of these contribute to the decreased life expectancy by about five to ten years compared to those without diabetes (CDA, 2009b).

The prevalence of type 2 diabetes, as with obesity, has reached epidemic proportions, affecting an estimated 285 million people worldwide (CDA, 2009b). Aboriginal people are known to have a five times greater risk of diabetes than the general population, and this is noted as being a worldwide problem despite geographical, cultural, and historical differences that exist between various Aboriginal populations (CDA, 2009b; Yu & Zinman, 2007). The dramatic increase in type 2 diabetes prevalence among Aboriginal groups in recent years is postulated to be caused by an interaction between genetic susceptibility and a rapidly changing environment (Yu & Zinman, 2007). Yu & Zinman note Neel's "thrifty gene hypothesis" as being the most popular explanation for the current situation (Yu & Zinman, 2007). Aboriginal nomads developed an energy-conserving genotype that was well adapted to the historical hunter-gatherer "feast or famine" lifestyle. Currently, acculturation has led to the adoption of a sedentary lifestyle, which includes "feast" but not "famine", but genotypes cannot adapt over only a few generations. The result is the "diabetes phenotype". This hypothesis has been supported by a recent worldwide systematic review which found a near absence of type 2 diabetes in Aboriginal communities having maintained traditional lifestyles, while comparable nearby communities with untraditional lifestyles were found to have a six times greater risk for type 2 diabetes (Yu & Zinman, 2007). Interestingly, while acculturation can explain why type 2 diabetes prevalence has increased in Aboriginal populations, it cannot explain why this prevalence has increased far beyond that of the dominant "Western" society (Yu & Zinman, 2007). This is where genetic susceptibility may play a role; this will be explained in detail in section 2.3.3.2.

2.3.3.1 Type 2 Diabetes in Women and Children

Certain segments of the population are of great concern regarding the occurrence of diabetes and its complications. Type 2 diabetes was once seen as an adult disease, but is increasingly becoming a pediatric concern, especially among Aboriginal children where the problem goes beyond that of the general population (Canadian Paediatric Society, 2005). In Aboriginal children, diabetes rates are on the rise in conjunction with a reduction in physical activity (Tremblay et al., 2005). The Canadian Paediatric Society (CPS) has recommended that culturally-based, community-run diabetes prevention programs be initiated to encourage traditional values, increased physical activity and healthy eating, and a reduction in passive activities (CPS, 2005). They also urge stores to stock healthy foods, and for community members to be active role models for today's children (CPS, 2005). Aboriginal women are also of particular concern because of their propensity towards the development of cardiovascular complications (Wang & Hoy, 2004a). Further, it has been noted that the sex ratio for diabetes is reversed in the Aboriginal population, with two-thirds of those with type 2 diabetes being women (Kelly & Booth, 2004). A New Zealand study has shown that while all Aboriginal people with type 2 diabetes were at increased risk for coronary heart disease, the difference was much greater for women, who seemed to develop a higher risk than men over time (Wang & Hoy, 2004a). Further, after adjusting for age, women with type 2 diabetes had a coronary heart disease risk that was 4.2 times greater than those without diabetes, compared to a 1.4 times greater risk seen in men (Wang & Hoy, 2004a). The increased risk in women indicates a need for particular diabetes care in this population.

2.3.3.2 Genetic Contribution to Type 2 Diabetes

The increased susceptibility to diabetes among Aboriginal populations suggests that in addition to environmental and lifestyle risk factors, a genetic predisposition is likely to exist (Hegele et al., 2003). Aboriginal populations are diverse, and it is likely that different gene-environment interactions are related to type 2 diabetes risk in different communities. Hegele and colleagues have studied the Oji-Cree of Sandy Lake, Ontario extensively, allowing for the identification of a specific gene related to diabetes risk via systematic genome scanning (Hegele et al., 1999a). It was found that a new variant mutation of the hepatic nuclear factor-1α (HNF1A) G319S allele was unique to the Oji-Cree, and was found at a frequency of 20% of those with type 2 diabetes, double the rate of those without diabetes (Triggs-Raine et al., 2002; Hegele et al., 1999a). The HNF1A allele was later found to have a specificity and positive predictive value of 95% and 97%, respectively, for the development of type 2 diabetes at age ≥50 years (Hegele, Cao, Hanley, Zinman, Harris, Anderson, 2000). It was also found that those with Oji-Cree type 2 diabetes had an earlier onset of diabetes, often in adolescence (Hegele, Hanley, Zinman, Harris, Anderson, 1999b), and were more likely to be obese, have high plasma c-reactive peptide concentrations (marker of inflammation), and high plasma insulin indicating insulin resistance. Such research is an interesting development and shows promise toward understanding the determinants of diabetes in other Aboriginal populations.

2.3.3.3 Type 2 Diabetes-Related Complications

Beyond the increased risk of type 2 diabetes, Aboriginal populations seem to also be at increased risk for diabetes-related complications, perhaps related to poor disease management. A study of Aboriginal inhabitants of the Bella Coola Valley, British Columbia, showed earlier onset of diabetes as well as higher rates of co-morbidities such as alcohol abuse history, retinopathy, renal disease, cardiovascular disease, neuropathy, hypertension, and elevated blood cholesterol levels than the general population (Thommasen, Patenaude, Anderson, McArthur, Tildesley, 2004). Kidney disease appears to be a common diabetes-related complication among Aboriginal people (Hanley, Harris, Mamakeesick, Goodwin, Fiddler, Hegele, et al., 2005). The prevalence of microalbuminuria and macroalbuminuria in those with diabetes in Sandy Lake, Ontario as found to be 44.0% and 16.9%, respectively. This was related to poor glycemic control, which was found in greater than 50% of participants. It has been shown that such diabetes complications are much more common in those who experience a reduced access to care (Booth, Hux, Fang, Chan, 2005), with First Nations people living on-reserve having rates of diabetes and complications that are up to triple those in the general population (FNRHS, 2003b). This may be because those living in remote locations are likely to delay seeking medical attention until the situation becomes very serious, requiring hospitalization (Booth et al., 2008).

2.4 Viable Strategies for Health Improvement

2.4.1 Targeting Beverage Choice with an Emphasis on Milk and Alternatives

It has been hypothesized that sweetened beverages are increasingly displacing milk in children's diets (Neilson & Popkin, 2004; Harnack, Stang, Story, 1999). This has been supported by a recent laboratory food consumption study in children, where the intake of sweetened beverages was negatively associated with the intake of milk, calcium, and vitamin D (Keller, Kirzner, Pietrobelli, St-Onge, Faith, 2009). This is especially the case as children age, as sweetened beverage intake tends to increase while the intake of milk as a beverage tends to decrease. Cross-sectional data have shown inadequate calcium intakes in American youth (Storey, Kaphingst, French, 2004; Park, Meier, Bianchi, Song, 2002); it is likely that a similar situation exists in Canada. This is especially concerning since adolescence is a time where calcium and vitamin D (found predominantly in milk in the Canadian diet) are required for the attainment of peak bone mass. Without adequate milk consumption, today's youth are laying the stage for complications related to inadequate calcium and vitamin D intake, such as osteoporosis, later in life.

2.4.1.1 Background on Canada's Food Guide and the Milk and Alternatives Food Group

Eating Well with Canada's Food Guide (CFG) is a publication from Health Canada with the goal of helping Canadians to select the types and amounts of foods that will support nutritional health (Health Canada, 2009a). The current version is a revision of the previous 1992 edition of Canada's Food Guide, and was published in 2007 (Health Canada, 2009a). It is based on scientific evidence (for example, current dietary reference intakes) and describes a dietary pattern that will meet the nutritional requirements of most healthy

Canadians and reduce the risk of chronic disease (Health Canada, 2009a). By following the dietary pattern described by CFG, individuals have a high probability of meeting their nutritional requirements (preventing nutrient deficiency) while minimizing their risk of nutrient excess (Health Canada, 2009a). The current iteration of CFG is user-friendly and includes four food groups (looks like a rainbow): vegetables and fruit, grain products, milk and alternatives, and meat and alternatives. For each of nine age and gender categories (boys and girls 2-3 years, 4-8 years, 9-13 years; males 14-18 years; females 14-18 years; males 19-50 years; females 19-50 years; males aged 50+ years; and females aged 50+ years) CFG describes the number of servings from each food group that should be eaten. For each food group, several examples of a serving size are given in pictures and in words. Finally, for each food group there are statements about how to make the best choices from each food group, based on evidence of associations between these foods and chronic disease (Health Canada, 2009a). The newest version of the food guide also includes messages about the intake of dietary fats, variety, beverage choice (emphasis on water), physical activity, trans fats, nutrition label reading,; as well as the special needs of women of childbearing age and those over 50 years of age (Health Canada, 2009a). The current version of CFG is available for free online or through Health Canada in english, french, and ten other languages (Health Canada, 2009a).

In the current version of CFG, the milk and alternatives food group includes milk products as well as other alternative sources of calcium and vitamin D that can be consumed for those who do not eat milk products. The number of servings recommended for each age and sex group is based on maintaining good bone health and reducing the risk of osteoporosis (Health Canada, 2009a). Foods in the milk and alternatives food group contribute to carbohydrate, protein, fat, riboflavin (vitamin B_2), vitamin B_{12}, Vitamin A, vitamin D, calcium, zinc, magnesium, and potassium intakes (Health Canada, 2009a). Milk is fortified with vitamin D in Canada and is therefore a predominant source of this vitamin in the Canadian diet. Other foods in this group may or may not be sources of vitamin D (Health Canada, 2009a). Foods in this group include dry, fresh, or canned milk (servings size is 250 ml), yogurt (175 g), kefir (175 g), and cheese (50 g). Also included are other foods such as soy beverage that have been fortified to include nutrients such as calcium and vitamin D in quantities equivalent to those found in milk (Health Canada, 2009a). CFG recommends drinking 2 cups (500 ml) of milk or fortified soy beverage daily, to obtain adequate vitamin D; and to select lower fat milk alternatives (Health Canada, 2009a).

Health Canada has produced a version of CFG specifically for First Nations, Inuit, and Métis people (Health Canada, 2009a). It is available in English, French, Inuktitut, Ojibwe, Plains Cree, and Woods Cree

(Health Canada, 2009a). It is similar to the standard version of CFG, but is adapted to include a combination of traditional and market foods that are typically available and affordable in Aboriginal communities and remote locations (Health Canada, 2009a). It includes photos of traditional foods and activities, and instead of being pictured as a rainbow, it looks more like a medicine wheel. The First Nations, Inuit, and Métis version of CFG also includes special information about those who do not eat/drink milk products, and about the traditional sources of calcium and vitamin D; including bannock (with baking soda), fish with bones, shellfish, nuts, beans, and traditional plants (Health Canada, 2009a).

2.4.1.2 Role of Calcium and Vitamin D; and Status in Canadian Aboriginal Populations

The role of calcium and vitamin D intake in bone health is one of the most important reasons to ensure adequate milk and alternatives intake, as these foods contain significant levels of these nutrients. This is of utmost importance in Aboriginal populations, as they have demonstrated increased fracture risk as compared to non-Aboriginal populations in Canada (Weiler, Leslie, Krahn, Wood Steiman, Metge, 2007; Leslie et al., 2006; Leslie et al., 2004). The First Nations Bone Health Study (FNBHS), which sampled urban and rural Aboriginal women as well as urban white women, demonstrated that after adjusting for weight and age, total body bone mineral density (BMD) and z-scores (measure of bone density vs. optimal peak bone mass) were significantly lower in Aboriginal versus white women, meaning that Aboriginal ethnicity was associated with lower bone mass (Leslie et al., 2006). Further evidence of the higher risk of fracture in Aboriginal populations includes a retrospective study using the Manitoba administrative health database (1987-1999) (Leslie et al., 2004). This study showed that in both male and female First Nations subjects, significantly higher fracture rates were found, including a risk of spine and hip fracture that was almost double that of the general population (Leslie et al., 2004). Geographic area, income quintile, and diabetes status were also found to be significant predictors of fracture, with those living further north, having a lower socioeconomic status, and having been diagnosed with diabetes having a higher risk (Leslie et al., 2005). It has also been shown that while Aboriginal populations seem to achieve higher peak bone mass than non-Aboriginal populations, Aboriginal women experience greater bone loss at menopause, which may also account for the increased risk of fracture in this population (Perry, Bernard, Horowitz, Miller, Fleming, Baker, et al., 1998).

It is difficult to ascertain all of the reasons behind the increased fracture risk in Aboriginal populations. Insufficient dietary intake of calcium and vitamin D is likely a factor. Further analysis of data from the FNBHS looked at the calcium and vitamin D intakes, as well as vitamin D status in the same previously mentioned Manitoba populations (Weiler et al., 2007). It was found that white women had significantly higher intakes of calcium as compared to Aboriginal women (Weiler et al., 2007). Interestingly, rural Aboriginal women had higher vitamin D intakes from food sources than urban white or Aboriginal women, but white women still had higher intakes of vitamin D because of the use of supplements, which did not exist in Aboriginal women (Weiler et al., 2007). Further analysis found that the Aboriginal women had very low calcium intakes (288-476 mg/d versus the recommended 1000 mg/d for those aged 25-50 years, and 1200 mg/d for those aged >50 years) (Weiler et al., 2007). Vitamin D deficiency (serum 25(OH)D <37.5 mmol/L) showed a prevalence rate of 32% in rural Aboriginal women, as compared to 18.6% in white women (Weiler et al., 2007). Such information is concerning, especially considering the increased fracture risk that is present in Aboriginal populations.

Vitamin D deficiency is not unique to Aboriginal populations, and it has been noted that up to 97% of Canadians have inadequate serum vitamin D levels at some point during the winter and spring (Pasco, Henry, Kotowicz, Sanders, Seeman, Pasco, et al., 2004; Rucker, Allan, Fick, Hanley, 2002). This is because the active form of vitamin D can be synthesized in the skin from UV rays (sunlight). Inadequate sunlight and wearing heavy clothing in the winter months means that vitamin D conversion in the skin becomes suboptimal. If this insufficiency is not made up via dietary sources, vitamin D deficiency may result, causing rickets in children and osteomalacia in adults (Schwalfenberg, 2007). Aboriginal people living in northern latitudes (above the 37th parallel) are at increased risk of insufficient vitamin D (Schwalfenberg, 2007). Darker skin, low dietary intakes, and obesity are other risk factors for vitamin D deficiency that are found in Aboriginal populations (Schwalfenberg, 2007). This further highlights the need for adequate milk & alternatives intake, as these are the predominant sources of vitamin D in the Canadian diet (fortified margarine is another source).

More recently, the need for adequate vitamin D has become more widely publicized as more evidence is becoming available. It has been shown that increasing serum vitamin D levels from 25 mmol/L to 75 mmol/L improved insulin sensitivity, and this improvement was better than that seen with certain diabetes medications (Chiu, Chu, Go, Saad, 2004). Vitamin D has also been shown to have a protective role against cardiovascular disease because it has a role in decreasing systolic blood pressure and heart rate (Pfeifer, Begerow, Minne, Nachtigall, Hansen, 2001). Finally, vitamin D has been shown to have a role in decreasing the risk of some types of cancer. Observational studies have shown that adequate vitamin D intake may decrease the risk of breast, colon, ovarian, and prostate cancers (Garland, Garland, Gordham, Lipkin, Newmark, Mohr, et al., 2006; Gross, 2006; Holick, 2006). These are all reasons why it would be important to ensure adequate vitamin D intake in the vulnerable Aboriginal population. Seeing the current inadequate intakes of calcium and vitamin D, as well as a suboptimal vitamin D status seen in Aboriginal populations and their increased risk of fractures, promoting the adequate intake of milk and alternatives is of utmost importance.

2.4.1.3 Contribution of Milk to a Healthy Body Weight

In 2009, a study of Aboriginal children in northern Quebec reported that only 19.1% of children consumed at least two servings of milk and alternatives daily as recommended by Canada's Food Guide (according to the most recent standards, children should consume 3-4 servings) (Downs et al., 2009). Similar inadequate intakes have been reported in the Mi'kmaq of Prince Edward Island (Taylor et al., 2007). Further, a study of a First Nations community in Walpole Island, Ontario noted that median intakes of low-income First Nations children were lower than low-income children in the general population (Kuperberg & Evers, 2006). Encouragingly, 87% of children in the northern Quebec study reported having milk available in the home (Downs et al., 2009). Malik and colleagues (2006) report that the "reduction in milk intake among children is a public health concern because milk is an important source of protein and certain vitamins and minerals, such as calcium, vitamin D, vitamin A, and vitamins B_{12} and B_6".

The contribution of milk and calcium consumption to a healthy body weight has been controversial, but research has been promising in demonstrating that milk intake has the potential to reduce the risk of overweight and obesity in children. Certainly, when considering the alternatives, milk is a nutritionally dense choice, providing numerous immediate and long-term nutritional benefits. Even chocolate milk, which is often preferred by children, offers all of the nutritional benefits of white milk while providing only about 15 g of added sugar per serving (as compared to the 40 g found in a can of soft drink). Epidemiological studies have shown an inverse association between dietary calcium consumption and body weight (Heaney, 2003; Teergarden, 2003), but calcium supplementation on its own has not been shown to have this same effect on body mass (Barr, 2003; Parikh & Yanovski, 2003; Davies, Heaney, Recher, 2000). This is suggestive that other components of milk may be responsible for the weight moderating effect (Barba, Troiano, Russo, Venezia, Siani, 2005). This reflects the action of other nutrients as well, which tend to be better absorbed and utilized when obtained from food vs. supplements, as food components tend to work in concert to achieve their health promoting effects. Further evidence from a study of schoolchildren in southern Italy has shown that the prevalence of overweight is inversely associated with the frequency of whole milk consumption (despite high fat content), with the risk of overweight being significantly higher in "poor" milk consumers (≤1 serving per week) (Barba et al., 2005). This supports the notion that there is a need to promote milk intake in Aboriginal schoolchildren.

2.4.1.4 Contribution of Sugar-Sweetened Beverages to Obesity

Following the nutrition transition described in section 2.1.2, the intake of healthy foods has declined, while the intake of low-cost and high-energy market foods has become dominant (Kuhlein et al., 2004). It has been shown that in Aboriginal populations across Canada, sugar intake is high (Willows, 2005b). From personal experience, sugar-sweetened beverages such as soft drinks and fruit drink powders such as Tang are widely available in northern Ontario grocery stores, with the tendency to be found at much lower prices than more healthy beverages such as milk or fruit juice.

The World Health Organization has suggested that added sugars should provide no more than 10% of daily dietary energy (WHO, 2003). To put things in perspective, one can of soda contains about 40 g of added sugars, equating to 160 kcal worth of added sugar. The reason that the excess intake of sugar-sweetened beverages is of great concern is that the consumption of sugar-sweetened beverages has been proposed as an independent risk factor for obesity in children, contributing to weight gain while providing little nutritional benefit (Malik et al., 2006; DiMeglio & Mattes, 2000).

A 2006 systematic review of the impact of sweetened beverage intake on obesity has shown strong evidence for the independent role of sugar-sweetened beverages (particularly soft drinks) in the promotion of weight gain and obesity in children and adolescents (Malik et al., 2006). Two large-scale cross-sectional studies, Growing Up Today (GUT) and NHANES III have suggested a positive trend between sugar-sweetened beverage intake and increased weight (Berkey, Rockett, Field, Gillman, Colditz, 2004; Forshee, Anderson, Storey, 2004). A prospective cohort study of the risk of overweight in low-income children over a one-year period showed that the consumption of sugar-sweetened beverages was associated with the development of overweight in normal weight children, and the maintenance of overweight over time (Welsh, Cogswell, Rogers, Rockett, Mei, Grummer-Strawn, 2005).

On a positive note, randomized controlled trials in children and adolescents have shown good results following the reduction of sugar-sweetened beverage intake in these populations (Sichieri, Trotte, de Souza, Veiga, 2008; Ebbeling, Feldman, Osganian, Chomitz, Ellenbogen, Ludwig, 2006; James, Thomas, Cavan, Kerr, 2004). While this is not the focus of the current research, this information is of interest as sweetened beverages intake interact with milk intake or be an indicator of diet quality. A closer look at their impact in the current population would be interesting in the future.

2.4.2 Children as a Target Population

Numerous studies have helped to establish the link between childhood obesity and overweight with an increased risk of obesity and overweight in adulthood (Herman, Craig, Gauvin, Katzmarzyk, 2009; Singh, Mulder, Twisk, van Mechelen, 2008; Deshmuck-Taskar, Nicklas, Morales, Yang, Zakeri, Berenson, 2006; Campbell, Katzmarzyk, Malina, Rao, Perusse, Bouchard, 2001; Kvaavik, Tell, Klepp, 2003; Power, Lake, Cole, 1997a, b). The persistence of weight status from early life into adulthood is known as "tracking", where early weight measurements allow for the prediction of later weight measurements because weight tends to maintain the same position within a population over time (Twisk, 2003). To elaborate, tracking can be measured in several ways, most commonly by the maintenance of percentile rank over time (Malina, 2001a, b). To understand the significance of weight tracking over time, it is useful to take a careful look at the available evidence. A large prospective study following 11 212 children between the ages of seven and 16 years and later at 23 and 33 years found that 43% of males and 60% of females who were obese at age seven continued to be obese at age 33, while 64% of males and 72% of females who were obese at 16 years continued to be obese at 33 years (Power et al., 1997). Here, we see that the relationship between childhood weight and adult weight status appears to become stronger with increasing childhood age. This has been supported by a study by Guo and colleagues (2002) that found that the strongest tracking of overweight and obesity was seen with increasing baseline age.

Recent systematic reviews have come to similar conclusions. A 2008 systematic review investigating weight tracking noted 25 published studies, all of which reported that overweight children were at an increased risk of being overweight in adulthood as compared to their normal weight peers (Singh et al., 2008). A further evaluation of the 2002-2004 Physical Activity Longitudinal Study in Canada claimed that overweight status in youth was almost a guarantee of future overweight or obese status in adulthood (Herman et al., 2009). As a result of these and similar findings, it becomes obvious that the current increasing rates of childhood obesity raise severe public health concerns for the future (Herman et al., 2009; Singh et al., 2008). With a large number of overweight children becoming overweight adults, the burden of obesity and its co-morbidities on the health care system and health of the population in general could be devastating. This makes a good case for the need to intervene early in children and youth, to prevent the onset of obesity in the first place and to help children adopt healthy habits that one would hope would track into adulthood.

Interestingly, not only does weight status seem to track over time, there seems to be a concurrent tracking of dietary behaviours. This has been investigated as related to the consumption of fruit and vegetables. A longitudinal study following 521 children in Norway from the ages of 14 to 21 showed that the relative ranking of fruit and vegetable intake was maintained over time (Lien, Lytle, Klepp, 2001). Perhaps not surprisingly, it was also found that eating habits tended to worsen with age until at least young adulthood; compared to at age 14, the prevalence of daily vegetable and fruit eaters decreased by almost half by age 21, with soft drink intake increasing dramatically (Lien et al., 2001). Here, we see the need for early and continued education to improve the diets of children and to help them to maintain these healthy eating patterns over time. Looking more carefully at milk and alternatives intake and bone mass, a recent study evaluated bone mineral content (BMC) in girls and boys between the ages of ten and 17 (Budek, Mark, Michaelson, Molgaard, 2010). It was found that the correlations between total BMC and age ten vs. age 17 were positive at 0.56 for boys and 0.81 for girls (Budek et al., 2010). This finding offers further support for the need to intervene early in childhood in order to prevent the devastating consequences of poor eating habits that could occur later in life, such as osteoporosis in this case.

Finally, it should be noted that childhood and adolescence are critical periods of growth and times where individuals may be quite easily influenced by peers, family, and others. Adolescence in particular has been identified as a critical transitional period where alterations in total body fat and body fat percentages occur in boys and girls, making it an important time for the potential development of obesity-related co-morbidities (Morrison, Barton, Biro, Daniels, Sprecher, 1999a; Morrison, Sprecher, Barton, Waclawiw, Daniels, 1999b). It is important to intervene at this critical time in order to prevent future problems. It can also be noted that children who are obese tend to become targets of discrimination (Dietz, 1998), which can have a lasting effect on their self-esteem, body image, and even later success in life. For example, results of the National Longitudinal Study of Youth showed that women who were obese in late adolescence had lower education completion rates, lower family income, and higher poverty rates in later life than non-obese women (Gortmaker, Must, Perrin, Sobol, Dietz, 1993). This relationship was independent of baseline socioeconomic status and aptitude test scores (Gortmaker et al., 1993). On another note, a study of 11 192 kindergarten children showed that overweight children had significantly lower math skills and reading scores than their normal weight peers, a relationship that persisted over time (Datar, Sturm, Magnabosco, 2004), meaning that overweight children may be at a disadvantage early on. Synthesizing all of this information, it becomes clear that interventions in children are essential to preventing the severe future public health consequences that will ensue if today's children are allowed to continue their poor dietary behaviours.

2.4.3 Schools as an Ideal Setting

According to the US Centers for Disease Control and Prevention (CDC), schools are an ideal setting for public health interventions because they can reach almost all children, allow for the opportunity to practice healthy eating, can teach children to resist social pressures, have a wealth of skilled personnel available, and are a central part of a child's social environment (CDC, 1996). For most youth, the majority of the day and week is spent at school (Story, Kaphingst, French, 2006), making the school the most predominant influence in a child's life, outside of the home. Perez-Rodrigo and Aranceta (2001) have stated that the "settings approach" has become popular in health promotion, recognizing that using specific settings such as schools should be seen as a crucial opportunity to influence health via policy implementation. They further indicate that schools may be one of the most effective ways to reach a large segment of the population; including children, school staff, family members, and the community (Perez-Rodrigo & Aranceta, 2001).

One reason that schools are an ideal setting for nutrition interventions is that schools will be unable to achieve their primary goal of general education if children and staff are not healthy, both physically and otherwise (Story et al., 2006). By providing the environment, support, and skills to adopt healthy eating habits, both children and the school will benefit as children will be better equipped to attain their educational potential (CDC, 1996). Research in children has shown that breakfast consumption (related to breakfast programs) in particular can improve daily nutrient intakes (including intake of milk and alternatives), school attendance, and cognitive function as compared to non-participation in breakfast programs (Gleason & Suitor, 2001; Story et al., 2006; Rampersaud, Pereira, Girard, Adams, Metzl, 2005; Kleinman, Hall, Green, Korsec-Ramirez, Patton, Pagano, et al., 2002).

An important aspect to investigate, especially in remote northern Aboriginal communities, is the ability of school nutrition programs to provide a 'safety net' for those who are at risk of malnutrition secondary to food insecurity (American Dietetic Association [ADA], 2006). School nutrition programs being universal, children who might otherwise experience food insecurity will have access to healthy food that will promote the healthy eating behaviours that contribute to optimal growth, development, and cognitive abilities (ADA, 2006; Brown & Pollitt, 1996). In the United States, universal nutrition programs have been shown to improve nutrient intakes and provide nutrition education to families and children at risk of poor nutritional status (Kennedy & Cooney, 2001; Kennedy, 1999). The ability of schools to reach a large segment of the population, including those who might otherwise have little access to health information, is an important reason to look to schools as a potential setting for nutrition and health interventions in today's youth.

2.5 Framework for the Development of a Comprehensive School Nutrition Program

In 1996, the US Centers for Disease Control and Prevention released guidelines for successful school nutrition programs in collaboration with experts in the field and based on the review of research, theory, and practice (CDC, 1996). The guidelines emphasize the need for a consistent message to be sent to children and youth, via a comprehensive program that is said to empower children with the knowledge, attitude, skills, environment, motivation, and support to independently make positive decisions regarding their health and dietary behaviours (Brant County Health Unit, 2005; CDC, 1996). According to this comprehensive framework, nutrition education itself is not enough, the school must also provide an environment that is conducive to behaviour change and that is supportive of the healthy behaviour choices that students will be expected to make. That being said, according to the CDC comprehensive framework, school nutrition programs should include a school nutrition policy and supportive school environment, a nutrition education component, integration of school food service, training for school staff, family and community involvement, and a program evaluation (CDC, 1996).

A recent review of 15 dietary change interventions in children has found that interventions that are effective in terms of changing dietary behaviour are ones that have a comprehensive approach, such as the one found in the CDC framework (Sahay, Ashbury, Roberts, Rootman, 2006). The need for a theoretical basis, family and community involvement, the delivery of clear messages, and the provision of adequate training and support were found to be key to program success (Sahay et al., 2006), all of which are found in the CDC framework. Daniels and colleagues (2005) have further noted that interventions taking a comprehensive approach offer a sufficient 'dose' of the intervention in order to cause significant and sustained changes in a child's behaviour (Daniels, Arnett, Eckel, Gidding, Hayman, Humanyika, et al., 2005). Further, the Position Statement of the American Dietetic Association (1996, 2006) shows agreement in the need for a comprehensive approach to dietary change when it comes to school programs, and further notes the need for the program to be culturally appropriate (ADA, 1996, 2006). In light of this information, the CDC framework, in combination with other similar approaches were used in devising a school nutrition intervention for the population of interest under study. Each element of the framework will be detailed in sections 2.5.1 through 2.5.6.

2.5.1 Nutrition Policy and a Supportive School Environment

According to the CDC, a school nutrition policy is a brief document that outlines the expectations of the nutrition program and provides a framework for the implementation of all the other components of the program (CDC, 1996). The importance of the school nutrition policy is that it includes input from all relevant stakeholders, so it will be assured that children will receive consistent health and nutrition messages (CDC, 1996). The CDC gives specific guidelines as to the content of a school nutrition policy. It should include a description of the importance of the nutrition education component; should publicly commit the school to all aspects of the nutrition program; should account for training of teachers and support staff; should commit to supplying healthy and appealing food at all occasions; should discourage teachers from using food as a reward or punishment; and commits teachers to eating with students and to be good role models (CDC, 1996). This policy can be very formal, or it can be informal, but should commit all members of the school community to providing a consistent healthy environment that is promoting of positive behaviour change. In the case of the Aboriginal communities under study, a more informal policy may be a good idea. Without previously established policy, it seems logical that the first step would be a more informal policy. Also, formal school policies don't appear to be the norm in these communities, and imposing them would seem to be a harsh first step that would be difficult to adapt to.

There is some evidence that underlines the importance of a school nutrition policy as a part of a comprehensive school nutrition program. Not surprisingly, it has been shown that in schools with established policies, students are less likely to make unhealthy snack purchases than in schools without such policies (Neumark-Sztainer, French, Hannan, Story, Fulkerson, 2005). This is especially the case if the policy directly restricts access to these types of unhealthy food and beverage options (Neumark-Sztainer et al., 2005). A recent review of successful school nutrition programs found that the social cognitive theory was well suited to guiding nutrition policies and guiding nutrition change in children (Sahay et al., 2006). A recent study in Prince Edward Island, Canada, looked at the change in student dietary intakes before and one year after the implementation of a province-wide school nutrition policy. This is the first study of its kind in Canada to show improvements in intakes following the implementation of such a policy, noting a decreased intake of low nutrient density foods and an increase in fruits and vegetables and milk and alternatives intakes (Mullally, Taylor, Kuhle, Bryanton, Hernandez, MacLellan, 2010). In general, the establishment of a policy that all members of the community agree on allows for consistent messages and expectations among all those involved (Brant County Health Unit, 2005).

2.5.2 Nutrition Education Curriculum

The nutrition education curriculum is a central component of any successful school nutrition program. According to the CDC framework, the nutrition education component needs to be focused on teaching children to understand how their dietary behaviour will affect their health (short- and long-term) (ADA, 1996; CDC, 1996). To ensure positive reception of the program by children, it should be culturally appropriate and delivered in a fun and developmentally appropriate way (CDC, 1996). Both the CDC and ADA agree that nutrition education should be integrated across the curriculum, and should start early and continue throughout the school years (ADA, 1996; CDC, 1996). By encouraging nutrition education across the curriculum, health messages will be reinforced often. This is important because it has been shown that behavioural changes correlate with the amount of nutrition education that a child is exposed to (Brant County Health Unit, 2005).

In delivering the nutrition education curriculum, the CDC notes that knowledge alone is not enough, so school nutrition programs need to be behaviour-based (CDC, 1996). For the school nutrition curriculum to translate into behaviour change, the development of the skills needed for food preparation, learning about the cultural aspects of food, and discussions about self-esteem should be included (Perez-Rodrigo & Aranceta, 2001).

Within this context, active learning techniques are recommended (CDC, 1996). This is because it has been shown that children will be more likely to adopt healthy eating habits when they learn via participatory activities; when the lessons emphasize the positive effects of healthy eating; when students have the opportunity to taste healthy foods; and when the healthy eating concepts are presented in a way that has a specific importance the child's everyday life (CDC, 1996). Along the same lines, social learning techniques are also recommended as they will give students repeated opportunities to practice their healthy habits and to have them reinforced, which in turn will give children and youth the confidence to be able to make independent healthy eating choices (CDC, 1996). Seeing as the nutrition transition has occurred over only the past one or two generations, parents and grandparents may not know which market foods are healthy and which are less healthy, so it may be difficult for them to be models for their children. In practicing healthy habits at school, children will be able to learn and hopefully bring their knowledge and practices home with them.

2.5.3 Training for School Staff

Training of school staff, especially teachers who will have direct contact with implementing the nutrition education curriculum, is imperative to allow for successful program implementation. With children and youth spending the majority of their day at school, teachers have the potential to be the greatest influence on a child's eating habits outside of the home (Brant County Health Unit, 2005). Being in a position of authority, children and youth are likely to trust their teachers as sources of nutrition information, so it is important that the information that they are relaying is accurate and conveyed in an appropriate manner (Brant County Health Unit, 2005).

To ensure that the nutrition curriculum is delivered in the most effective way possible, teachers need to be educated in the techniques that the CDC recommends for the most successful delivery of information that will affect behaviour change in participating children, rather than simply an accretion of knowledge (CDC, 1996). For this reason, it is recommended that teacher's training be focused on helping teachers to know how to use active learning techniques (CDC, 1996). According to the CDC, training is most effective when it is designed to meet the specific needs of teachers based on their experience with the subject matter and techniques that will be used; allows teachers to practice the techniques they have learned; is continuous and allows teachers to try out newly learned techniques and share experiences with others; and provides a post-training session to allow teachers to discuss any difficulties and successes (CDC, 1996).

Training sessions should also focus on behaviour change in the teachers themselves (Perez-Rodrigo & Aranceta, 2001). This is because the teachers themselves must be positive role models for the children they are teaching at all times (Story et al., 2006; Brant County Healthy Unit, 2005; CDC, 1996). As with the participation of school food services, teachers who do not role model the behaviours that they are teaching will dilute the effects of the nutrition education curriculum. By being educated on behaviour change modeling, they will be better equipped to act as good examples for the children they are teaching, and will hopefully strengthen their belief in the curriculum, which may in turn improve the enthusiasm with which it is delivered. Further, environmental change, such as access to healthier foods via food services, will be helpful to the teachers as well as the students.

2.5.4 Integration of School Food Service

The integration of food service within the comprehensive school nutrition program framework is of utmost importance because school meals and snacks give children the opportunity to practice the healthy eating behaviours that they have learned in class via nutrition education (Brant County Healthy Unit, 2005; Perez-Rodrigo & Aranceta, 2001; ADA, 1996; CDC, 1996). Where a cafeteria or vending machines are available, students can use the skills they learn in the classroom to make positive choices and translate their learning into behavoiur change. With this in mind, it is essential that the school food service closely follows the school nutrition policy and is coordinated with classroom lessons (Brant County Health Unit, 2005; CDC, 1996). This is critical because the school nutrition program will lose effectiveness if children receive competing health messages (Brant County Health Unit, 2005). For this reason, it is recommended that competitive foods be eliminated (Story et al., 2006), because these are barriers to healthy eating (ADA, 1996) and do not encourage healthy choices. By integrating food service with the school curriculum, children will receive the consistent messages needed to help them practice healthy eating habits in a controlled environment.

There are several recommended actions that school food service personnel can take to become active participants in a healthy school nutrition program. Some activities include teaching students about preparing healthy foods (hands-on) and using recipes, involving students in planning the menu to ensure healthy and palatable foods, offering students foods that reinforce classroom lessons, posting flyers about healthy eating, and providing nutrition information to allow students to practice label reading and making healthy choices (CDC, 1996). On that note, the Pathways program is a success story in terms of school foodservice, being able to significantly decrease the fat content of school meals in five pilot schools after 18 months (Snyder, Anliker, Cunningham-Sabo, Dixon, Altaha, Chamberlain, et al., 1999). Here, the foodservice intervention had five components, including nutrient guidelines, behavioural guidelines, food service personnel training, hands-on activities, and kitchen visits (Snyder et al., 1999). These five components would therefore be recommended to school foodservice operations in order to help them to provide an environment that is supportive to students acting on the information that they have learned in their classroom lessons.

2.5.5 Family and Community Involvement

Family and community support and involvement in the school nutrition intervention is recommended because it has been shown that children are more likely to adopt healthy eating habits if they receive consistent messages from multiple sources (Brant County Health Unit, 2005; CDC, 1996). Parents may be the most influential sources for children's eating habits because they are usually responsible for what food is brought into the home, what foods are served and how often, when meals are consumed outside the home, and are models for eating and physical activity behaviours (Story et al., 2006). A recent study of 1 589 grades four to six students found that a child's dietary beliefs and behaviours were significantly associated with parental dietary beliefs and behaviours (Lazarou, Kalavana, Matalas, 2008). For example, parents who were demanding or perfectionists tended to have children who were over-concerned with their eating behaviours and body weight (Lazarou et al., 2008). Parental diet quality was also found to have an effect on children. Parents with mediocre eating habits as described by the Healthy Eating Index were likely to have children whose diets included frequent unhealthy food consumption (Lazarou et al., 2008). In this case it is said that children learn from parents via modeling of behaviour (Lazarou, 2008). Specifically looking at milk products, a recent study of a representative sample of children in the United States found that calcium and dairy product intake were strongly correlated to the mother's intake (Beydoun, & Wang, 2009).

Parents can also be barriers to healthy eating in children. It has been proposed that that kind and amount of food consumed is related to the availability of those foods in the home (Lazarou et al., 2008; Patrick & Niklas, 2005). If healthy foods are not available, most children do not have the means to obtain them themselves. Further barriers that may be imposed include unhealthy family dietary practices, family members' unwillingness to change diet habits, and the financial risk of trying new foods in the home (Sahay et al., 2006). Since parents have such a great influence on children's eating habits, it is suggested that changing a parent's eating habits may be the best way to change a child's eating behaviour (CDC, 1996). The CDC recommends activities that can be done at home to involve parents and family members in healthy dietary behaviour change (CDC, 1996). These include sending home nutrition education materials, teaching how to prepare healthy snacks, and inviting parents and community members to exhibitions of students' nutrition projects (CDC, 1996).

While parents have a great influence on a child's eating habits, they cannot explain the whole picture. It is suggested that other factors including the community, peer influences, media, and self-esteem play a role (Lazarou et al., 2008). It should also be noted that even parents with good intentions and knowledge about healthy eating habits may be constrained by food insecurity or other factors beyond their control. Community involvement can provide important resources for activities related to healthy eating behaviours (Story et al., 2006). The involvement of community members also ensures that the program is culturally appropriate and reflects the interests of the entire community (Sahay et al., 2006). Also, elders in the community can help to aid as good role models for children.

2.5.6 Program Evaluation

Regular program evaluation and adaptation is needed to ensure that the program is being as effective as possible in promoting healthy eating and behaviour change in all its facets (CDC, 1996). To make sure that the evaluation measures the effectiveness of all program components, it is important that all of the stakeholders involved be allowed to provide input (CDC, 1996). This might involve students, teachers, school staff, parents, and community members. It is important that the evaluation measures the variables that the program was aimed to change. In this case, it may be important that the evaluation measure the effects of the program on self-reported eating behaviours and key variables influencing behaviour such as knowledge, intentions, and self-efficacy (CDC, 1996).

The CDC outlines some key components that should be included in program evaluation. First, the evaluation should assess whether a comprehensive policy exists, and whether that policy is actually being implemented (CDC, 1996). Next, there should be a focus on whether the nutrition education is being provided throughout the school curriculum and throughout all school years (CDC, 1996). It should be ensured that teachers are trained and that they are delivering the curriculum via developmentally appropriate, culturally relevant, fun and participatory activities that involve social learning (CDC, 1996). Finally, it should be ensured that teachers and food service have a joint action plan, and that families and community members have been adequately involved to create an overall environment that is conducive to change and provides children with a consistent message (CDC, 1996). In general, it should be assured that all facets of the program are working together to achieve the desired behaviour changes.

When evaluating a school nutrition program, it is important that evaluation take place throughout the implementation because changes could be made at any stage to improve upon program effectiveness. Prior to implementation of the program, a formative evaluation can include the testing of curriculum components with teachers, and focus groups with the target audience to measure program acceptability, cultural appropriateness, and possible implementation obstacles that may arise (Perez-Rodrigo & Aranceta, 2001). During the program implementation, ongoing process evaluation can give insight into lessons that have been learned effectively and can lead to changes that improve program efficiency (Perez-Rodrigo & Aranceta, 2001). Process evaluation can allow those implementing the program to know what works and what doesn't and to make the necessary changes. This further allows for quality control, and an analysis of how materials are being used, extent of program participation, and environmental changes that may have occurred (Perez-Rodrigo & Aranceta, 2001). Finally, at completion of the program, an outcome evaluation can be used to determine overall effectiveness of the program in reaching specific program goals (Perez-Rodrigo & Aranceta, 2001). This usually involves a pre- and post-program measurement of variables of interest, which may include degree of awareness, attitude change, and changes in knowledge and behaviour (Perez-Rodrigo & Aranceta, 2001). This evaluation may involve the use of various tools such as food frequency questionnaires, 24-hour recalls, interviews, and questionnaires. In the end, evaluation of the program is essential to knowing what worked and what didn't, in order to inform future implementations of the program in similar populations.

2.6 Participatory/Collaborative Research

When conducting research in Aboriginal communities, it is important that those living in the communities are not only the subjects of research, but active participants. Simply collecting data and publishing findings is not enough; for research to be of use to Aboriginal communities, it is preferable that it be collaborative.

Collaborative or participatory research can be described as "researchers working together to achieve a common goal of producing scientific knowledge" (Kishk Anaquot Health Research, 2008), where researchers include community members. Jacklin and Kinoshameg (2008) noted that there are eight principals that need to be adhered to in order for a research project to be ethical, culturally and community appropriate: partnership, empowerment, community control, mutual benefit, wholism, action, communication, and respect (Jacklin & Kinoshameg, 2008). Similarly, The Assembly of First Nations describe the principals of ethical and collaborative research using the acronym OCAP – Ownership (relationship community has to the data), Control (community rights to control all aspects of data collection), Access (right to restrict access to collected data), and Possession (physical ownership of data to prevent breach of confidentiality) (Assembly of First Nations, 2005). This has been described as "more of an attitude than a technique"; an approach where the main focus is to empower community members to take charge and make changes in their own communities (Kishk Anaquot Health Research, 2008). In this case, participatory research would improve the likelihood that initiatives such as school snack programs will be sustainable in the long-term, far beyond the time where researchers from the University of Waterloo will be visiting the community.

Several advantages of a participatory approach have been described. This type of approach will allow for a sharing of perspectives and will increase the probability that the knowledge and skills needed to conduct the research will be exist within individuals in the community, decreasing the time and resources needed to build new skills (Kishk Anaquot Health Research, 2008). In terms of dissemination of research results, a recent study by Jack and colleagues (2010) has come up with three principals to promote knowledge exchange by interviewing 30 health researchers who had been involved in Aboriginal research in Canada (Jack, Brooks, Furgal, Dobbins, 2010). They noted that relationships with the community should be based in respect, trust, and equity in order to create an environment of empowerment (Jack et al., 2010). Knowledge exchange should be planned in advance and occur throughout the research process (rather than simply at the end) (Jack et al., 2010). Finally, it was said that the most effective was to transfer knowledge to the communities is by using "locally relevant messages, selecting messengers seen as credible to the target audience, and using multiple communication channels" (Jack et al., 2010).

3.0 Chapter 3: Study Objectives and Hypotheses

3.1 Objectives

The main objective is to gain insight into the milk and alternatives intakes of on-reserve First Nations youth in Ontario, Canada; and to investigate viable school based-programs that may contribute to decreasing the prevalence and incidence of overweight, obesity, metabolic syndrome, and type 2 diabetes in three First Nations communities of the Mushkegowuk Territory, on the western coast of James Bay and Hudson Bay, Ontario. The current research will investigate the intakes of milk and alternatives in First Nations schoolchildren in comparison to dietary standards. The current research will further investigate the relationship between milk and alternatives, calcium, and vitamin D intakes and youth overweight and obesity (as measured by self-reported BMI). As childhood prevention is a viable approach to reducing the prevalence and incidence of overweight and obesity in adulthood, the current research will further investigate the impact of school snack (food provision) programs on milk and alternatives intakes; and will evaluate the process of implementing a comprehensive school nutrition program, while investigating the impact of such a program on dietary intakes, nutrition knowledge, intentions, and self-efficacy, with a particular emphasis on milk & alternatives.

Using data on the dietary habits of on-reserve First Nations school children in grades six to eight, collected using validated approaches (Hanning, Royall, Toews, Blashill, Wegener, Driezen, 2009), the specific objectives of this research are:

3.1.1 Objectives for Chapter 4

1. To describe the milk and alternatives, calcium, and vitamin D intakes of the children in relation to current dietary standards in Canada (minimum recommended CFG servings) and to Dietary Reference Intakes (Adequate Intakes (AI)), and to the intakes of the general Canadian population (Canadian Community Health Survey (CCHS) 2004) by age and sex.
    - Adequate Intake (AI) for children and youth aged 9-18 years

      Calcium: 1 300 mg/day

      Vitamin D: 5 μg/day (200 International Units (IU))

- Recommended CFG servings for children and youth aged 9-18 years

  3-4 servings

- CCHS (2004) data reveals mean (95% CI) daily intakes of milk and alternatives as follows:

  Ages 9-13 years: Males = 2.55 (2.41, 2.69) servings, Females = 2.08 (1.96, 2.21) servings

  Ages 14-18 years: Males = 2.64 (2.50, 2.79) servings, Females = 1.82 (1.72, 1.93) servings

2. To evaluate the variation in milk and alternatives, calcium, and vitamin D intakes of the children within age and sex groupings, where conditions are comparable and data is available, by:
   a) year (within communities) through testing for significant differences in intakes for communities where data is available from different years but the same season.
   b) latitude (between communities) through testing for significant differences in intakes between communities of differing latitudes where data is available for the same year and season.
3. To evaluate the possible association between milk and alternatives, calcium, or vitamin D intake and BMI, controlled for age and sex. BMI will be used as a categorical variable, where children will be grouped into normal, overweight, and obese categories as determined by the cutoffs proposed by Cole et al. (2000). BMI will be calculated using self-reported height and weight data. Milk and alternatives, calcium, and vitamin D intake will be used as a continuous (# of servings, mg, μg) variable.

3.1.2 Objectives for Chapter 5

1. To investigate the milk and alternatives, calcium, and vitamin D intakes of children in grades six to pre- and post-pilot food provision (snack) program in Kashechewan, Ontario. Short-term post-program (May 2009 to June 2009) and long-term post-program (May 2009 to May 2010) intakes were evaluated.
2. To investigate the change in milk and alternatives, calcium, and vitamin D intakes of children in grades six to eight as a result of a supplementary food provision (milk and alternatives) program in Attawapiskat, Ontario. Short-term change (February2010 to March 2010) was evaluated.
3. To describe the impressions of the programs from students (Kashechewan and Attawapiskat), teachers (Kashechewan), and administrators (Kashechewan).

3.1.3 Objectives for Chapter 6

1. To describe the process of implementing a comprehensive school nutrition program in Fort Albany Ontario.
2. To describe the impressions of the program from the perspective of teachers, parents, and students after the program is completed (May 2010).
3. To evaluate the milk and alternatives, calcium, and vitamin D intakes of children in grades six to eight pre- and post-comprehensive school nutrition program in Fort Albany, Ontario.
4. To evaluate the nutrition knowledge, self-efficacy and intentions to eat/drink milk and alternatives pre- and post-comprehensive school nutrition program in Fort Albany, Ontario.

3.2 Hypotheses

The following hypotheses were tested:

3.2.1 Hypotheses for Chapter 4

1. It was expected that mean milk and alternatives intakes would be below CFG recommendations, while mean calcium and vitamin D intakes would be below the DRIs for each age and sex group. This hypothesis was based on available data on the intake of milk and alternatives in Aboriginal youth.
2. a) It was expected that significant differences in yearly mean milk and alternative, calcium, and vitamin D intakes would exist when looking at the same community and season but different years. Although not addressed, this hypothesis was based on differing availability and cost of harvest products, hunting products, and market foods.

   b) It was expected that more northern communities would have significantly lower mean milk and alternative, calcium, and vitamin D intakes as compared to more southern communities. Although not addressed, this hypothesis was related to cost and availability.
3. It was expected that a significant inverse relationship between BMI and mean milk and alternatives, calcium, and vitamin D intakes would be observed. This hypothesis was based on the association between milk and calcium intake and body weight from the literature. Since vitamin D is a component of milk, it was of interest to look at a possible relationship with vitamin D as well.

3.2.2 Hypotheses for Chapter 5

1. In the short-term, a significant increase in mean milk and alternatives, calcium, and vitamin D intakes was expected as a result of a pilot school nutrition (food provision) program in Kashechewan, ON. In the long-term, no prediction is made regarding milk and alternative, calcium, and vitamin D intakes because of numerous barriers to improved intakes, which may be overriding factors.
2. In the short-term, a significant increase in mean milk and alternatives, calcium, and vitamin D intakes was expected as a result of a supplementary milk and alternatives school nutrition program in Attawapiskat, ON.
3. Teachers, administrators, and students were expected to have positive impressions of the programs. Barriers and opportunities will be identified.

3.2.3 Hypotheses for Chapter 6

1. Positive impressions were expected regarding a comprehensive school nutrition program in Fort Albany, on the part of students, teachers, and parents. Barriers and opportunities will be identified.
2. Following a comprehensive school nutrition program in Fort Albany, mean intakes of milk and alternatives, calcium, and vitamin D were not expected to improve significantly. As Peetabeck Academy in Fort Albany already has a longstanding snack program, and there exist numerous barriers to increased milk and alternatives intakes in the community, significant increases in mean intakes were not expected.
3. Following a comprehensive school nutrition program in Fort Albany, it was expected that the knowledge of the reasons for adequate milk and alternative intakes would improve significantly, and students' intentions and self-efficacy to consume adequate milk and alternatives would improve significantly (scores would increase).

4.0 Chapter 4: Examining the Intakes of Milk and Alternatives, Variation by Year and Latitude, and Relationship to BMI of On-Reserve First Nations Youth in Ontario, Canada

4.1 Introduction

The high prevalence of childhood overweight and obesity is of concern in Canada, with First Nations youth demonstrating higher rates than those from other ethnic groups (Willows, 2005; Story et al., 2003). This is a multi-factorial problem; physical inactivity, food intake, genetic susceptibility, physical and social environments play a role (Swinburn et al., 2004). Some research has demonstrated that milk intake has the potential to reduce the risk of overweight and obesity in children. Epidemiological studies have shown an inverse association between dietary calcium consumption and body weight (Heaney, 2003; Teergarden, 2003). Beyond the problem of obesity, adequate calcium and vitamin D intake, for which milk and alternatives are the main dietary source, is of utmost important for Aboriginal populations, as they are at a higher risk of bone fracture compared to non-Aboriginal populations in Canada (Weiler et al., 2007; Leslie et al., 2006; Leslie et al., 2004). A recent study of Aboriginal children in Northern Quebec found that more than 80% had milk & alternative intakes below national standards (Downs et al., 2009). Further, a literature review investigating the food intake of Aboriginal people in Canada has revealed diets that are low in calcium and vitamin D, among other nutrients (Willows, 2005). Many barriers exist to healthy eating in remote First Nations, including a lack of variety and availability, and high cost of healthy foods. Little data exist on the intakes of milk and alternatives, calcium, and vitamin D among on-reserve First Nations youth, as national dietary surveys exclude on-reserve populations. Given the diversity of challenges faced by each First Nations community, research into the dietary status of individuals in various communities is of value.

In this paper, we investigate the milk and alternatives, calcium, and vitamin D intakes of youth living in remote (distant from major urban centers) First Nations communities of the Mushkegowuk Territory, northern Ontario, Canada, and less remote southern Ontario First Nations. Intakes were compared to national standards, including Dietary Reference Intakes (DRI) and Canada's Food Guide (CFG) servings. Comparison with data from the 2004 Canadian Community Health Survey (CCHS) Cycle 2.2: Nutrition was used to contrast intakes from the study group to the general population. The intake of milk and alternatives, calcium, and vitamin D in relation to body mass index was also investigated. Further, the effect of year and latitude on the intakes of milk and alternatives, calcium, and vitamin D was examined in instances where conditions were comparable.

4.2 Methods

4.2.1 Sampling and Data Collection

Using the Web-based Eating Behaviour Questionnaire (WEB-Q), dietary data were collected in the school setting between November 2003 and June 2010 from children and youth aged ten to eighteen in the geographically remote northern Ontario communities of the Mushkegowuk Territory (western James Bay and southwestern Hudson Bay region, northern Ontario, Canada), which is home to approximately 10 000 Cree First Nations individuals. Data collection took place in the communities of Moose Factory, Fort Albany, Kashechewan, Attawapiskat and Peawanuck (listed in order from most southern to most northern). These communities are situated on the western James Bay coast, and are accessible only by air year round and by ice road in the winter. Most communities have only one grocery store, where food prices tend to be high and access to healthy food is limited due to a lack of variety and poor condition of these foods. Data were also collected in the two southern non-remote First Nations of Georgina Island and Christian Island, southern Ontario.

The WEB-Q was revised for use in First Nations populations after feedback from community-based First Nations advisory councils, and collects self-reported dietary information with a 24-hour recall using a multiple-pass methodology (Hanning, Royall, Toews, Blashill, Wegener, Driezen, 2009). Sample screens of the WEB-Q can be seen in Appendix B. A recent comprehensive review of electronic dietary assessment instruments supports the feasibility and benefits of this approach (Gates, 2010). Dietary data collected represented weekday intakes of nutrients from food alone, though frequency data suggests that the use of vitamin and mineral supplements was rare (R Hanning, personal communication). Demographic information was also collected via the questionnaire. Trained research assistants measured participants' heights to the closest inch using a wall-mounted measuring tape, and participants weighed themselves to the closest pound using an analog scale. Participants then self-reported their height and weight in the WEB-Q. Body mass index (BMI) was computed to the closest 0.1 kg/m^2, and participants were assigned to normal (includes underweight), overweight, or obese categories using the BMI cutoffs for children and youth proposed by Cole et al. (2000). Nutrient calculations for the 24-hour recall were performed electronically using the Canadian Nutrient File, version 2001 or 2007 depending on the year of the survey (ESHA Food Processor, Salem, Oregon).

This study was approved by the University of Waterloo Office of Research Ethics, and passive consent to participate in the study was obtained by sending letters home to parents explaining the nature of the study. Active consent was also obtained from participating students following the first explanatory screen of the WEB-Q. A sample consent letter can be seen in Appendix C.

4.2.2 Statistical Analyses

Frequency data were used to compare intakes of milk and alternatives, calcium, and vitamin D to dietary standards and CCHS data, by age category and sex. Data sets included in this analysis were Christian Island (Fall 2004), Georgina Island (Winter 2003), Moose Factory (Winter 2007), Fort Albany (Fall 2004), Kashechewan (Spring 2009), Attawapiskat (Winter 2006 and 2010), and Peawanuck (Winter 2005 and Spring 2010). Dietary standards used for comparison in the analysis are displayed in Table 4.1. Multivariate Analysis of Variance (MANOVA) was used to assess yearly variation in intakes in Attawapiskat (2006 vs. 2010), Christian Island (2003 vs. 2004), Fort Albany (2005 vs. 2009), and Kashechewan (2009 vs. 2010), controlling for season, as season is known to affect dietary intakes in these communities (Skinner, Hanning, Tsuji, unpublished data). Latitudinal variation in intakes was assessed by comparing the communities of Attawapiskat and Peawanuck (Winter 2005-2006), Christian Island and Fort Albany (Fall 2004), Moose Factory and Fort Albany (Winter 2007), and Fort Albany and Kashechewan (Spring 2009) using MANOVA, controlling for season and year (the community mentioned first is more southern than the latter: Figure 4.1). The relationship between BMI and milk and alternatives, calcium, and vitamin D was assessed using MANOVA. All dietary variables were adjusted for energy intake using the energy density method (per 1000 kcal), as to ensure that differences in intake were due to differences in diet composition and not differences in overall amount of food consumed (Willet, Howe & Kushi, 1997). This helped to account for differences in age and sex between communities, since older individuals and males tend to consume more energy. For all analyses, variables were transformed as necessary to ensure equality of variances. Statistical analyses were performed using SPSS software (version 17.0; SPSS Inc., Chicago, IL, 2008). A p level of ≤ 0.05 was considered statistically significant.

Figure 4.1. Map of the Ontario First Nations communities included in the analysis

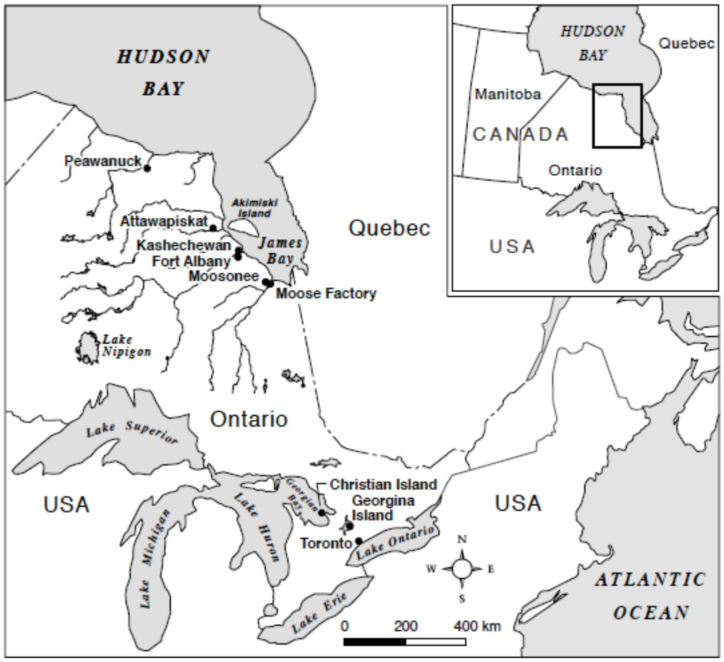


Table 4.1. Dietary standards and Canadian Community Health Survey data used for comparison

Age & Sex group	Milk & Alternatives (servings)	CCHS - Mean Canadian intake of Milk & Alternatives (servings)	Calcium (AI mg)	Vitamin D (AI mcg)
Males 9-13 years	3-4*	2.55	1300	5
Females 9-13 years	3-4	2.08	1300	5
Males 14-18 years	3-4	2.64	1300	5
Females 14-18 years	3-4	1.82	1300	5

*The minimum number of 3 servings was used in all statistical analyses

4.3 Results

4.3.1 Participant Characteristics

Participant demographic characteristics for all datasets used in the analysis are displayed in table 4.2. A total of 456 participants completed the WEB-Q for those included in the dietary standard analysis. Individuals who failed to report 24-hour recall data (n=8), who did not include their age (n=4), or who were older than 18 years (n=1) were excluded from the analysis. A total of 443 individuals were included in the analysis (Table 4.2). A similar number of males and females completed the survey (n= 212 and 231, respectively), while the majority of participants fell into the 9-13 years age category versus the 14-18 years category (n=312 and 131, respectively).

Table 4.2. Participant demographic characteristics by analysis

Sample	n (%)	Age (mean)	BMI (% overweight, obese)
Participants included in dietary standard analysis			
Total	443 (100.0)	13.0	31.8, 19.6
Males 9-13 years	139 (31.4)	12.1	33.3, 26.1
Females 9-13 years	173 (39.1)	12.1	34.6, 20.5
Males 14-18 years	73 (16.5)	15.1	26.4, 11.3
Females 14-18 years	58 (13.1)	14.9	26.7, 11.1
Attawapiskat Winter 2006	62 (100.0)	12.5	45.5, 15.9
Males 9-13 years	21 (33.9)	12.2	50.0, 21.4
Females 9-13 years	31 (50.0)	12.3	45.5, 13.6
Males 14-18 years	6 (9.7)	14.0	40.0, 20.0
Females 14-18 years	4 (6.5)	14.3	33.3, 0.0
Attawapiskat Winter 2010	69 (100.0)	12.2	45.5, 15.9
Males 9-13 years	25 (36.2)	12.0	26.1, 43.5
Females 9-13 years	36 (52.2)	11.9	40.6, 37.5
Males 14-18 years	0 (0.0)	-	-
Females 14-18 years	8 (11.6)	14.0	12.5, 25.0
Christian Island Fall 2004	40 (100.0)	11.8	33.3, 19.4
Males 9-13 years	23 (57.5)	11.8	33.3, 23.8
Females 9-13 years	17 (42.5)	11.7	33.3, 13.3
Males 14-18 years	0 (0.0)	-	-
Females 14-18 years	0 (0.0)	-	-
Fort Albany Fall 2004*	63 (100.0)	13.5	25.4, 10.2
Males 9-13 years	14 (22.2)	12.1	21.4, 7.1
Females 9-13 years	22 (34.9)	12.0	28.6, 9.5
Males 14-18 years	14 (22.2)	15.8	0.0, 23.1
Females 14-18 years	13 (20.6)	15.2	54.5, 0.0
Fort Albany Winter 2007*	50 (100.0)	13.0	-**
Males 9-13 years	12 (24.0)	11.8	-
Females 9-13 years	21 (42.0)	12.0	-
Males 14-18 years	10 (20.0)	15.2	-
Females 14-18 years	7 (14.0)	15.1	-
Georgina Island Winter 2003	12 (100.0)	11.5	0.0, 12.5
Males 9-13 years	6 (50.0)	11.3	0.0, 20.0
Females 9-13 years	6 (50.0)	11.7	0.0, 0.0
Males 14-18 years	0 (0.0)	-	-
Females 14-18 years	0 (0.0)	-	-
Kashechewan Spring 2009	43 (100.0)	13.1	42.5, 17.5
Males 9-13 years	18 (41.9)	12.8	43.8, 25.0
Females 9-13 years	15 (34.9)	12.5	35.7, 21.4
Males 14-18 years	8 (18.6)	14.4	62.5, 0.0
Females 14-18 years	2 (4.7)	14.0	0.0, 0.0
Moose Factory Winter 2007	81 (100.0)	14.4	24.2, 10.6
Males 9-13 years	10 (12.3)	12.7	44.4, 22.2
Females 9-13 years	14 (17.3)	12.6	18.2, 0.0
Males 14-18 years	34 (42.0)	15.2	23.1, 7.7
Females 14-18 years	23 (28.4)	15.2	20.0, 15.0
Peawanuck Winter 2005	10 (100.0)	11.5	28.6, 28.6
Males 9-13 years	4 (40.0)	11.0	0.0, 33.3
Females 9-13 years	6 (60.0)	11.8	50.0, 25.0
Males 14-18 years	0 (0.0)	-	-
Females 14-18 years	0 (0.0)	-	-

Sample	n (%)	Age (mean)	BMI (% overweight, obese)
Peawanuck Spring 2010	13 (100.0)	13.0	65.3, 24.2
Males 9-13 years	6 (46.2)	12.5	50.0, 33.3
Females 9-13 years	5 (38.5)	12.6	20.0, 60.0
Males 14-18 years	1 (7.7)	14.0	100.0, 0.0
Females 14-18 years	1 (7.7)	14.0	0.0, 0.0
Participants included in yearly analysis			
1. Attawapiskat Winter 2006* **	62 (100.0)	12.5	45.5, 15.9
Males 9-13 years	21 (33.9)	12.2	50.0, 21.4
Females 9-13 years	31 (50.0)	12.3	45.5, 13.6
Males 14-18 years	6 (9.7)	14.0	40.0, 20.0
Females 14-18 years	4 (6.5)	14.3	33.3, 0.0
1. Attawapiskat Winter 2010	69 (100.0)	12.2	45.5, 15.9
Males 9-13 years	25 (36.2)	12.0	26.1, 43.5
Females 9-13 years	36 (52.2)	11.9	40.6, 37.5
Males 14-18 years	0 (0.0)	-	-
Females 14-18 years	8 (11.6)	14.0	12.5, 25.0
2. Christian Island Fall 2003	36 (100.0)	11.8	19.4, 9.7
Males 9-13 years	18 (50.0)	11.7	25.0, 12.5
Females 9-13 years	17 (47.2)	11.8	14.3, 7.1
Males 14-18 years	1 (2.8)	14.0	0.0, 0.0
Females 14-18 years	0 (0.0)	-	-
2. Christian Island Fall 2004	40 (100.0)	11.8	33.3, 19.4
Males 9-13 years	23 (57.5)	11.8	33.3, 23.8
Females 9-13 years	17 (42.5)	11.7	33.3, 13.3
Males 14-18 years	0 (0.0)	-	-
Females 14-18 years	0 (0.0)	-	-
3. Fort Albany Spring 2005*	45 (100.0)	13.4	28.2, 12.8
Males 9-13 years	8 (17.8)	12.4	37.5, 0.0
Females 9-13 years	20 (44.4)	12.5	23.5, 11.8
Males 14-18 years	13 (28.9)	14.9	27.3, 27.3
Females 14-18 years	4 (8.9)	15.0	33.3, 0.0
3. Fort Albany Spring 2009*	30 (100.0)	13.0	60.0, 8.0
Males 9-13 years	5 (16.7)	12.6	75.0, 0.0
Females 9-13 years	15 (50.0)	12.3	50.0, 7.1
Males 14-18 years	5 (16.7)	14.4	75.0, 25.0
Females 14-18 years	5 (16.7)	14.0	66.7, 0.0
4. Kashechewan Spring 2009	43 (100.0)	13.1	31.0, 23.8
Males 9-13 years	18 (41.9)	13.0	38.9, 22.2
Females 9-13 years	16 (37.2)	12.6	26.7, 33.3
Males 14-18 years	9 (20.9)	14.4	22.1, 11.1
Females 14-18 years	0 (0.0)	-	-
4. Kashechewan Spring 2010	67 (100.0)	13.5	22.8, 26.3
Males 9-13 years	12 (17.9)	12.6	33.3, 11.1
Females 9-13 years	20 29.9)	12.6	42.9, 28.6
Males 14-18 years	20 (29.9)	14.4	15.0, 30.0
Females 14-18 years	15 (22.4)	14.8	7.1, 28.6
Participants included in latitudinal analysis			
1. Christian Island Fall 2004	40 (100.0)	11.8	33.3, 19.4
Males 9-13 years	23 (57.5)	11.8	33.3, 23.8
Females 9-13 years	17 (42.5)	11.7	33.3, 13.3
Males 14-18 years	0 (0.0)	-	-
Females 14-18 years	0 (0.0)	-	-

Sample	n (%)	Age (mean)	BMI (% overweight, obese)
1. Fort Albany Fall 2004*	63 (100.0)	13.5	25.4, 10.2
Males 9-13 years	14 (22.2)	12.1	21.4, 7.1
Females 9-13 years	22 (34.9)	12.0	28.6, 9.5
Males 14-18 years	14 (22.2)	15.8	0.0, 23.1
Females 14-18 years	13 (20.6)	15.2	54.5, 0.0
2. Attawapiskat Winter 2006	62 (100.0)	12.5	45.5, 15.9
Males 9-13 years	21 (33.9)	12.2	50.0, 21.4
Females 9-13 years	31 (50.0)	12.3	45.5, 13.6
Males 14-18 years	6 (9.7)	14.0	40.0, 20.0
Females 14-18 years	4 (6.5)	14.3	33.3, 0.0
2. Peawanuck Winter 2005	10 (100.0)	11.5	28.6, 28.6
Males 9-13 years	4 (40.0)	11.0	0.0, 33.3
Females 9-13 years	6 (60.0)	11.8	50.0, 25.0
Males 14-18 years	0 (0.0)	-	-
Females 14-18 years	0 (0.0)	-	-
3. Moose Factory Winter 2007	81 (100.0)	14.4	24.2, 10.6
Males 9-13 years	10 (12.3)	12.7	44.4, 22.2
Females 9-13 years	14 (17.3)	12.6	18.2, 0.0
Males 14-18 years	34 (42.0)	15.2	23.1, 7.7
Females 14-18 years	23 (28.4)	15.2	20.0, 15.0
3. Fort Albany Winter 2007*	50 (100.0)	13.0	-**
Males 9-13 years	12 (24.0)	11.8	-
Females 9-13 years	21 (42.0)	12.0	-
Males 14-18 years	10 (20.0)	15.2	-
Females 14-18 years	7 (14.0)	15.1	-
4. Fort Albany Spring 2009*	30 (100.0)	13.0	60.0, 8.0
Males 9-13 years	5 (16.7)	12.6	75.0, 0.0
Females 9-13 years	15 (50.0)	12.3	50.0, 7.1
Males 14-18 years	5 (16.7)	14.4	75.0, 25.0
Females 14-18 years	5 (16.7)	14.0	66.7, 0.0
4. Kashechewan Spring 2009	43 (100.0)	13.1	42.5, 17.5
Males 9-13 years	18 (41.9)	12.8	43.8, 25.0
Females 9-13 years	15 (34.9)	12.5	35.7, 21.4
Males 14-18 years	8 (18.6)	14.4	62.5, 0.0
Females 14-18 years	2 (4.7)	14.0	0.0, 0.0

* School snack program serving milk & alternatives at the time of data collection
** Height and weight data not collected at this time
*** Numbers indicate paired samples

4.3.2 Comparison of Intakes to Dietary Standards and Canadian Population Intakes

Table 4.3 summarizes the mean intakes of milk and alternatives, calcium, and vitamin D by age and sex category, in comparison to dietary standards and to intakes in the general Canadian population. Of note, mean intakes of milk and alternatives were below the recommendations of Canada's Food Guide in all age and sex groups, with females aged 14-18 years having the poorest intakes. In all subgroups, more than two-thirds of participants fell below CFG standards. All subgroups had mean intakes of milk and alternatives that fell below the mean intakes seen in the general population, with males aged 9-13 year falling the furthest below, with a mean intake of 1.86 servings as compared to 2.55 servings in the general population. The vast majority of participants fell below the Adequate Intake (AI) established for calcium and vitamin D. Notably, in females aged 14-18 years, only one of the 59 participants had an intake of calcium above the AI, leaving 98.3% of participants below this level of intake.

Table 4.3. Mean intakes of selected nutrients and comparison to dietary standards

Age & sex group	Food group or nutrient	Intake		% below recommen-dation
		Mean (SD)	Median	
Males 9-13 years	Milk & Alternatives (svgs)	1.9 (1.7)	1.5	79.9
	Calcium (mg)	775.2 (573.6)	673.0	-
	Vitamin D (μg)	3.2 (3.5)	2.5	-
Females 9-13 years	Milk & Alternatives (svgs)	1.9 (2.2)	1.5	83.8
	Calcium (mg)	762.7 (658.6)	608.9	-
	Vitamin D (μg)	3.6 (3.9)	2.7	-
Males 14-18 years	Milk & Alternatives (svgs)	2.5 (2.1)	2.0	72.6
	Calcium (mg)	1028.1 (711.8)	902.7	-
	Vitamin D (μg)	5.3 (5.2)	4.0	-
Females 14-18 years	Milk & Alternatives (svgs)	1.5 (1.3)	1.5	84.7
	Calcium (mg)	608.0 (408.5)	595.8	-
	Vitamin D (μg)	2.9 (2.7)	2.6	-

4.3.4 Yearly Variation in Intakes

The MANOVA revealed significant yearly differences in the intakes of milk and alternatives (p=0.046) and calcium (p=0.033) between Fall 2003 and 2004 in Christian Island, where intakes were higher in 2003 (Table 4.4). A significant sex effect was seen for milk and alternatives (p=0.011) and calcium (p=0.014), where males consumed significantly more; a significant effect was seen for the YEAR X SEX interaction for milk and alternatives (p=0.027) and calcium (p=0.022). There were no significant yearly differences detected between Winter 2006 and 2010 in Attawapiskat; there was a significant effect for the AGE X SEX interaction for vitamin D (p=0.024). No significant yearly differences nor interaction effects were seen between Spring 2009 and 2010 in Kashechewan; nor between Spring 2005 and 2009 in Fort Albany.

Table 4.4. Yearly variation in intakes of selected nutrients for four First Nations communities

Community	Nutrient or Food group	Intake						p-value*
		n	Mean (SD)	Median	n	Mean (SD)	Median	
Attawapiskat			**2006**			**2010**		
	Milk & alternatives (svgs)	62	2.6 (2.6)	1.9	70	1.7 (1.6)	1.6	0.087
	Calcium (mg)		934.2 (835.2)	748.6		685.0 (480.1)	632.0	0.921
	Vitamin D (μg)		5.0 (5.1)	4.0		2.1 (2.3)	1.6	0.199
Christian Island			**2003**			**2004**		
	Milk & alternatives (svgs)	36	1.5 (1.8)	1.0	40	0.8 (1.1)	0.4	**0.046**
	Calcium (mg)		740.0 (551.4)	629.1		498.9 (386.4)	368.7	**0.033**
	Vitamin D (μg)		3.1 (4.2)	2.5		2.0 (2.6)	1.0	0.297
Fort Albany			**2005**			**2009**		
	Milk & alternatives (svgs)	45	1.5 (1.7)	1.3	30	1.8 (1.1)	1.7	0.152
	Calcium (mg)		749.3 (581.0)	576.3		785.4 (423.5)	682.4	0.316
	Vitamin D (μg)		3.7 (3.6)	2.9		2.7 (2.4)	2.2	0.523
Kashechewan			**2009**			**2010**		
	Milk & alternatives (svgs)	43	2.8 (1.9)	2.5	67	1.7 (1.4)	1.5	0.173
	Calcium (mg)		996.3 (603.7)	839.1		626.8 (426.8)	581.7	0.096
	Vitamin D (μg)		3.1 (3.1)	1.6		1.7 (1.8)	1.0	0.730

*p-values are for intakes adjusted per 1000 kcal

4.3.5 Latitudinal Variation in Intakes

The MANOVA revealed significant latitudinal differences in the intakes of milk and alternatives (p=0.020), calcium (p=0.019), and vitamin D (p=0.018) for the Fall 2004 Christian Island – Fort Albany pair, where intakes in Fort Albany exceeded those in Christian island for all dietary variables (Table 4.5). Significant differences in the intakes of milk and alternatives (p=0.002) and calcium (p=0.002) were seen for the Winter 2007 Moose Factory – Fort Albany pair, where intake was higher in Fort Albany than in Moose Factory. A significant effect for the COMMUNITY X AGE X SEX interaction was seen for milk and alternatives (p=0.040), calcium (p=0.005) and vitamin D (p=0.030) for this pair. No significant latitudinal differences in intakes were detected for the Spring 2009 Fort Albany – Kashechewan comparison nor the Winter 2005-2006 Attawapiskat – Peawanuck comparison; there were no significant interaction effects.

Table 4.5. Latitudinal variation in intakes of selected nutrients for four First Nations community pairs

Season & year	Nutrient or Food group	Intake						p-value*
		n	Mean (SD)	Median	n	Mean (SD)	Median	
Fall 2004			**Christian Island**			**Fort Albany**		
	Milk & alternatives (svgs)	40	0.8 (1.1)	0.4	63	1.7 (1.7)	1.5	**0.020**
	Calcium (mg)		498.9 (386.4)	368.7		842.0 (573.5)	727.3	**0.019**
	Vitamin D (µg)		2.1 (2.6)	1.0		4.5 (4.5)	3.8	**0.018**
Winter 2005			**Attawapiskat**			**Peawanuck**		
	Milk & alternatives (svgs)	62	2.6 (2.6)	1.9	10	1.9 (1.4)	1.5	0.494
	Calcium (mg)		934.2 (835.2)	748.6		1090.8 (842.6)	827.2	0.382
	Vitamin D (µg)		5.0 (5.1)	4.0		3.6 (2.7)	2.6	0.722
Winter 2007			**Moose Factory**			**Fort Albany**		
	Milk & alternatives (svgs)	82	1.8 (1.8)	1.5	50	2.7 (2.2)	2.1	**0.002**
	Calcium (mg)		714.3 (573.3)	569.7		1004.5 (733.3)	740.8	**0.002**
	Vitamin D (µg)		3.7 (3.4)	2.8		5.6 (5.1)	4.4	0.071
Spring 2009			**Fort Albany**			**Kashechewan**		
	Milk & alternatives (svgs)	30	1.8 (1.1)	1.7	43	2.2 (1.9)	1.8	0.723
	Calcium (mg)		785.4 (423.5)	682.4		812.9 (577.5)	679.4	0.522
	Vitamin D (µg)		2.7 (2.4)	2.2		2.4 (2.4)	2.0	0.719

*p-values are for intakes adjusted per 1000 kcal

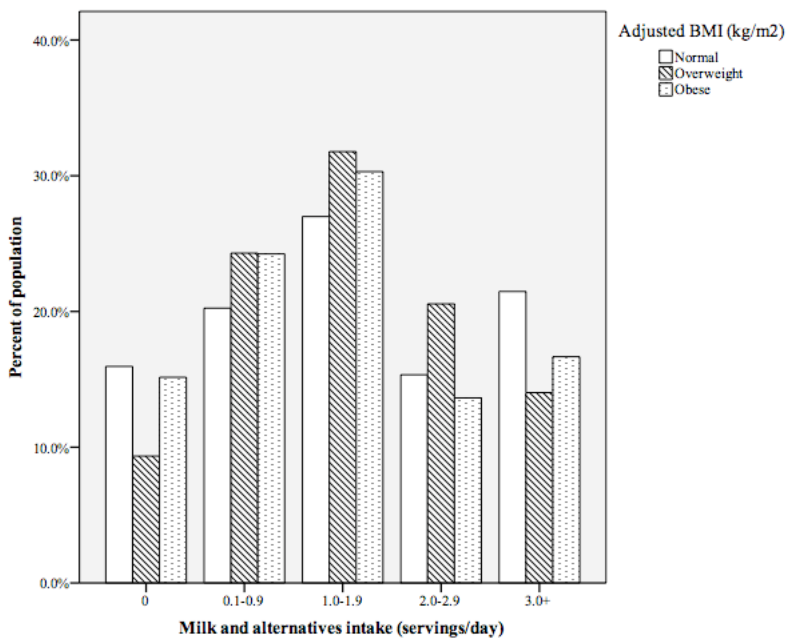
4.3.6 Relationship Between Milk and Alternatives Intake and BMI

Of the 443 participants with complete dietary data from the WEB-Q, 107 failed to report either height or weight and were excluded from the analysis because BMI could not be calculated; 336 participants were included in the analysis. The MANOVA revealed no significant differences in intakes of any of these key dietary variables by BMI category in the youth studied (Table 4.6). A significant effect for the BMI X SEX interaction was seen for milk and alternatives (p=0.041). Looking at milk and alternatives intake, a higher proportion of normal weight participants had adequate intakes (at least 3 servings per day) than did overweight or obese participants (Figure 4.1). Further, a greater proportion of overweight and obese participants had relatively low intakes of milk and alternatives (0.1-1.9 servings per day) as compared to normal weight participants.

Table 4.6. Relationship between milk and alternatives, calcium, and vitamin D intakes and BMI category in First Nations youth

Nutrient or Food Group	Intake									p-value
	Normal			Overweight			Obese			
	n	Mean (SD)	Median	n	Mean (SD)	Median	n	Mean (SD)	Median	
Milk & alternatives (svgs)	163	1.9 (1.8)	1.5	107	1.7 (1.7)	1.50	66	1.6 (1.6)	1.4	0.702
Calcium (mg)		816.7 (644.9)	665.6		698.4 (549.7)	608.8		675.8 (510.6)	577.3	0.206
Vitamin D (µg)		3.5 (3.9)	2.7		3.2 (3.3)	2.5		2.6 (2.8)	1.8	0.118

Figure 4.1. Distribution of milk and alternatives intakes by BMI category in First Nations youth



4.4 Discussion

This research has paralleled findings in other Aboriginal populations, documenting low intakes of milk and alternatives and their associated nutrients among children and youth. A 2005 literature review of the eating habits of Canadian Aboriginal populations showed diets low in calcium and vitamin D, among other nutrients (Willows, 2005). A recent study in northern Quebec, Canada, showed that approximately 80% of Aboriginal children in the region failed to meet the recommendations of Canada's Food Guide for milk and alternatives (Downs, 2009), a figure similar to what was found in the current study.

The findings are especially important given the health implications associated with a low intake of milk and alternatives. The First Nations Bone Health Study (FNBHS) found an association between Aboriginal ethnicity and low bone mass in women (Leslie et al., 2006). The FNBHS also revealed that rural Aboriginal women had lower calcium and vitamin D intakes than urban white or Aboriginal women, with 32% of rural Aboriginal women being vitamin D deficient (serum 25(OH)D<37.5 mmol/L) (Weiler et al., 2007). Thus, the low intakes of milk and alternatives among youth in the present population is concerning as milk and alternatives are significant sources of dietary calcium and vitamin D. Without adequate intake of this food group, these First Nations youth may be risk for osteoporosis later in life. Further, the link between the intake of milk, dietary calcium, and a healthy body weight (Heaney, 2003; Barba et al., 2005) suggests that suboptimal intake of milk and alternatives in this population may be contributing to the elevated rates of overweight and obesity seen in this study.

The current findings suggest that there is need to improve dietary intakes of milk and alternatives, calcium, and vitamin D in this population. Taylor et al. (2007) suggested the need for health promotion and education programs to improve dietary practices. School nutrition programs are a viable approach for behaviour change in First Nations youth where adequate resources exist. Comprehensive programs that address multiple influences on a child's dietary knowledge, attitudes, and intentions would be ideal, and may help children and youth to overcome barriers to healthy eating that exist in their community. The results presented here suggest the need for initiatives such as these in communities where the resources exist.

Unfortunately, in many First Nations communities, adequate resources for school nutrition programs are not available. Barriers to successful program implementation can include a lack of adequate facilities and storage space; poor food availability, variety, freshness, and high prices; lack of availability of volunteers to run the program; and the high cost of operating such programs in remote locations. It has been noted that a large proportion of the North American Aboriginal population may be lactose intolerant (Born, 2007), which could be a barrier to achieving adequate intake. However, in a sample of students in Fort Albany, Ontario (n=26 children in grades 6-8) there were no children who reported having a milk allergy/intolerance or feeling sick when they drink milk (M Gates, 2010 unpublished data). Milk alternatives are available in most communities; fortified soy beverage is usually available, but is expensive (as is milk). Food price data from Fort Albany, Ontario in February 2010 revealed that a 2L carton of 2% milk cost $7.95 versus $8.29 for 2L of fortified soy beverage, a

$0.34 difference. Yogurt and cheese is also usually available; these products can sometimes be tolerated by those with lactose intolerance.

4.4.1 Yearly Variation in Intakes

Yearly variation in milk and alternatives, calcium, and vitamin D may arise due to differences in the success of hunting and harvest seasons in the communities under study. We hypothesized that more successful hunting seasons would mean greater intakes of traditional foods and concomitantly lower intakes of store-bought foods including milk and alternatives. Traditional sources of calcium and vitamin D include bannock, fish with bones, fish bone soup, shellfish, beans, and nuts (Health Canada, 2009b). These could contribute to calcium and vitamin D intakes while not being considered a milk and alternative product as per the CFG group. In the current study, significant yearly effects were seen for the communities of Christian Island (southern, non-remote). This suggests that such yearly variation can exist at times in non-remote First Nations communities in Ontario, Canada. Knowing that such variation exists is of value; it is now known that within-year and between-year variations should be taken into account as a potential confounder when comparing intakes between communities.

4.4.2 Latitudinal Variation in Intakes

We hypothesized that northern, remote communities would have lower intakes of milk and alternatives and their associated nutrients than southern, non-remote communities. Controlling for year and season, a comparison of community pairs of varying latitude showed significant variation in milk and alternatives and associated nutrient intakes between Christian Island and Fort Albany in Fall 2004, and between Moose Factory and Fort Albany in Winter 2007. These results were unexpected as Fort Albany is more remote and northern than the comparison communities of Christian Island and Moose Factory. However, in both cases youth Fort Albany had greater intakes milk and alternatives, calcium (Christian Island comparison only), and vitamin D than the comparison community. It had been thought that less remote communities would have greater access to milk and alternatives and cheaper prices, and therefore have greater intakes. However, it is suspected that the snack program in place at the school in Fort Albany, which has been running successfully for over 20 years, may be responsible for the higher intakes of milk and alternatives, calcium, and vitamin D seen in the community. The fact that youth in this community are consistently supplied with milk and alternative products on a daily basis may be a factor. It would be of interest to compare latitudinal variation in intakes during the summer months when youth are not in school and cannot rely on the snack program. This is a powerful demonstration of the positive impacts that school-based nutrition programs can have on the diets of First Nations youth, and provides further evidence for the benefits of such programs in areas where access to healthy foods may be otherwise limited. Further investigation will be needed to clarify the relationship between latitude and milk and alternatives intakes in Ontario First Nations communities.

4.4.3 Relationship Between Milk and Alternatives and BMI

Mean intakes of milk and alternatives, calcium, and vitamin D were not related to BMI category in our sample. This is in contrast to the inverse association between dietary calcium intakes and body weight that has been seen in some epidemiological studies (Heaney, 2003; Teergarden, 2003), and the inverse association between milk consumption and the risk of being overweight seen in a study of schoolchildren in southern Italy (Barba et al., 2005). However, it is possible that the relationship between BMI and milk and alternatives (and associated nutrients) may not hold true for Aboriginal youth, such as our study population. In any case, the intake of milk and alternatives and their associated nutrients was low for all age and sex categories under study, while the prevalence of overweight and obesity was high. Further study with increased sample size might reveal more definitive results in this population, but we were restricted by the number of individuals living in the communities under study. A trend was seen with a higher proportion of normal weight individuals consuming adequate milk and alternatives as compared to overweight or obese individuals. In addition, the current study did not look at sweetened beverage intake, but it is known that high intakes of sugar-sweetened beverages exist in other Aboriginal communities across Canada (Garriguet, 2008; Willows, 2005). Sweetened beverage intake has been identified as an independent predictor of weight gain and obesity in children and youth (Malik et al., 2006). Further analysis of sweetened beverage intake in relation to milk and alternatives and BMI would be of interest in this population to help clarify the relationship between these variables.

4.4.4 Limitations

Because of the great diversity seen in First Nations populations - the results presented herein may not be representative of other First Nations populations - but remain particularly useful for the Ontario First Nations communities. In some cases, small sample sizes may have limited our ability to detect differences in intakes, but this was beyond our control. All children and youth attending school on the day of data collection were included; efforts were made to include those who were not present on the day of the WEB-Q, for example on a subsequent day.

The 24-hour recall is a meaningful measure of the average intakes of groups (Thompson & Byers, 1994), and was chosen with its feasibility for the study population in mind. The 24-hr recall has certain limitations including its reliance on memory, difficulty of portion size estimation, and underreporting (Johansson, Wilkman, Ahren, Hallmans, Johansson, 2001; Thompson & Byers, 1994). Use of the United States Department of Agriculture (USDA) Automated Multiple-Pass Approach (AMPM), which is mimicked in the WEB-Q, has been found to improve accuracy at a group level (Moshfegh, Rhodes, Baer, Murayi, Clemens, Rumpler, et al., 2008; Blanton, Moshfegh, Baer, Kresch, 2006). The WEB-Q also uses realistic 3-D portion size images to improve estimation.

It should be noted that participant samples varied between the time periods and intakes represent those obtained from a single 24-hour recall. Intra- and inter-individual variation makes it very difficult to accurately measure usual intake (Palaniappan, Cue, Payette, Gray-Donald, 2003). A study by Palaniappan et al. (2003) (n=1541) noted that when using within and between subject variances in estimating the number of days needed to accurately (r=0.8) measure usual intake, two days would be needed for energy as well as for calcium intake. Basiotis et al. (1987) (n=29) have reported needing three days of intake to accurately estimate group intakes of energy, and 10 days to estimate calcium intake in males or seven days for females (Basiotis, Welsh, Cronin, Kelsay, Mertz, 1987). A 1992 study by Tarasuck & Beaton noted a mean standard deviation of 588 kcal for energy and 154 mg/1000kcal for calcium (Tarasuck & Beaton, 1992). Calcium and energy were stated to have day-to-day variations of 40.3% and 27.2%, respectively. Using the WEB-Q, 24-hr recall data was collected daily for five school days in Fort Albany in 2008 (n=6). Using this subpopulation, milk and alternatives, calcium, and vitamin D intakes were found to have coefficients of variation of 0.86, 0.60, and 1.02, respectively. Since the differences seen in this study fall within this range, day-to-day variation cannot be excluded as a contributor to the yearly and latitudinal differences observed; the differences seen should therefore be interpreted within this context.

Self-reported height and weight were used in the calculation of BMI. It has been shown that self-reported heights and weights are well correlated with actual height and weight, but individuals tend to over-report their height and under-report their weight (Spencer, Appleby, Davey, Key, 2002). This leads to the potential for underestimating BMI but our data showed high prevalence of overweight and obesity not unlike that in communities where measured values were obtained.

4.5 Conclusions

In summary, the present study has confirmed that northern and southern Ontario on-reserve First Nations youth are similar to other Canadian Aboriginal youth, with low intakes of milk and alternatives, calcium, and vitamin D, and a high prevalence of overweight and obesity that exceeds that of the general population. The current data do not support the inverse relationship between milk and alternatives intake nor calcium and BMI. However, a trend towards a greater proportion of overweight and obese individuals having inadequate milk and alternatives intakes as compared to normal weight individuals was noted. Further study would be useful to clarify this relationship. Yearly effects as well as latitudinal effects were seen among the communities under study, this should therefore be accounted for as a source of variability in future assessments of dietary intake. This new information on the diets and BMIs of First Nations youth suggests the need for community-based interventions to improve the intakes of milk and alternatives within this population. School-based programs remain a viable approach to addressing the current situation, however many barriers to their implementation may exist and these need to be addressed. The current latitudinal analysis has suggested that a snack program in Fort Albany had a positive impact on expected milk and alternatives intakes among youth in the community. In communities where the resources exist, comprehensive school based nutrition programs may be a next step in improving intakes of milk and alternatives among First Nations youth. In addition, qualitative data from individual communities would be very useful in determining the feasibility of implementing such programs, or about other approaches that may be more be more appropriate given the culture and existing opportunities and barriers seen in each community.

5.0 Chapter 5: Assessing the Impact of Pilot School Snack Programs on Milk and Alternatives Intake in Two Remote First Nations Communities in Northern Ontario, Canada

5.1 Introduction

The worldwide prevalence of overweight and obesity has reached epidemic proportions over the past 25 years (Sheilds & Tjekema, 2006). In Canada, Aboriginal people have two-and-a-half times greater odds of being obese than non-Aboriginals (Garriguet, 2008). Childhood overweight and obesity are also mounting problems; 2004 Canadian Community Health Survey (CCHS) (Cycle 2.2) data indicate that 21% of off-reserve Aboriginal youth aged 12-17 are overweight, and 20% are obese (as compared to a prevalence of 18% and 8% in the general population) (Sheilds, 2005).

The increased prevalence of obesity in recent years is a multi-factorial problem; physical inactivity, unhealthy dietary intake, genetic susceptibility, physical and social environments play a role (Swinburn et al., 2004). Beyond obesity and overweight, Aboriginal populations in Canada experience much poorer health than the general population. Related to obesity and other factors, Aboriginal people are known to have a fives times greater risk of diabetes than the general population (CDA, 2009). Current diets of Aboriginal children are known to be low in iron, folate, calcium, vitamin D, vitamin A, fibre, vegetables and fruits; while containing excess added sugar and fat (Willows, 2005). A recent study of the diets of Aboriginal children in northern Quebec has shown that less than 20% consumed at least two servings of milk and alternatives daily (Downs et al., 2009). The low intake of milk and alternatives and their component nutrients is of utmost concern in Aboriginal populations, as they have demonstrated increased fracture risk as compared to non-Aboriginal populations in Canada (Weiler et al., 2007; Leslie et al., 2004 & 2006). Also, epidemiological studies have demonstrated an inverse relationship between dietary calcium consumption and body weight (Heaney, 2003; Teergarden, 2003); other studies have suggested that this relationship is related to milk intake rather than calcium itself (Barba et al., 2005; Barr, 2003).

Since low milk and alternatives intake is a problem amenable to change, and given the understanding that many barriers to adequate milk and alternatives intake exist, it is important to test opportunities for interventions to improve the current situation. Seeing as numerous studies have helped to establish the link between childhood obesity and overweight with an increased risk of obesity and overweight in adulthood (Herman et al., 2009; Singh et al., 2008), it is important to address the problem early. Schools are an ideal setting to support behaviour change; they can be a rich source of personnel who can positively influence children's eating habits, including snack program coordinators, teachers, and administrators (Sahay et al., 2006). The US Centers for Disease Control and Prevention (CDC) note that schools can reach almost all children, and provide an environment to practice healthy eating and to deal with social pressures to do otherwise (CDC, 1996).

A major barrier to dietary behaviour change is food insecurity, which is more common in the Aboriginal population compared to the general population (Willows, 2005). Because of this, the price of market foods often becomes a more important determinant of choice than nutritional value (Downs et al., 2009). It is for this reason that food provision programs can be of great benefit in remote communities. The objective of this research is to investigate the change in milk and alternatives, calcium, and vitamin D intakes of First Nations children and youth in grades 6-8 as a result of a pilot food provision program in Kashechewan, Ontario; and a supplemental milk and alternatives program Attawapiskat, Ontario.

5.2 Methods

5.2.1 Participants

This study was approved by the University of Waterloo Office of Ethics Research and was conducted in collaboration with St. Andrew's School in Kashechewan, Ontario and J.R. Nakogee School in Attawapiskat, Ontario. Participants included a convenience sample of children and youth attending grades six to eight at these schools. Kashechewan is located on the northern shore of the Albany River, about 10 km inland from James Bay, in Ontario (Mushkegowuk Council, 2010). Attawapiskat is situated a bit further upriver, five kilometers inland on the western coast of James Bay, near the Attawapiskat River (Wakenagun, 1999a). Both First Nations communities are isolated (accessibility is limited) and geographically remote (distant from surrounding communities and major urban centers), being accessible only by air year round and ice road in the winter months (Wakenagun, 1999b). The closest urban center is Timmins, about 300 km to the south of Kashechewan (Wakenagun, 1999b). Each community has one main grocery store, where fresh, healthy foods such as milk and alternatives are often scarce, very costly, and of questionable quality. Poverty and overcrowding are problems. Starting in May 2009 and continuing through the 2009-2010 school year, a pilot snack program was administered to students in pre-K to grade eight at St. Andrew's School in Kashechewan; while a pilot milk provision program was administered for grades six to eight at J.R. Nakogee School in Attawapiskat during the 2009-2010 school year, supplementing an existing snack program that lacked milk and alternatives due to insufficient funding. No students in the schools were known to have allergies or intolerances to milk and alternatives. Both schools consist of portables; while plans for building a new school in Attawapiskat are underway, a new school for Kashechewan has yet to be announced. Students in grades six to eight completed the Web-based Eating Behaviour Questionnaire (WEB-Q) to assess dietary intakes before and after initiation of the program. Participation in the WEB-Q was voluntary, and passive consent for participation was obtained prior to each administration of the WEB-Q by sending an information letter home to parents. Students could opt-out of completing the survey at any time without consequence. Active consent for participation from each student was obtained following the first explanatory screen of the WEB-Q.

5.2.2 Web-based Eating Behaviour Questionnaire

The validated WEB-Q, developed by Hanning and colleagues (2009) at the University of Waterloo, was used to assess milk and alternatives, calcium, and vitamin D intakes (Hanning et al., 2009). Since 2001, the WEB-Q has been used to survey more than 20 000 students in Ontario and other provinces, and assesses eating habits using a 24-hour dietary recall and food frequency questionnaire (Hanning et al., 2009). The WEB-Q has been validated in multiethnic grade six to eight students in Ontario, and the First Nations community of Fort Albany, Ontario (n=25) (Hanning et al., 2009). The WEB-Q has been shown to have moderate to good validity in this population and was significantly correlated with dietitian interviews, with ICC=0.77 and r=0.87 for energy (Hanning et al., 2009). Web-based assessment demonstrates many benefits over traditional data collection techniques, and a recent review supports the feasibility of this approach (Gates, 2010). The web-based approach allows for the assessment of many participants at once, shortening the time and reducing the cost of data collection (Hagler, Norman, Radick, Calfas, Salus, 2005; Bakker, van Mechelen, Mensink, Kemper, 2003). The WEB-Q is easy to use, and reduces participant burden by allowing for several methods to search (Subar, Thompson, Potischman, Forsyth, Rock, Ethelbah, et al., 2007) within the database of 800 foods (Hanning et al., 2009). It also mimics a multiple-pass technique and uses realistic 3-D portion images to produce the most accurate possible reported information (Hanning et al., 2009; Matthys, Pynaert, De Keyzer, De Henauw, 2007). Personalized feedback and unique login and ID numbers help participants to feel at ease and reduce social desirability bias. The WEB-Q was also used to collect self-reported height and weight data. Trained research assistants measured participants using a wall-mounted measuring tape, while participants weighed themselves using an analog scale. Participants then entered their height and weight into the WEB-Q, and BMIs were calculated to the closest 0.1 kg/m^2. Participants were categorized as normal (includes underweight), overweight, or obese as defined by the cut-offs suggested by Cole et al. (2000).

5.2.3 Administrator, Teacher, and Student Impressions

In Kashechewan, after one year of program implementation, administrator impressions of the snack program were gathered via informal discussion with the current school principal. Teacher impressions were gathered via a focus group session after school where teachers were asked open-ended questions and were allowed to express their opinions regarding the snack program. In both Kashechewan and Attawapiskat, student impressions of the program were gathered via open-ended questions that were included in the WEB-Q. Participation in any of these discussions was voluntary and collected information was confidential.

5.2.4 Procedure

Prior to initiation of the snack program in Kashechewan and the supplemental milk and alternatives program in Attawapiskat, students in grades six to eight completed the WEB-Q to establish baseline data. The pilot snack program was then initiated in Kashechewan for students in grades pre-K to eight in May 2009; and the supplemental milk program in Attawapiskat for students in grades six to eight in February 2010. In Kashechewan, the program was initiated by a team of three Masters students (two were registered dietitians) and two professors from the University of Waterloo, in collaboration with the school principal, community members, and the local grocery store. Foods were prepared in the school's main portable and delivered to individual classrooms where students ate at their desks. The initial menu was developed by researchers at the University of Waterloo, and was modified based on local food availability. The program aimed to serve at least one serving from the vegetable and fruit and milk and alternatives food groups daily; other food groups were optional. After one week, students repeated the WEB-Q to determine short-term impacts of the program. Due to the intensity of the program, it was predicted that intakes would improve. Control of the program was then handed over to a school volunteer, who was trained and given written guidelines following a traffic light approach to food choice, where "green foods" were more nutritious and suggested to be served at least 90% of the time, while "amber foods" were less nutritious and suggested to be served at most 10% of the time, while "red foods" were discouraged from ever being served (Cancer Care Ontario, 2010; Ontario Ministry of Education, 2010; Ontario Society of Nutrition Professionals in Public Health School Nutrition Workgroup Steering Committee, 2004).

They were also given a sample shopping list of appropriate foods that would fall into each category and were available at the community Northern store. The written guidelines and sample shopping list can be seen in Appendix D. The program continued intermittently (due to various logistical and staffing issues), and students once again completed the WEB-Q in June 2010 to assess long-term impacts of the program. In Attawapiskat, the project advisory committee consisted of the investigators, school principal and vice principal, and a community nurse. School administrators began serving at least one serving from the milk and alternatives food group per day following baseline data collection. Administrators were given written guidelines about appropriate foods, similar to those used in Kashechewan. Short-term impacts were assessed using the WEB-Q in March 2010. For both schools, researchers were kept informed of program integrity via conversations with program coordinators and school administrators via e-mail and telephone.

5.2.5 Statistical Analyses

Nutrient analysis was based on Canadian Nutrient File (CNF) data (version 2007) using The Food Processor software (version 8.0; ESHA Research, Salem, OR, 2002). Food group servings were based on the 2007 version of Canada's Food Guide (CFG), as described by the CNF (Health Canada 2009a,b). Descriptive statistics were used to compare participants' intakes to dietary standards and to intakes seen in the general population. Paired samples were analyzed using the Wilcoxon signed-rank test to compare intakes of milk and alternatives, calcium, and vitamin D, between pre-program and one week post-program; including short- and long-term program impacts in Kashechewan. All dietary variables were adjusted for energy intake using the energy density method (per 1000 kcal), as to ensure that differences in intake were due to changes in diet composition and not differences in overall amount of food consumed (Willet et al., 1997). Table 5.1 presents the dietary standards used for comparison in the analysis (Health Canada, 2006), as well as Canadian Community Health Survey data pertaining to milk and alternatives intakes in the general Canadian population for the age and sex groups under study (Statistics Canada, 2010). For the pre- to one-week post-program analysis, one-tailed tests were used as we predicted an improvement due to the intervention. For the pre- to one-year post-program and one-week post to one-year post-program comparisons, two-tailed tests were used as we made no predictions because logistical and other issues were overriding factors. Statistical analyses were performed using SPSS software (version 17.0; SPSS Inc., Chicago, IL, 2008). A p level of ≤ 0.05 was considered statistically significant.

Table 5.1. Canadian Dietary Standards and Canadian Community Health Survey data used for comparison

Age and sex group	Standard for comparison			
	Milk & alternatives (Canada's Food Guide servings)	**Mean milk and alternatives (servings) general population intake (CCHS)**	**Calcium Adequate Intake (mg)**	**Vitamin D Adequate Intake (μg)**
Males 9-13 y	3-4*	2.55	1300	5
Females 9-13 y	3-4	2.08	1300	5
Males 14-18 y	3-4	2.64	1300	5
Females 14-18 y	3-4	1.82	1300	5

*Minimum number of 3 servings was used for all statistical analyses

5.3 Results

5.3.1 Changes in Dietary Intakes

In Kashechewan, 37 pairs were included the pre- to short-term post-program analysis. Two participants were excluded due to incomplete dietary data. Twenty-four pairs were included in the pre- to long-term post-program analysis, and 24 pairs were included in the short-term post-program to long-term post-program analysis. In Attawapiskat, 48 pairs were included in the pre- to short-term post-program analysis. Five participants were excluded due to an Internet shutdown, which did not enable them to complete the 24-hr recall portion of the WEB-Q. Demographic characteristics of all participants at each time point are presented in Table 5.2. At all time points, there were no statistically significant differences between students participating in the survey and those for whom paired data were available in terms of sex distribution, energy, milk and alternatives, calcium, or vitamin D intakes. For the long-term (one-year) post-program survey in Kashechewan, those with paired data were significantly younger than the sample as a whole (mean age of 13.08 vs. 13.52 years). In both Kashechewan and Attawapiskat, baseline overweight and obesity rates greatly exceeded those of the general Canadian population. In Kashechewan, 60.0% of students were overweight or obese while, in Attawapiskat 68.8% were overweight or obese. This is compared to a reported prevalence of 26% in the general Canadian population aged 12-17 years (Sheilds, 2005). Furthermore, in both Kashechewan and Attawapiskat, the vast majority of participants failed to meet the recommendations of Canada's Food Guide for milk and alternatives (74.4 and 82.9%, respectively). Mean intakes of milk and alternatives also fell below mean intakes in the general population for all age categories. In Attawapiskat, males aged 9-13 had a mean (SD) intake of 1.9 (1.5) servings per day, females aged 9-13 had a mean intake of 1.7 (1.8) servings per day, and females aged 14-18 had a mean intake of 1.4 (1.5) servings per day. Calcium and vitamin D intakes were generally low. Of note, at baseline 81.4% of participants in Kashechewan and 92.9% in Attawapiskat had calcium intakes below the Adequate Intake. For vitamin D, 90.7% of participants in Kashechewan and 87.1% in Attawapiskat had intakes below the Adequate Intake

Table 5.2. Short- and long-term snack program participant demographic characteristics and nutrient intakes as compared to Canadian dietary standards

	Kashechewan			Attawapiskat	
	Baseline	**One week post-program**	**One year post-program**	**Baseline**	**One week post-program**
n	43	43	67	70	64
Age (median, range)	13 (11-14)	13 (12-15)	14 (12-16)	12 (11-14)	12 (11-14)
Sex (% male)	60.5	58.1	47.8	35.7	35.9
BMI (% overweight, obese)	42.5, 17.5	31.0, 23.8	22.8, 26.3	31.3, 37.5	33.9, 35.6
Milk & alternatives intake (mean, SD) (servings)	2.2 (1.9)	2.8 (1.9)	1.7 (1.4)	1.7 (1.6)	2.3 (1.6)
% below minimum CFG recommendations for milk & alternatives	74.4	55.8	80.6	82.9	78.1
Calcium intake (mean, SD) (mg)	812.9 (577.5)	996.3 (603.7)	626.8 (426.8)	685.0 (480.1)	805.7 (511.3)
Vitamin D intake (mean, SD) (μg)	2.4 (2.4)	3.1 (3.1)	1.7 (1.8)	2.2 (2.3)	3.2 (3.2)

Table 5.3 describes the change in energy-adjusted intakes of milk and alternatives, calcium, and vitamin D after following one week and one year of snack program initiation in Kashechewan, and following one week of the addition of milk and alternatives to the snack program in Attawapiskat. The Wilcoxon signed-rank test revealed a significant increase in calcium intake (p=0.044) in the short-term in Kashechewan. While milk and alternatives intakes improved, this was not significant, and more than 50% continued have an intake below the minimum recommendations of Canada's Food Guide. By contrast, in the short term in Attawapiskat, the intakes of milk and alternatives (p=0.034) and vitamin D (p=0.022) improved significantly. Still, 78.1% of students failed to meet the recommendations of Canada's Food Guide. In Kashechewan, there was no significant change in any of the dietary variables over the long-term, while a significant decrease in milk and alternatives intake was seen when comparing one week to one year post-program (p=0.021).

Table 5.3. Difference in mean (SD) intakes of selected nutrients pre- and post-pilot school snack program

Comparison	Food group or nutrient	Baseline	One week post-program	One year post-program	p-value*
Kashechewan					
Baseline to 1-week post-program (n=37)	Milk & Alternatives (servings)	2.2 (1.9)	2.8 (2.0)	-	0.072
	Calcium (mg)	805.9 (552.0)	1027.6 (603.7)	-	**0.044**
	Vitamin D (μg)	2.3 (2.1)	3.5 (3.2)	-	0.193
Baseline to 1-year post-program (n=24)	Milk & Alternatives (servings)	2.4 (2.0)	-	1.7 (1.2)	0.317
	Calcium (mg)	794.3 (545.3)	-	675.5 (384.8)	0.932
	Vitamin D (μg)	2.6 (2.4)	-	1.9 (1.6)	0.670
1-week to 1-year post-program (n=24)	Milk & Alternatives (servings)	-	2.7 (1.9)	1.6 (1.1)	**0.021**
	Calcium (mg)	-	937.1 (557.8)	645.9 (379.5)	0.052
	Vitamin D (μg)	-	2.4 (2.9)	1.8 (1.6)	0.715
Attawapiskat					
Baseline to 1-week post-program (n=48)	Milk & Alternatives (servings)	1.7 (1.7)	2.1 (1.4)	-	**0.034**
	Calcium (mg)	661.9 (476.2)	751.3 (446.0)	-	0.117
	Vitamin D (μg)	2.5 (2.6)	3.5 (3.4)	-	**0.022**

*p-value for intakes adjusted per 1000 kcal

Figures 5.1 to 5.4 show the percentage of students in various categories of milk and alternatives intakes at various time periods throughout the implementation of the food provision programs in Kashechewan and Attawapiskat. Between pre-program and one week post-program, there was more than a doubling in the percentage of the population achieving at least three servings of milk and alternatives per day (almost 50%) (Figure 5.1). Less promising results were shown for the pre- to one year post-program, where a similar proportion of participants achieved adequacy at both time points, and there was a large decrease in the percentage of students consuming 2.0-2.9 servings of milk and alternatives per day (Figure 5.2). Between one week post-program and one year post-program implementation, there was a severe decrease in the percentage of participants consuming at least three servings of milk and alternatives daily, attributable to the vast improvement seen over the short-term (Figure 5.3). In Attawapiskat, between pre-program and one week post-program implementation, the percentage of students consuming 0.0-0.9 servings per day decreased, while there was an increase in the proportion of students consuming greater than one serving. A similar proportion of students achieved adequacy pre- and one week post-program (Figure 5.4).

Figure 5.1. Change in intakes of milk and alternatives pre- to one week post-program in Kashechewan (n=37)

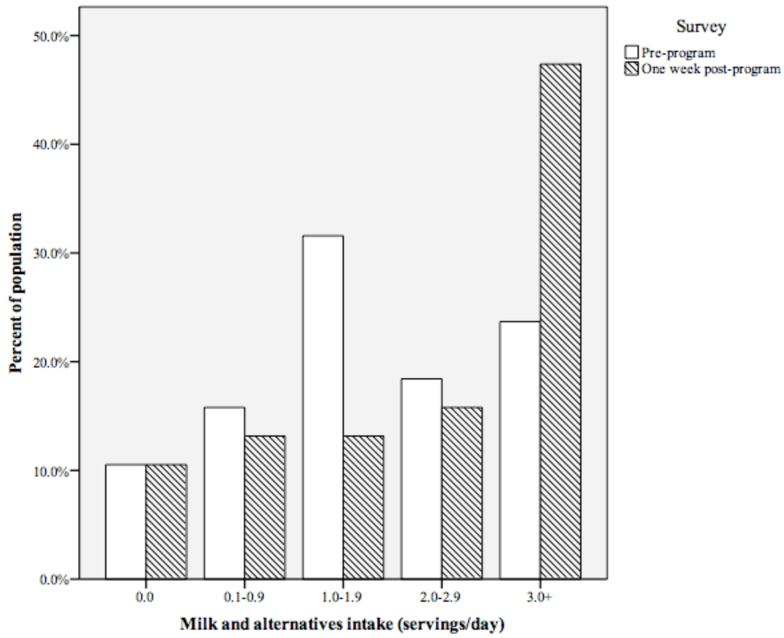


Figure 5.2. Change in intakes of milk and alternatives pre- to one year post-program in Kashechewan (n=24)

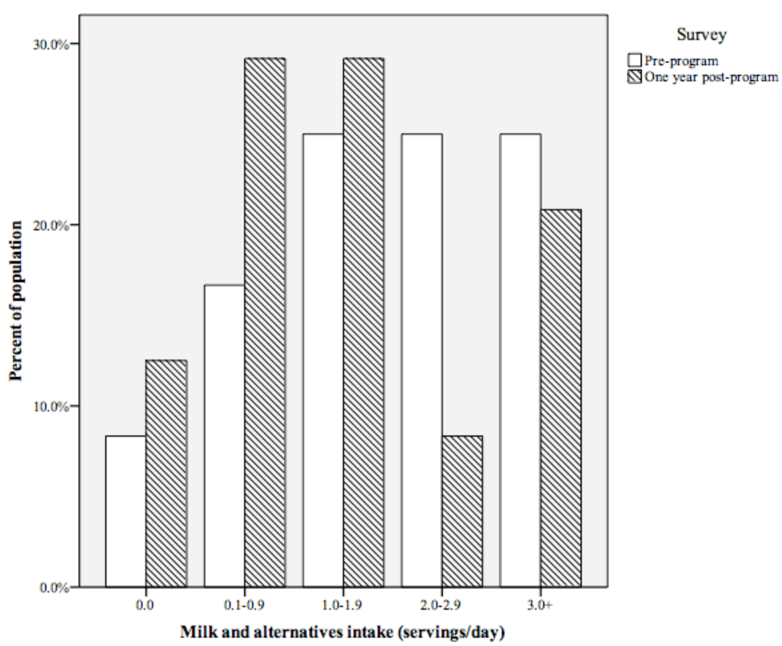


Figure 5.3. Change in intakes of milk and alternatives one week to one year post-program in Kashechewan (n=24)

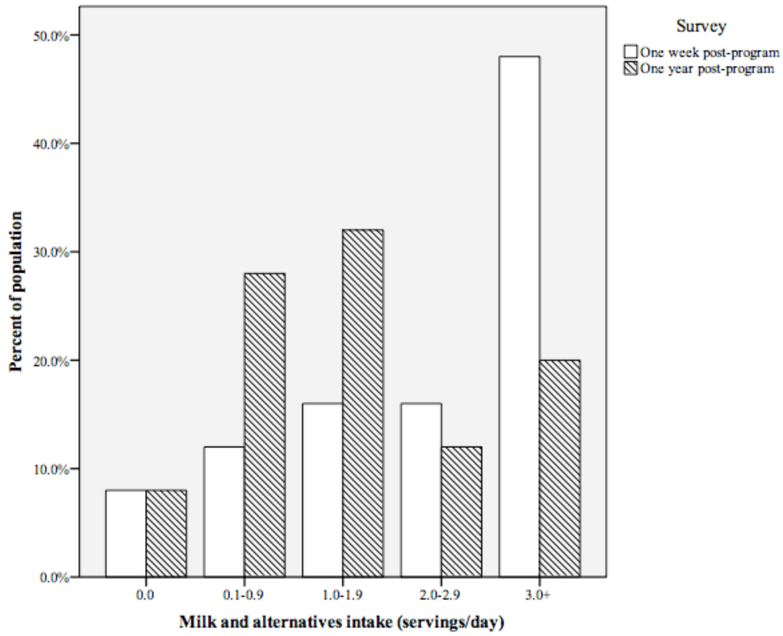
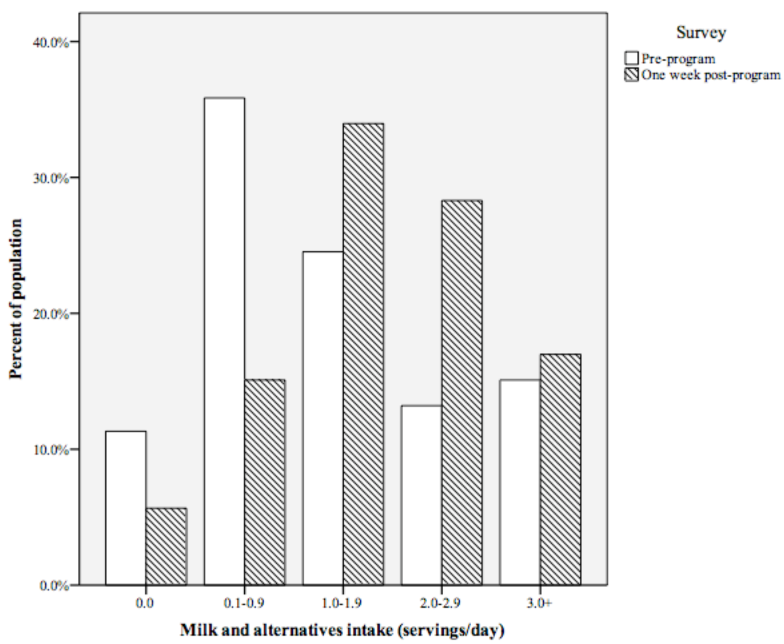


Figure 5.4. Change in intakes of milk and alternatives pre- to one week post-program in Attawapiskat (n=48)



5.3.2 Student Impressions of the Snack Programs

In general, students had positive things to say about the programs, and felt that they had made positive lifestyle changes as a result of the snack programs. In Kashechewan, after receiving snacks for one week, 62% of students reported that they were motivated to eat healthier, while 67% said they made better choices about what they eat. Several students noted that they liked the snack program because they were hungry in the morning when they arrived at school. Comments from students included, “I like having food in the morning because I’m hungry”, “I like that I get to eat when I come to school”, and “It fills my stomach”. One student in Attawapiskat even said that they’d like to have an additional snack in the afternoon, “[I’d like to] have a snack after we come back from lunch in the afternoon”. In general, students simply viewed the snack program as a good thing and a time to socialize, with comments including, “It’s cool and fun” and “[I like] eating with friends”. When asked what their favorite part of the snack program was, several students in Attawapiskat said yogurt and chocolate milk were their favorite milk and alternative products to receive. When asked what they would change about the snack program if they could, students seemed to enjoy the fact that they were receiving healthy foods and got to try new foods. Comments included “we would like to try [new foods] from Waterloo (kiwi, pineapple, coconut)” and “more fruits, more milk, more bread”.

5.3.4 Teacher and Principal Impressions of the Snack Program in Kashechewan

Teachers were also overwhelmingly positive about the effects of the snack programs. In Kashechewan, several teachers agreed that many students do not eat breakfast, so the snack program definitely augments their intake, wakes them up, and helps them to be more motivated. As a group, they agreed that the program was beneficial, but that its sporadic operation (due to logistical and staffing difficulties, as mentioned ealier) made it difficult to plan their lessons around snack time and made it difficult to see its true effects and potential. One teacher said “It’s crucial, the more good food that can be put into the school the better”, while another noted “It introduced [the students] to foods they would never have been able to try”. In Kashechewan, the school principal also had positive things to say about the program, and was optimistic about its future. He emphasized the need for a strong and dedicated individual to be in charge and to have a system in place to make the program run smoothly. He noted the logistics of obtaining food items and the price of foods at the local grocery store as major barriers to program success. He noted that under the current circumstances (staffing, time availability, equipment availability, setting), with sustainable funding, he is confident that the program could continue. He also emphasized the extreme need for a program such as this in the community, saying "the kids are always hungry".

5.4 Discussion

The current study explored the current intakes of milk and alternatives and their associated nutrients of First Nations youth in two remote northern Ontario communities, and explored the changes in the intakes of these dietary variables after the implementation of a pilot school snack program and a supplemental milk and alternatives program. Based on the reported findings, intakes of calcium improved in the short-term in Kashechewan while intakes of milk and alternatives and vitamin D improved in Attawapiskat. In assessing long-term change in Kashechewan, the positive changes in nutrient intakes were not sustained. Even with the improvements seen over the short-term in both communities, median consumption of milk and alternatives remained far below national standards. The vast majority of students continued to fall below the Adequate Intake established for calcium and vitamin D. In most cases, despite improved intakes, student's intakes continued to fall below those of youth of the same age and sex group in the general population.

The results presented here reflect the situation reported in studies of milk and alternative intakes in other Canadian Aboriginal populations. A 2009 study of Aboriginal children living in Northern Quebec found that only 19.1% consumed at least two servings of milk & alternatives per day (Downs et al., 2009). A 2010 study of Cree youth aged 9-18 residing in communities on the eastern side of James Bay showed that 95% failed to consume the minimum of three servings of milk and alternatives per day as recommended by Canada's Food Guide (Boukhalil, Johnson-Down & Egeland, 2010). Our data indicate a similar (perhaps not as drastic) situation, at baseline 74.4% of youth in Kashechewan and 82.9 in Attawapiskat failed to consume three servings of milk and alternatives on the day of the study. Our data indicate intakes that are poorer in terms of milk and alternatives as compared to on-reserve Mi'kmaq youth aged 9-18 in Prince Edward Island, Canada, of whom 49% consumed adequate milk and alternatives daily (Taylor et al., 2007). All of these data indicate low intakes of milk and alternatives among Aboriginal youth in Canada.

The reported results are not entirely unexpected. Food provision is only one factor among others that influence food intake among school-aged children and youth, and such programs require a devoted advocate to be sustainable. However, the improvements in intake seen in the short-term demonstrate the potential of such programs under best-case circumstances and should be seen as a first step towards a more comprehensive program addressing a greater number of factors affecting dietary behaviour. The US Centers for Disease Control have suggested that to affect dietary patterns, schools must provide an environment that is conducive to behaviour change, while supporting the behaviour choices that students will be expected to make (CDC, 1996). The current findings suggest the need for a more comprehensive school-based intervention, including a nutrition policy and supportive school environment, nutrition education, integration of school food service, training for school staff, family and community involvement, and a program evaluation (CDC, 1996). This is supported by a recent review of 15 dietary change interventions in children, which found that those interventions that were effective in terms of changing dietary behaviour were ones that employed a comprehensive approach (Sahay et al., 2006). However, the logistics of a comprehensive program need to be considered, and this is a step that could only be undertaken once a sustainable food provision program has been in place for several years and the resources exist to implement a more comprehensive and sustainable program.

The present study allowed for the identification of numerous opportunities and barriers to the implementation of school snack programs in remote First Nations communities. The suboptimal intakes of milk and alternatives, below those seen in the general population, accompanied by a low intake of associated nutrients clearly identified a need for school based interventions in both Kashechewan and Attawapiskat. There is also the opportunity to address the high rates of overweight and obesity seen in our sample. Students showed great excitement at being introduced to a variety of healthy foods that they would not normally have access to because of price or availability. One student noted "I'm glad that I tasted new food" while others thanked us for introducing them to things, such as types of cheese that they had never tried before. Further, addressing the nutritional need brought upon a secondary benefit regarding learning potential. Several teachers in Kashechewan noted that students were more motivated and ready to learn after having eaten their snack, with one teacher noting "It wakes them up, the earlier the better".

Many barriers to healthy eating were identified, as well as challenges in program implementation. As food insecurity (including problems with food access, availability, and use) is a prevalent in First Nations. While healthy foods can be provided at school, it remains a challenge to supply children with healthy food on a regular basis outside of school due to availability and affordability. Prices are extremely high and many healthy foods are simply not available or of poor quality at either of the communities' one grocery store. Nevertheless, teachers at the school in Kashechewan noted that the snack program had a positive impact on the variety of healthy foods available at the grocery store, saying "[The program] encourages the Northern to stock variety if the kids ask for it (if it gets purchased)". Once foods were purchased for Kashechewan's snack program, storage was a major problem, as the school consists of portables with very limited space for preparation and storage. In addition, the lack of fridge space meant that milk and alternatives could not always be served on a regular basis. Transporting snacks from the main portable to individual classrooms was challenging and time consuming. Some teachers noted that the snack program took time out of their teaching that they did not have to spare, because distributing and cleaning up the snacks took up to half an hour. Lack of personnel was problematic; much of the burden of each program fell on one individual. In Kashechewan, unforeseen circumstances meant that the volunteer coordinator was unavailable for several weeks. Without a replacement, the program was forced to be discontinued for some time. Another barrier is a lack of funding. With funds running short, the variety and quantity of foods offered by the program in Kashechewan needed to be reduced to one item per day, meaning milk and alternatives were not always served. It has been noted that funds available through usual program assistance programs in Canada (Nutrition for Learning, 2010) do not keep pace with the high cost of food in the North; this was true in the current study. Thus, the noted lack of improvement in the dietary variables being studied in the long-term is understandable taking into account the barriers faced in remote communities. Nevertheless, the short-term improvements should be seen as a best-case scenario that would be achievable once some of the current challenges are overcome.

The results of this research have immediate application to the communities under study. For example, over time, some of the identified challenges encountered can be addressed. For example, in Kashechewan a charter could be used to order non-perishables in bulk at a lower cost than what is found at the community grocery store. The school is planning to purchase re-usable bowls, plates, cups, and cutlery. This allows for purchasing cereal and milk, for example, in bulk rather than having to buy individual servings. Funding options are currently being explored to allow programs in both Kashechewan and Attawapiskat to continue on an ongoing basis, five days a week.

5.4.1 Limitations

As First Nations populations vary in degrees of isolation, remoteness, and traditional lifestyles, the results present herein may not be representative of other First Nations populations. The limited sample size in the present study may have impacted our ability to detect significant changes in intakes. While single 24-hour recalls are effective population-based dietary assessment techniques in adolescents (Livingstone, Robson & Wallace, 2004) and the approach was selected for feasibility, it is recognized that the single data collection and reliance on recall are limiting (Thompson & Byers, 1997). Even with the anonymity of the web-based approach, underreporting can be a problem, related to a number of potential factors including social desirability and weight concerns (Vance, Woodruff, McCargar, Husted, Hanning, 2007). Use of the United States Department of Agriculture (USDA) Automated Multiple-Pass Approach (AMPM), which is mimicked in the WEB-Q, has been found to improve accuracy at a group level (Moshfegh et al., 2008; Blanton et al., 2006). While the 24-hour recall does not allow for generalizations about an individual's intake, it is useful in measuring the average intakes of groups (Thompson & Byers, 1997).

5.5 Conclusions

Although not generalizable to all Canadian First Nations populations, the current study provides a unique first look at the positive impact that school snack provision programs can have on the intake of milk and alternatives and associated nutrients in First Nations youth living in Kashechewan and Attawapiskat, Ontario under ideal circumstances. Unfortunately, it is often the case these circumstances do not exist, and food provision programs suffer when resources, staff, facilities, and funding are lacking. These results support the need for continued efforts to improve and sustain current programs; and in the future, to implement more comprehensive school-based nutrition programs to encourage First Nations youth in these and other communities to adopt healthy eating habits. Follow-up studies looking into the impacts and feasibility of such programs in remote First Nations communities are needed.

5.6 Implications for School Health

In summary, the findings for the current research bring great insight into developing and initiating snack programs in remote First Nations communities. Prior to beginning such a program, it is important to consider barriers to their implementation as well as realistic outcome expectations. Barriers in the communities involved in this research included a lack of facilities and storage space, high food prices combined with a limited budget, environmental constraints to changing dietary patterns, interruption of class time, and limited availability of personnel. Consideration of these barriers prior to program implementation will improve the sustainability of the program. While intensive, well-organized food provision programs can produce positive results, outcome expectations should be realistic in light of existing barriers. Further, implementing a food provision program does not change the environment in which the children live. In this case the environment is not supportive of healthy eating, with high food prices and limited availability of healthy foods, so global changes in diet should not necessarily be expected. More comprehensive programs require greater inputs of staff, time, and funding, in order to change dietary behaviour. Schools that have the resources required to initiate such programs may want to investigate this as a viable way to improve the nutrient intakes of schoolchildren, especially in remote First Nations communities where the need is so great.

6.0 Chapter 6: Evaluating the Process of Implementing a Comprehensive School Nutrition Program and Impact on the Milk and Alternatives Intake, Knowledge, Intentions, and Self-efficacy of First Nations Youth in Fort Albany, Ontario, Canada

6.1 Introduction

In Canada, the prevalence of childhood overweight and obesity among Aboriginal peoples is much higher than the general population (Sheilds, 2005). The loss of traditional lifestyles with a transition to market foods of low nutritional quality and high energy density over the past several decades is seen as a major contributor to the problem (Kuhnlein et al., 2004; Swinburn et al., 2004). Among dietary concerns faced by the Aboriginal population is the low intake of milk and alternatives. A recent study of Aboriginal children living in northern Quebec found that only 19.1% consumed at least two servings of milk and alternatives per day as recommended by Canada's Food Guide (Downs et al., 2009). This is of concern because epidemiological studies have demonstrated an inverse relationship between dietary calcium consumption and body weight (Teergarden, 2003, Taylor et al., 2007), and the Canadian Aboriginal population is at a higher risk of bone fractures than the general population (Weiler et al., 2007; Leslie et al., 2004 & 2006). Further milk and alternatives are a key source of dietary vitamin D, and sunlight is an unreliable source of this vitamin in northern latitudes (Schwalfenberg, 2007). Taylor et al. (2007) have noted that the dire nutritional situation facing Aboriginal populations emphasizes the need for health promotion and education programs to increase the intake of milk and alternatives.

The US Centers for Disease Control (CDC) has noted that schools are an ideal setting to promote healthy eating (CDC, 1996). However, there is little information describing successful school nutrition education programs for on-reserve youth living in remote (distant from major urban centers) northern First Nations communities. The objective of this study was to assess the process of implementing a comprehensive school nutrition program over the 2009-2010 school year, and assess its impact of the program on knowledge, intentions, and self-efficacy regarding milk and alternatives intake of First Nations schoolchildren in grades six to eight in Fort Albany, Ontario. Its impact on the milk and alternatives, calcium, and vitamin D intakes of these children was also assessed. It was predicted that the school-based program would improve the knowledge, intentions and self-efficacy towards milk and alternatives intake, and help to overcome some of the barriers to healthy eating experienced in the community.

6.2 Methods

6.2.1 Study Design

6.2.1.1 Theoretical Framework

A recent review by Glanz & Bishop (2010) has indicated that when public health interventions have a theoretical basis, they tend to be more effective at changing behaviour compared to interventions without a theoretical basis. Looking specifically at dietary variables, a review of dietary interventions by Ammerman and colleagues (2002) found that those using social cognitive theory (versus no theory) were associated with greater reductions in fat intake and higher vegetable and fruit intakes among participants (Ammerman, Lindquist, Lohr, Hersey, 2002). The theory lays out a key set of interacting determinants of successful health promotion and personal change: knowledge, perceived self-efficacy, outcome expectations, health goals, perceived facilitators, and perceived impediments (Bandura, 2004). Perceived self-efficacy to exercise control over personal eating behaviour is said to play the central role in health promotion and personal change (Bandura, 2004). By improving self-efficacy, individuals will set higher goals for themselves, improve outcome expectations, and be more ready to face possible obstacles (Bandura, 2004).

The reciprocal determinism between the individual, their environment, and behaviour seen in the social cognitive theory (Glanz & Bishop, 2010) is of particular importance in the context of this study. While a person's knowledge and intentions may be improved, if the environment remains the same, then it will be difficult for them to make sustainable changes in behaviour, even if they are highly motivated (Glanz & Bishop, 2010).

6.2.1.2 Comprehensive School-based Nutrition Education Program

The CDC emphasized the need for consistent messages to be sent to children and youth, via the many channels of comprehensive school programs, including school nutrition policy, supportive school environment, nutrition education, school food service, training for school staff, family and community involvement, and program evaluation (CDC, 1996). Specific guidelines regarding milk and alternatives and a sample shopping list were provided to the snack program coordinator to guide food choices, as the nutrition policy portion of the program. These guidelines were consistent with the school nutrition policy platform of the Ontario Ministry of Health Promotion and a pilot Aboriginal school nutrition policy program spearheaded by Cancer Care Ontario (Ontario Ministry of Health Promotion, 2010; Cancer care Ontario, 2010), that involved the school snack program coordinator. The nutrition education component of the current program was adapted from the Power4Bones (P4B) program developed by the Dairy Farmers of Canada (Dairy Farmers of Canada, 2010). P4B is a school-based nutrition education program emphasizing the need for adequate intake of milk and alternatives and weight-bearing physical activity for bone health (Dairy Farmers of Canada, 2010). Because the program relies heavily on computers, to which access at the school was limited, activities were adapted to be completed without the use of a computer. The program was delivered by a University of Waterloo senior undergraduate student (on a work term placement) with teaching experience, who lived in the community for the duration of the program. The nutrition education was delivered using interactive sessions with students; each grade was taught one class of 30 minutes per week, for five weeks. Parents were included using informative handouts (n=5) that were given to students to bring home to their families. In-class nutrition education materials and parent involvement materials can be seen in Appendix E. The program also involved a food provision component via the pre-existing daily breakfast and snack program at the school. In the final week of the program, students were involved in a community feast, which included nutrition information, a raffle of nutritious food items, and the opportunity to taste and obtain recipes for healthy foods containing milk and alternatives. Students cooked healthy pizzas to be served at the feast, after learning about how to incorporate milk and alternative products into one of their favorite foods. They were invited to attend the event with their families. Parents, teachers, and community members were invited to attend using posters that were posted in prominent locations throughout the community (convenience stores, school, grocery store) one week before the event, and by word of mouth.

6.2.1.3 Program Evaluation

All documents and teaching plans used in the nutrition education program underwent a formative evaluation for cultural sensitivity, content, and approach, with the school's snack program coordinator (a community member), and the necessary changes were made prior to implementation. Parent education materials were geared for a grade six reading level. Throughout the program, the co-operative student delivering the nutrition education documented program integrity, classroom attendance, and ongoing feedback. Student dietary intakes were assessed pre- and post- program using the University of Waterloo Web-based Eating Behaviour Questionnaire (WEB-Q). Student knowledge, self-efficacy, and intentions regarding milk and alternatives were assessed pre- and post-program using a pen-and-paper questionnaire adapted for this purpose from a questionnaire measuring similar constructs regarding fruits and vegetables in the European Pro Children Project (De Bourdeaudhuij, Klepp, Due, Perez-Rodrigo, de Almeida, Wind, et al., 2005).

Following completion of the program, student impressions were gathered via questions within the WEB-Q. Parent impressions were gathered using a short questionnaire (Appendix B) at the community feast described earlier. Teachers' impressions were gathered during a group discussion over lunch with the study researchers. All information gathered was anonymous and confidential; participation was voluntary.

6.2.1.4 Participants and Recruitment

This study was approved by the University of Waterloo Office of Ethics Research and was conducted in collaboration with Peetabeck Academy (a First Nations administered school) in Fort Albany, Ontario, Canada.. Passive consent for participation in surveys and the nutrition education program was obtained from parents by sending an information letter home prior to each survey and the initiation of the school-based program. No students opted-out of the program. Active consent was obtained from students following an explanatory screen at the beginning of each web survey. Students could choose not to participate at any time without consequence. All surveys were confidential; for online surveys, unique identification numbers and passwords were assigned to maintain anonymity and confidentiality. Participants included a convenience sample of all attending children and youth attending grades six to eight at Peetabeck Academy. The community is accessible only by plane year-round and by ice road in the winter. The community has one school (grades K-12) and one main grocery store.

6.2.2 Instruments

6.2.2.1 Web-based Eating Behavior Questionnaire

The WEB-Q was developed by Hanning and colleagues at the University of Waterloo, to collect dietary data from diverse populations of grade six to eight students in Ontario, Canada (Hanning et al., 2009). The WEB-Q has been used to survey more than 20 000 students since 2001, and assesses eating habits using a 24-hour dietary recall and food frequency questionnaire (Hanning et al., 2009). The web-based survey offers numerous benefits over traditional methods of dietary data collection, including convenience, cost- and time-efficiency, and improved confidentiality.

The WEB-Q was initially validated in grade six to ten students in Ontario and Alberta (Hanning, Woodruff, Lambraki, Jessup, Driezen, Murphy, 2007). More recently, it was revised and adapted for use in First

Nations populations (Hanning et al., 2009). The WEB-Q was validated versus dietitian interviews in First Nations children in grades six to ten (n=25) in Fort Albany, Ontario. Moderate to good validity was found, with ICC=0.77 for energy (Hanning et al., 2009).

6.2.2.2 Knowledge, Self-efficacy, and Intentions Questionnaire

The Knowledge, Self-Efficacy, and Intentions Questionnaire (KSIQ) was adapted from a questionnaire used in the European Pro Children project, aimed at promoting and sustaining health by increasing vegetable and fruit consumption in schoolchildren (De Bourdeaudhuij et al., 2005). It was based on various learning theories including the social cognitive theory (De Bourdeaudhuij et al., 2005), which was used as a model for the current research. It looks at key psychosocial predictors of fruit and vegetable intake such as perceived barriers, skills, self-efficacy, preferences, parental modeling, and perceived accessibility and availability of food items (De Bourdeaudhuij et al., 2005). Although this questionnaire underwent rigorous testing, including test-retest reliability, internal consistency, predictive validity, and was shown to be valid and reliable for a diverse population (De Bourdeaudhuij et al., 2005), the questionnaire has not been validated in First Nations children. However, the European Pro Children project questionnaire, adapted for milk and alternatives intake, underwent formative evaluation with the snack program coordinator at Peetabeck Academy to check cultural appropriateness of the questions asked. The final adaptation was deemed culturally appropriate. The adapted questionnaire can be seen in Appendix B.

6.2.3 Measures

6.2.3.1 Twenty-four Hour Recall

As part of the WEB-Q, a 24-hour recall was used to assess self-reported dietary intakes for group comparison by age and sex. With the 24-hour recall, dietary behavior is unlikely to be affected when participants are not warned of the assessment beforehand (Fowles & Gentry, 2008). The 24-hour recall does not allow for generalizations about an individual's usual intake (Whitney & Rolfes, 2008; Mahan & Escott-Stump, 2004), and is most useful for assessing the average usual intake of groups (Thompson & Subar, 2001), which is the case in the present study. The WEB-Q was used to collect weekday intakes only, focusing on school day food and beverage intake. The WEB-Q mimics a multiple-pass approach, allowing for multiple cues to help participants recall their intake (Moshfegh et al., 2008; Blanton et al., 2006). It also includes realistic 3-dimensional portion size images, which have been shown to allow for most accurate estimation.

6.2.3.2 Statistical Analyses

Nutrient analysis was based on Canadian Nutrient File data (CNF) (version 2007) using The Food Processor software (version 8.0; ESHA Research, Salem, OR, 2002). Food group servings were based on the 2007 version of Canada's Food Guide (CFG), as described by the CNF (Health Canada 2009a,b). Descriptive statistics were used to compare participants' intakes to Canadian dietary standards (Health Canada, 2006b) and to intakes seen in the general population as described by the 2004 Canadian Community Health Survey (CCHS) Cycle 2.2: Nutrition (Statistics Canada, 2010). Table 6.1 presents the Canadian dietary standards and CCHS data used as comparators in the analysis for data from the age and sex groups under study. The Mann-Whitney U test was used to compare pre- and post-program dietary intakes, which were adjusted for energy intake using the energy density method (per 1000 kcal) in order to ensure that differences in intake were due to diet composition and not a change in overall food consumption (Willet et al., 1997). The test was two-tailed as we made no predictions about dietary intake as issues surrounding availability and accessibility of healthy foods in the community were overriding factors. The Wilcoxon signed-rank was used to compare paired pre- and post-program scores regarding knowledge, self-efficacy, and intentions towards milk and alternatives intake. The test was one-tailed as we predicted an improvement as a result of the intervention. Statistical analyses were performed using SPSS software (version 17.0; SPSS Inc., Chicago, IL, 2008). A p level of ≤ 0.05 was considered statistically significant.

Table 6.1. Canadian dietary standards and Canadian Community Health Survey data used for comparison

	Standard for comparison			
Age & Sex group	**Milk & Alternatives (Canada's Food Guide servings)**	**Milk & Alternatives mean general population intake (servings) (CCHS)**	**Calcium Adequate Intake (mg)**	**Vitamin D Adequate Intake (µg)**
Males 9-13 y	3-4*	2.55	1300	5
Females 9-13 y	3-4	2.08	1300	5
Males 14-18 y	3-4	2.64	1300	5
Females 14-18 y	3-4	1.82	1300	5

*Minimum number of 3 servings used in all statistical analyses

6.3 Results

6.3.1 Participant Characteristics

A total of 30 participants completed the WEB-Q at baseline (June 2009), and 10 post-program (June 2010). No exclusions were necessary; all participants were included in the analysis. A total of 26 participants completed the KSIQ at baseline, and 19 post-program. Participants who were missing a pre- or post-questionnaire were excluded from the analysis. A total of 16 individuals were included in the paired analysis. In all cases, all students attending school on the day of the questionnaire/survey completed the assessments. There were no statistically significant differences between students participating in the KSIQ and those for whom paired data were available, in terms of age and sex distribution, knowledge, self-efficacy, intention, or number of milk and alternatives liked or tried. Subject demographic characteristics are presented in Table 6.2. At baseline, the vast majority (86.7%) of participants failed to meet the minimum recommendations of Canada's Food Guide for servings of milk and alternatives. Of note, intakes of milk and alternatives among all except females aged 14-18 fell below intakes seen in the general population as reported by CCHS data. Males aged 9-13 had mean (SD) intakes of 0.9 (0.9) servings per day, while females aged 9-13 had intakes of 1.8 (1.0) servings per day and males aged 14-18 had intakes of 2.4 (0.9) servings per day. Females aged 14-18 had mean intakes greater than those seen in the general population (1.9 (1.2) servings per day). Relating to the inadequate intake of milk and alternatives, the vast majority of participants consumed levels of calcium and vitamin D that fell below the Adequate Intake established for these nutrients (90.0% and 80.0% for calcium and vitamin D, respectively).

Table 6.2. Participant demographic characteristics

Variable	Baseline		Post-program	
n	30	26	10	19
Age (median, range)	13 (11-15)	13 (10-14)	12 (11-13)	13 (11-15)
Sex (% males)	33.3	53.8	70.0	63.2
% below minimum CFG recommendations	86.7	-	80.0	-

6.3.2 Changes in Dietary Intakes

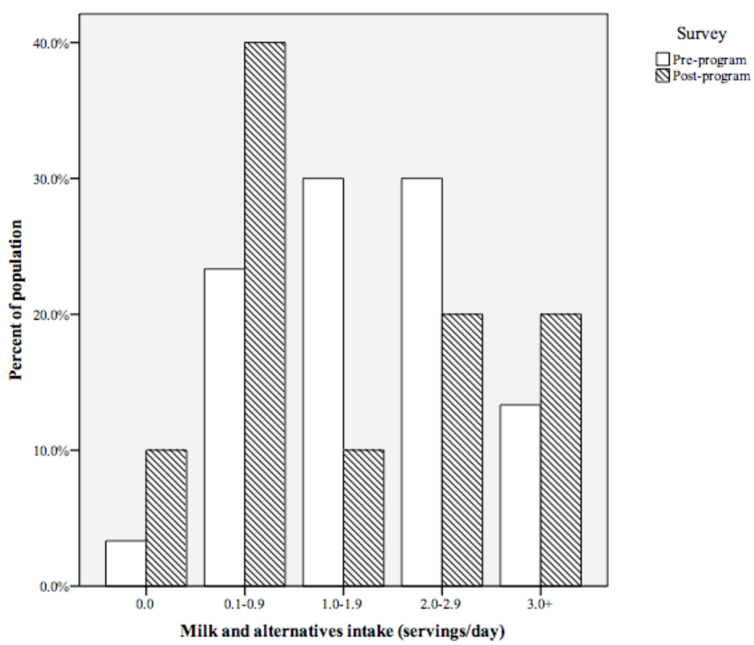
Table 6.3 describes the change in intakes of milk and alternatives, calcium, and vitamin D from baseline following the comprehensive school-based nutrition program. The Mann-Whitney U test revealed no significant change in any of the dietary variables under study. Figure 6.1 describes the change in milk and alternatives intake from pre-to post program, among students consuming milk and alternatives. Here, it is seen that while many students continue to consume inadequate milk and alternatives, the percentage of students achieving adequacy (at least 3 servings) improved at post-program as compared to pre-program.

Table 6.3. Dietary intakes pre- and post-comprehensive school-based program

Food group or nutrient*	Baseline (n=30)			Post-program (n=10)			p-value*
	Median	Mean	SD	Median	Mean	SD	
Milk & Alternatives (servings)	1.7	1.8	1.1	1.1	2.1	3.0	0.213
Calcium (mg)	682.4	785.4	423.5	588.8	829.3	874.1	0.085
Vitamin D (μg)	2.2	2.7	2.4	3.7	5.5	7.2	0.251

*p-value for intakes adjusted for energy

Figure 6.1. Milk and alternatives intake observed pre- and post-comprehensive school-based program



6.3.3 Changes in Knowledge, Intentions, and Self-efficacy

Table 6.4 shows the change in knowledge, intentions, and self-efficacy for adequate milk and alternatives intake from baseline to post-program, as measured by the KSIQ. The change in the number of milk and alternative products that participants had tried and liked was also evaluated, as assessed by a 13-item list. The Wilcoxon-signed rank test revealed a significant improvement in both knowledge (p=0.050) and intentions (p=0.010) with respect to adequate milk and alternatives intake.

Table 6.4. Knowledge, self-efficacy and intentions for milk and alternatives pre- and post-comprehensive school-based program

Parameter measured (# of questions or options)	Baseline			Post-program			p-value
	Median	**Mean**	**SD**	**Median**	**Mean**	**SD**	
Knowledge (on 10)	6.0	6.0	1.5	6.0	6.9	1.5	**0.050**
Intentions (on 18)	10.0	9.6	4.4	11.0	11.3	4.1	**0.010**
Self-efficacy (on 26)	10.5	11.7	5.6	12.0	12.3	6.2	0.163
Number of milk & alternatives tried (of 13)	9.0	11.4	1.5	9.5	11.6	1.7	0.280
Number of milk & alternatives liked (of 13)	11.5	9.6	1.9	12.0	9.6	2.0	0.489

6.3.4 Program Integrity

Attendance rates for the lessons ranged from 22% to 89% of enrolled students (attendance was mandatory), depending on the class and grade. Grade seven had the worst overall attendance rates for the five classes at 49%, with grade six having an attendance rate of 82% and grade eight having an attendance rate of 81%. The main modifications that were needed were to include more interactive activities to increase students' motivation and attentiveness.

6.3.5 Impressions of the Program

6.3.5.1 Student Impressions

Student impressions of the program were overall very positive. Students tended to enjoy and learn best from activities that were interactive, with students listing lessons involving cooking and games as being their favorites. In one lesson, students assembled healthy pizzas as a way to learn about how easy it can be to incorporate a serving of milk and alternatives (cheese) into their diets while enjoying a favorite food. A student in grade six noted, "we all loved the pizza!" while, when asked about their favorite lesson, a student in grade seven said, "making the pizza and tasting food". In another lesson, students played a game where they were asked to rank a list of food items by their calcium content. Games such as these were effective in motivating students to learn and remember the concepts introduced in class. At program completion, a student in grade seven said, "I learned a lot about bones, and I'm not going to forget that vegetable lasagna is good for your bones". This shows how the games played in class can help students to relate the learned material to their everyday lives. All but one student said that they enjoyed the nutrition classes. When asked about what further information they would like to have learned, one student noted, "where milk comes from" as a topic of interest. Regarding the snack program at the school, students appeared satisfied with the program, noting chocolate milk as one of their favorite items served, and saying, "I like that I get healthy food [at school]".

6.3.5.2 Teacher Impressions

Sixteen teachers attended an informal discussion that was held over lunch to gather their impressions of the nutrition education portion of the program. Since the education program included all students in the school, this represents teachers from all grades K-8. Teachers were generally thankful to have had the opportunity for their school to be involved in this program, with one stating that having "somebody other than the teacher who has the energy and time to make nutrition a priority is great". Teachers commented that the nutrition education component fit well with the Ontario education curriculum being taught at the school, but that having more visuals including traditional foods could have helped the program to be more culturally appropriate. Teachers also noted that students enjoyed the lessons that were more interactive. Comments included, "Kids really like the taste testing", and, "Kids liked the physical activity components". Teachers expressed that the lessons gave the students a new perspective that they didn't have pre-program. One teacher said that they saw a huge difference in the students post-program, noting, "they know the four food groups now, it is exciting that they're thinking this way about nutrition now" while, another said, "weight-bearing exercise was something that the kids didn't know about before". In suggesting program improvements, the overall consensus was that a greater number of visuals (in colour) should be a priority, since these types of teaching aids are generally not available in remote communities. One teacher expressed that they would have liked the students to learn about the sugar content of foods, given the high prevalence of diabetes in the community.

6.3.5.2 Parent Impressions

Forty-seven parents/guardians completed the questionnaire distributed at the community feast hosted at program completion. The community feast was well attended, with over 150 people signing the guestbook, and the event was enjoyed by all. Thirty-three (70%) of the parents said that they were aware that there was a nutrition program at their child's school; while, only twenty-four (51%) recalled receiving the handouts that were distributed to students to bring home to their parents, as the family component of the program. In terms of the information received, parents seemed generally satisfied; several noted that the information they received was "very helpful". Parents also made suggestions for types of information that they would like to have received. A common comment was that they would like to know how to include milk and alternatives into everyday meals, saying they would like "more recipes with milk and alternatives", "fun snack ideas and recipes", and "some recipes to try with the kids at home". Other comments described wanting to receive information on allergies and academic performance as related to milk and alternatives intake. Parents noted affordability and accessibility as the major barriers to milk and alternatives intake at home. Sixty-four percent of respondents said that milk amd alternatives are often too expensive, and 43% said that milk and alternatives were often not available at the store. Five respondents noted that they were unsure about how to prepare milk and alternatives, and one further noted that even when available, the milk and alternatives available at the store were not always fresh. When asked about what would help them most to serve more milk and alternatives at home, the overwhelming response was a decrease in prices to make milk and alternatives more affordable (milk is three to four times more expensive in northern Ontario as compared to southern Ontario). Parents who were aware of the program generally agreed that they would like it if the program could run again in the future, saying "it was an excellent program", "[it should run] all year round", and "the students deserve it".

6.4 Discussion

The current study explored the effect of a comprehensive nutrition education program on the intakes of milk and alternatives and their associated nutrients, as well as the knowledge, self-efficacy, and intentions towards adequate milk and alternatives intake among First Nations youth in Fort Albany, Ontario. Based on the reported findings, no change was seen in dietary intakes, but knowledge and intentions to consume adequate milk and alternatives improved over the course of the program. The program was well received by students, teachers, and parents.

The guidelines for successful school-based programs proposed by the US Centers for Disease Control and Prevention in 1996 were useful in planning the pilot program under study (CDC, 1996). According to this comprehensive framework, the school environment should be conducive to behavioural change in addition to providing nutrition education; the family and community should also be involved (CDC, 1996). A combination of these components has been found to be key to program success in a recent review of dietary change interventions (Sahay et al., 2006).

While the program framework was multifaceted, the lack of improvement in milk and alternatives, calcium, and vitamin D intakes over the study period may not entirely take into account the numerous barriers to adequate milk and alternatives consumption in the community. Even with a successful school snack program serving milk and alternatives daily, therefore contributing to student's intakes, being in place for several years, dietary intakes remain below CFG recommendations and lower than intakes seen in the general population for all but females aged 14-18 years. Food insecurity is prevalent in many First Nations; so, while healthy foods can be provided at school and children can ask their parents to provide them, a lack of availability and affordability was noted by parents in our study as major barriers to providing these foods on a regular basis at home. A 2006 study in Fort Albany, Ontario paralleled our observations; high cost and poor availability, quality, and variety of food items were noted as barriers to healthy eating (Skinner et al., 2006). The suboptimal intakes of milk and alternatives and associated nutrients clearly identified a need to attempt to improve upon the current situation. The results presented herein suggest that in order to be successful in improving the dietary intakes of the children and youth under study, major changes in the food environment experienced in Fort Albany are necessary. Until the people of this community are offered sufficient quantities of high quality, personally acceptable milk and alternatives or alternative calcium and vitamin D sources at affordable prices, any efforts made by programs such as the one described here are likely to encounter difficulty in successfully improving dietary intakes.

Despite the lack of significant improvement in intakes, students expressed excitement with the hands-on nature of many of the lessons included in the program and learned some valuable lessons. These types of lessons proved to be beneficial in terms of improving the students' knowledge and intentions regarding adequate milk and alternatives intake. In this situation, the participants' improved intentions have not been reflected in their intakes, likely because of the numerous barriers that they face when it comes to adequate intakes. . This suggests that if environmental constraints were removed, it is likely that informed students would choose to consume more milk and alternatives as their intentions improved from baseline. The lack of improvement in student self-efficacy may be related to the unsupportive food environment in which they live. Student self-efficacy is related to their confidence in their ability to improve their milk and alternatives intake, and the amount of family and community support they feel that they have to do so. With milk and alternatives being often unavailable and unaffordable, leading to adequate intake, it is understandable that self-efficacy would not have improved.

The program was generally well received, and should be seen as a first step towards potentially improving the intakes of milk and alternatives among youth in Fort Albany. The program demonstrated some success and is an example of what can be achieved in communities that have the personnel and resources to administer such a program. Teachers and parents were helpful in suggesting ways to address some of the current barriers to healthy eating. A greater level of community and family involvement, if combined with environmental change, may have the potential to address some of the barriers to healthy eating that were encountered, and would be recommended for future implementations of the program. Parents mentioned that a greater frequency of farmers markets that provide fair prices for healthy foods would help them to serve more milk and alternatives at home. The parents' request for recipes and the students' enjoyment of hands-on activities may suggest that cooking classes would be a way to improve intakes.

6.4.1 Limitations

Although not generalizable to all Canadian First Nations populations, the current study provides a description of the potential impacts of a comprehensive school-based nutrition education on knowledge and intentions towards milk and alternatives intake that may be useful to other remote First Nations. The limited sample size in the present study may have impacted our ability to detect significant changes in intakes and self-efficacy. The post-program WEB-Q took place nearing the end of the school year, and school attendance was poor. With respect to the WEB-Q, the 24-hr recall used has certain limitations, such as underreporting (Thompson & Byers, 1994; Johansson et al., 2001). The WEB-Q uses realistic 3-D images and unique user identification numbers and passwords to overcome problems of portion estimation and social desirability bias. Use of the United States Department of Agriculture (USDA) Automated Multiple-Pass Approach (AMPM), which is mimicked in the WEB-Q, has been found to improve accuracy at a group level (Moshfegh et al., 2008; Blanton et al., 2006). While the 24-hour recall does not allow for generalizations about an individual's intake, it is useful in measuring the average intakes of groups (Thompson & Byers, 1994). With respect to the KSIQ, the adaptation from the questionnaire used in the Pro Children project had not been pre-tested or validated in the study population prior to its use in the current study. However, pre-testing with the snack program coordinator prior to its use meant that questionnaire was likely to be culturally appropriate.

6.5 Conclusions and Implications for Research and Practice

In summary, the findings from the current research bring insight into developing and initiating comprehensive school-based nutrition interventions in remote First Nations communities. Prior to initiating such a program, necessary supports such as staff, time, funding, and facilities must be in place in order to improve sustainability and program impact. In many First Nations communities these circumstances do not exist. Realistic outcome expectations should be established prior to program initiation in light of existing barriers. Barriers encountered in this research included high food prices and the lack of availability of healthy foods. In cases such as this, significant changes in diet should not be expected until these barriers have been addressed. We have seen here that comprehensive programs will likely need to involve extensive family and community components in order to achieve success in the realm of dietary change. Community participation in program development and implementation can provide important insight into existing barriers and ways that these can be overcome. Comprehensive programs are likely a step in the right direction, but environmental constraints to healthy diets that exist beyond school need to be addressed concurrently in order to achieve measurable success.

7.0 Chapter 7: Overall Conclusions and Future Directions

The present findings are of great value to the communities under study and others, as this data is the first of its kind for this population. Most population surveys addressing nutrition in Canada do not include on-reserve First Nations populations, so the data presented here represent a first view of the situation that exists among on – reserve First Nations populations on the western coast of James Bay and Hudson Bay, northern Ontario, Canada. Studies including on-reserve First Nations populations in Ontario are rare, but data is available from the Sandy Lake region (Hanley, Harris, Gittelsohn, Wolever, Saksvig, Zinman, 2000), and from Cree communities on the Eastern coast of James Bay (Quebec). The information obtained from the current study is likely of value to the communities involved, as it has described the degree of dietary inadequacies seen in today's youth. The dietary information revealed in this study, combined with visits to the various communities, provided the impetus for the pilot school nutrition programs that have been described in this thesis. This is of further value to the communities involved, as the first steps towards possible solutions to the current situation have been successful in improving intakes, knowledge, and intentions in certain cases.

A low intake of milk and alternatives, calcium and vitamin D was found for the complete sample of youth residing in the remote, northern communities of the Mushkegowuk territory, along with Georgina Island and Christian Island, two southern Ontario First Nations communities. Mean intakes of milk and alternatives were below the minimum recommended intake from CFG, where females aged 14-18 had the poorest intakes with mean (SD) intakes of only 1.49 (1.29) servings per day, less than half of what is recommended. Males aged 14-18 came closest to meeting recommendations, at 2.47 (2.09) servings daily. This suboptimal intake is consistent with other studies of Canadian First Nations populations. Mean intakes also fell below mean intakes of youth in the general population, and the trends in intake were similar to those seen in the general Canadian population, where males aged 14-18 tend to have the highest intakes (2.64 servings) and females aged 14-18 have the poorest intakes (1.82 servings). As with the First Nations population studied, as a whole youth in Canada fail to meet the minimum recommendations of Canada's Food Guide for milk and alternatives. Of males in the current study, 77% fail to meet recommendations, as compared to 61% in the general population (Garriguet, 2004). Females parallel the general population very closely, 84% in this study fail to meet CFG recommendations, as compared to 83% in the general population (Garriguet, 2004). A closer look at the data shows a shocking proportion of First Nations youth who consume virtually no milk and alternatives at all. Thirty percent of males consumed less than one serving per day, with 12% of those consuming none at all. Among females, 36% consumed less than one serving daily, with 14% consuming none at all. With this, it is not surprising that intakes of calcium and vitamin D in the current study were quite low. While the AI impedes the ability to make statements regarding adequacy, it is notable that both males and females had a high prevalence of individuals with calcium intakes below the AI. For males, 87% of those aged 9-13 and 75% of those aged 14-18 had intakes below the AI (median intakes of 673 and 903 mg, respectively). For females, 87% of those aged 9-13 had calcium intakes below the AI, while almost all of those aged 14-18 had intakes below the AI (98%) (median intakes of 609 and 596 mg, respectively). This same trend is seen among youth in the general population, where median intakes are reported to fall below the AI for the population as a whole (aged 9-18 years) (Health Canada, 2009c). Looking at vitamin D, in all age categories except males aged 14-18 years, intakes fell below the AI for at least 70% of the population. This is in contrast to what is seen in the general population where the prevalence of intakes below the AI is low, except for females aged 14-18 (Health Canada, 2009c). This trend was not seen in the current study. It is important to note that between 2003 and 2010 (regardless of season, community, and year) in no case did mean intakes of milk and alternatives meet recommendations, nor did intakes of calcium or vitamin D ever meet or exceed the AI. The inadequate intakes documented were consistent over time. As a whole, it can be seen that in the current study, intakes of calcium and vitamin D parallel the intakes of milk and alternatives. Milk and alternatives, calcium, and vitamin D intakes were all highest for males aged 14-18 and lowest for females in the same age category. This is suggestive that for the First Nations population in this study, milk and alternatives are the dominant source of calcium and vitamin D, thus milk and alternatives are a logical target when attempting to make improvements to calcium and vitamin D intakes.

A high prevalence of overweight and obesity was seen in the current study, once again beyond the prevalence seen in the general population (Sheilds, 2005). Overall population prevalence of overweight and obesity in the First Nations youth in this study was 52%, more than one and a half times the prevalence of 29% for youth aged 12-17 in the general Canadian population (Sheilds, 2005). This clearly emphasizes the severity of the current problem. Sheilds (2005) reports an average BMI of 22.1 kg/m^2 in the general population, where data from this study note a mean BMI that is only slightly higher at 23.2 kg/m^2, although our small sample of youth from Peawanuck had an average BMI of 26.6. The prevalence of overweight and obesity seen in this study also exceeds the prevalence of 41% that is seen in the off-reserve Canadian Aboriginal population by 11% (Sheilds, 2005). Within this, 20% of off-reserve Canadian Aboriginal youth aged 12-17 are said to be obese, which is 2.5 times the rate seen in the general population; this is a statistic that holds true even after adjustment for socioeconomic factors (Sheilds, 2005). This study also found an obesity prevalence of 20%. However, of interest is the fact that Sheilds (2005) reports the prevalence of overweight and obesity by self-report in 2003 compared to those calculated by directly measured height and weight in 2004. Here, the directly measured data revealed overweight and obesity rates that were 7% higher for girls and 11% higher for boys as compared to the self-reported data (Sheilds, 2005). The current study uses self-reported data, so it is possible that the prevalence of overweight and obesity is underestimated. Unlike some other studies, the current data did not support the relationship between milk and alternatives intake and body mass index (Barba et al., 2005; Heaney, 2003; Teergarden, 2003). Nor was a relationship found between calcium or vitamin D and BMI. A small sample size may have limited the power to detect this relationship, or it is possible that such a relationship does not exist in the Aboriginal population. Still, the summary of the current findings does note low intakes of milk and alternatives, calcium, and vitamin D with a concurrent high prevalence of overweight and obesity. Further research in this area is needed to clarify the relationship between milk and alternatives intake and BMI in aboriginal youth. Further, future study looking at waist circumference may give a better measure of the possible link between milk and alternatives intake and adiposity in this population.

In agreement with our hypotheses, a yearly and latitudinal association for milk and alternatives, calcium, and vitamin D intakes among Ontario First Nations communities was detected. The latitudinal effects detected were unexpected in that they did not concur with the literature which states that less isolated and more southern communities are less likely to consume traditional foods, and therefore consuming a greater proportion of market foods (Kuhnlein et al., 2001; Receveur et al., 1997). In the current study, in two of the cases where latitudinal variation was detected, it was the more northern and isolated community (Fort Albany) that had the higher intakes of milk and alternatives, calcium, and vitamin D. Here, a well-run snack program that has been in existence for more than two decades may be a contributing factor to the higher intakes in Fort Albany. Perhaps this snack program allowed for students to overcome community barriers to milk and alternatives intake; because even if these foods were not available or affordable at the store, they would be provided for free at the school. This suggests that snack programs can be such a valuable resource to youth living in remote communities where acceptable fresh foods might not often be available.

The poor milk and alternatives intakes noted in the current study suggest the need for community-based approaches to address the problem. School nutrition programs might be a next step. As seen in Kashechewan and Attawapiskat, under close-to-ideal circumstances, simple food provision programs can be successful in improving intakes of milk and alternatives among First Nations youth. Unfortunately, these ideal circumstances often do not always exist in northern, remote First Nations communities. Numerous barriers exist that must be overcome to be able to implement such programs, and a dedicated leader is essential. Further, community level barriers including high food prices and lack of availability mean that changing overall dietary habits is a challenge that remains difficult to overcome. For example, in February 2010 in Fort Albany, Ontario, 2L of milk cost $7.95, 650g of yogurt ranged from $5.99 to $13.39, and 300g of mozzarella cheese cost $8.39. The variety available was limited, and when visiting Kashechewan during the same time period there was no milk available for purchase. Note that the winter ice road was open at this time, and prices are likely to be higher when the road is closed. These community-level barriers are consistent with those described by Skinner et al. (2006) in Fort Albany, Ontario. When initiating the snack program in Kashechewan, many of the students had never tried yogurt (and yogurt tubes) or cheese (and cheese strings) before; but when given the chance to try these products they did enjoy them. Students enjoyed chocolate milk but this was unavailable at the store at the time of our price analysis. These choices are viable and acceptable sources of milk and alternatives for youth if they can be supplied, seeing as acquiring them can be challenging for individual families. The benefits of such programs mustn't be overlooked, and the principal, teachers, and students all showed great appreciation for the snack programs initiated in their community.

In communities where greater resources exist, the initiation of more comprehensive, multi-faceted school programs may be useful in improving the knowledge, intentions, and self-efficacy of youth towards adequate milk and alternatives intake. Unfortunately, in this study, such a program in Fort Albany, Ontario, did not lead to improvements in dietary intake of milk and alternatives. This is likely attributable to overriding factors including the lack of availability and high cost of healthy foods in the community. Indeed, many parents noted the high prices, lack of availability, and poor quality of milk and alternatives as major barriers to adequate intakes. Also, the post-program survey had a very small sample size (n=10), due to very low school attendance, which was beyond our control. This hindered our ability to detect changes in intakes over time. However, feedback about the program was overwhelmingly positive, and the program did lead to improvements in knowledge and intentions. This means that, presented with closer to ideal circumstances, the youth involved would be equipped with the skills to make better choices. The community variability in intakes seen in Chapter 4 supports the need for community level approaches that are individualized to meet the specific needs of each community. Unlike Fort Albany, the majority of the communities studied do not benefit from a dedicated school snack program volunteer coordinator, a relatively newly built school with a full kitchen, adequate and sustained funding, etc. Moreover, data from Chapter 4 indicate that the need may be greater in other communities where the intakes of milk and alternatives are poorer. Beyond school nutrition programs, one parent in Fort Albany suggested that regularly scheduled farmers markets would be a good solution, as it makes healthy foods available at fair prices. Other solutions could include government subsidies for healthy foods (this was suggested by a parent in the school program impressions survey in Fort Albany). It is unfortunate that the situation in Canada means that school nutrition programs are not universal and therefore fail to meet the needs of remote communities where, as demonstrated in Chapter 4, the situation is even more concerning than what is seen in the general population. Communities are reliant on often unreliable sources of funding and community volunteers in times when individual communities typically have many other problems that are equally deserving of special attention. In the current study, results from Chapter 5 have been used to apply for snack program funding, and will continue to be used in future funding applications.

In the context of school nutrition programs, in the future, similar comprehensive programs with a greater emphasis on community and family involvement may prove to be more successful. In the current study, the community feast hosted as part of the comprehensive school nutrition program in Fort Albany was very successful, with more than 150 community members in attendance. While it was labour intensive, it was a good way to allow the community to feel involved, get feedback from parents, and to spread messages about healthy eating. However, to make a significant impact on the eating habits of First Nations youth in the remote communities in this study, it seems that substantial community barriers such as price and availability of healthy foods would need to be addressed. In Fort Albany, Farmers Markets have been a way to supply community members with fresh, healthy foods at fair prices. However, family involvement could be improved in the future, as only half of the parents who offered feedback recalled receiving any of the handouts about milk and alternatives that were sent home. Parents who answered the questionnaire noted that they would like to learn more about cooking with milk and alternatives, so in the future cooking classes or other interactive, hands-on activities may be more useful than the approach used in the current study.

Most importantly, when implementing such programs, outcome expectations should be realistic in terms of logistical barriers that exist. Overall, the pilot programs investigated in the study represent a first attempt at school programs to improve the dietary intakes among on-reserve First Nations youth in the communities under study. The information found will be useful to the communities for future programs such as the ones piloted in this study. Sustainability of such programs remains a concern, mainly due to logistical barriers including the availability of dedicated personnel, time constraints, availability of food items, and the high cost of operating such programs in the north. While this type of research is of importance because it adds to the literature on school programs in remote First Nations, it is also important that these communities be left with the resources to continue these programs on their own. Unfortunately, this is often difficult, and with numerous other concerns throughout the schools and the community, the resources do not always exist to continue such programs. However, since the research included some participatory approaches by including community members, and seeing the enthusiasm of teachers at the schools involved, it is hoped that those involved will be sufficiently empowered to continue the programs in the long-term.

In terms of future directions, Willows (2005a) has described some of the gaps that exist in Aboriginal dietary knowledge in Canada. We continue to know little about food insecurity and how it affects food selection in Aboriginal communities, seeing as culturally appropriate measurement tools for food insecurity do not yet exist (Willows, 2005a). It would also be useful to look at the usefulness of store policies regarding the sale of healthy foods on the diets of individuals in specific communities. This would be a useful approach to attempting to overcome the barrier of high prices and lack of availability of healthy foods in remote communities. If it could be proven that people would purchase these foods if they were sold in acceptable conditions and affordable prices, it is possible that stores would stock these foods and diets could improve. It would be of interest to look at the knowledge of contamination of traditional food sources, how this impacts on diet, and to look at weighing the pros and cons of traditional food consumption given levels of contamination versus nutritional benefit (Willows, 2005a). This knowledge would be of use when implementing healthy eating initiatives, as we know that traditional diets tend to be healthier, but recommendations cannot be made if we are not sure about the safety of these foods. Within the datasets used for the current study, there remains a large quantity of data that has yet to be analyzed. It would be of interest to look at physical activity patterns and how they relate to obesity or dietary intake of various nutrients. It would further be of interest to look at concepts such as body image and how it relates to diet and physical activity, since it is known that in some Aboriginal communities obesity is seen as a positive attribute.

Overall, the current research reveals important new information about the eating habits and weight status of youth living on-reserve in First Nations communities in northern and southern Ontario, Canada. The involved communities are in need of information about the determinants of healthy eating in their communities and how these interact, so that they can act to create initiatives for health improvement. We have demonstrated that school nutrition programs can have some positive impacts on the eating habits, knowledge, and intentions of First Nations youth; but numerous barriers to healthy eating and sustainability of such initiatives were also encountered. The knowledge of these barriers is an important first step to developing strategies to overcome them. It is unfortunate that the situation in Canada means that Aboriginal people are not offered equal access to health services and have been left with few resources to improve the current situation. In the future, it is hoped that in partnership with individual communities, more viable and sustainable strategies to improving the diets and overall health of individuals living in First Nations communities can be devised. While there is a long way to go, it is through this kind of participatory research that individual communities will be empowered to take positive steps towards healthier lifestyles.

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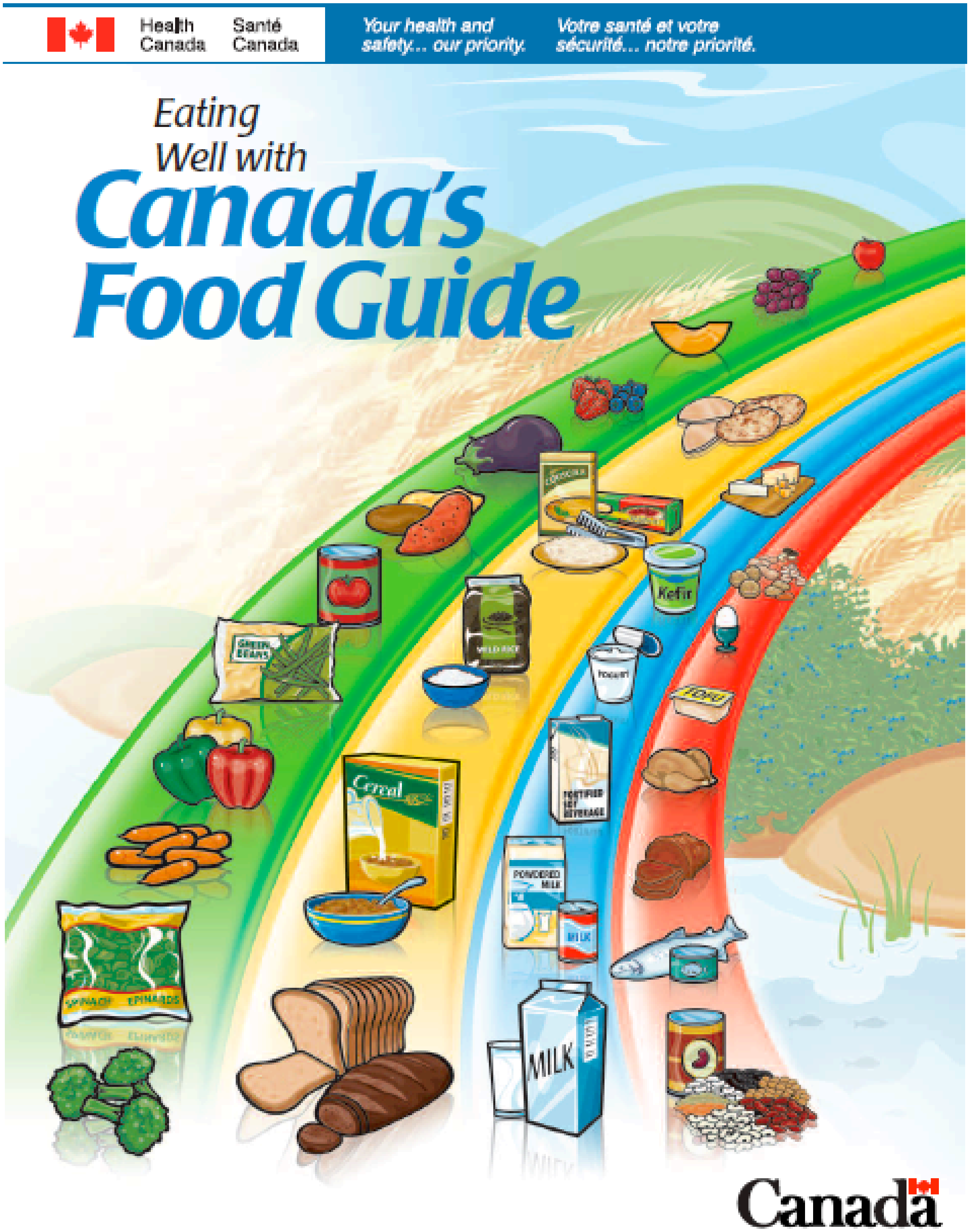
Appendices

Appendix A: Eating Well with Canada's Food Guide

Eating Well with Canada's Food Guide (2007)



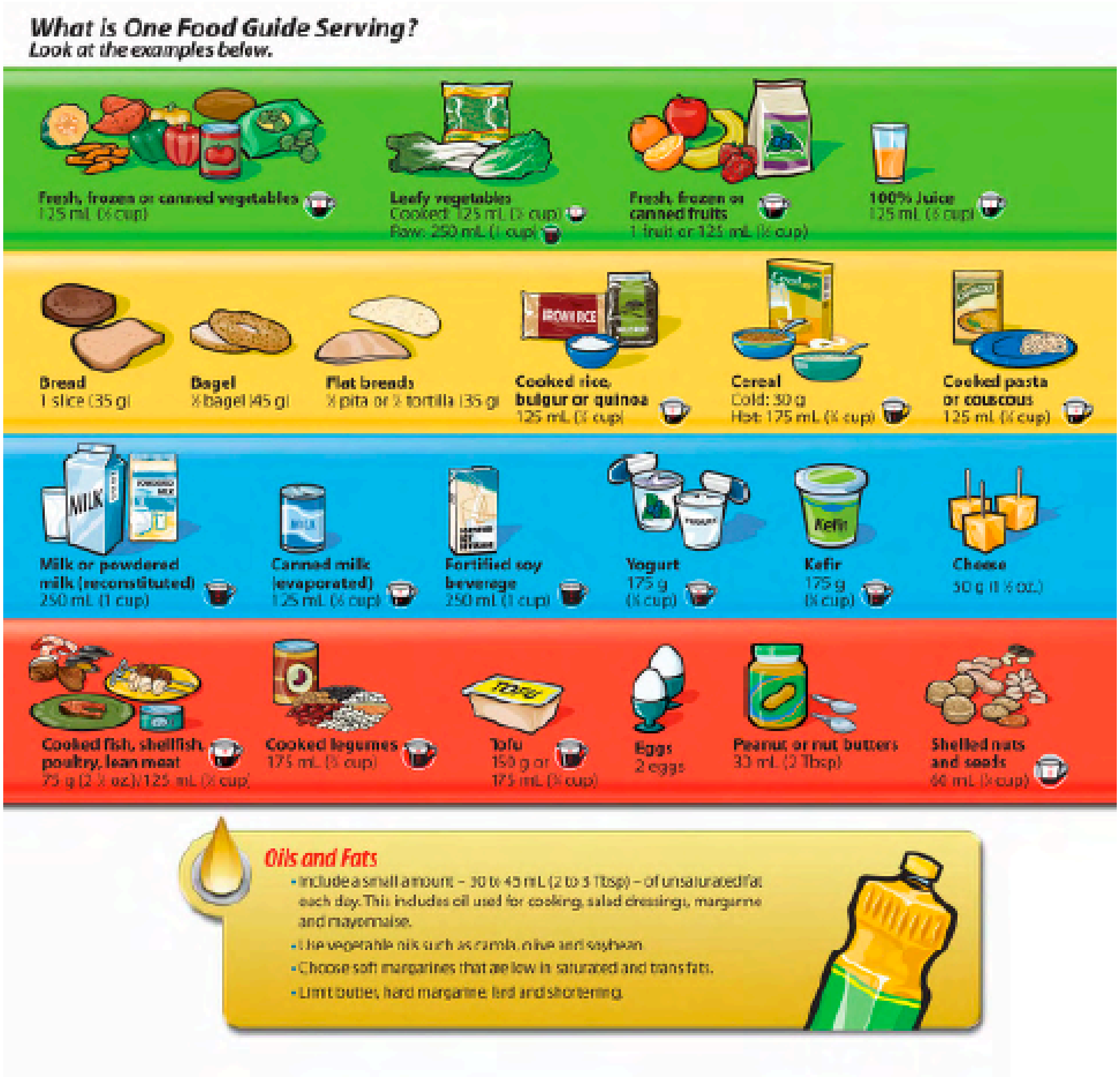
Recommended Number of Food Guide Servings per Day

	Children			Teens		Adults			
Age in Years	2-3	4-8	9-13	14-18		19-50		51+	
Sex	Girls and Boys			Females	Males	Females	Males	Females	Males
Vegetables and Fruit	4	5	6	7	8	7-8	8-10	7	7
Grain Products	3	4	6	6	7	6-7	8	6	7
Milk and Alternatives	2	2	3-4	3-4	3-4	2	2	3	3
Meat and Alternatives	1	1	1-2	2	3	2	3	2	3

The chart above shows how many Food Guide Servings you need from each of the four food groups every day.

Having the amount and type of food recommended and following the tips in *Canada's Food Guide* will help:

- Meet your needs for vitamins, minerals and other nutrients.
- Reduce your risk of obesity, type 2 diabetes, heart disease, certain types of cancer and osteoporosis.
- Contribute to your overall health and vitality.



What is One Food Guide Serving?
Look at the examples below.
Fresh, frozen or canned vegetables
125 mL (½ cup)
Leafy vegetables
Cooked: 125 mL (½ cup)
Raw: 250 mL (1 cup)
Fresh, frozen or canned fruits
1 fruit or 125 mL (½ cup)
100% Juice
125 mL (½ cup)
Bread
1 slice (35 g)
Bagel
½ bagel (45 g)
Flat breads
½ pita or ½ tortilla (35 g)
Cooked rice, bulgur or quinoa
125 mL (½ cup)
Cereal
Cold: 30 g
Hot: 175 mL (¾ cup)
Cooked pasta or couscous
125 mL (½ cup)
Milk or powdered milk (reconstituted)
250 mL (1 cup)
Canned milk (evaporated)
125 mL (½ cup)
Fortified soy beverage
250 mL (1 cup)
Yogurt
175 g (¾ cup)
Kefir
175 g (¾ cup)
Cheese
50 g (1 ½ oz.)
Cooked fish, shellfish, poultry, lean meat
75 g (2 ½ oz.)/125 mL (½ cup)
Cooked legumes
175 mL (¾ cup)
Tofu
150 g or 175 mL (¾ cup)
Eggs
2 eggs
Peanut or nut butters
30 mL (2 Tbsp)
Shelled nuts and seeds
60 mL (¼ cup)
Oils and Fats
• Include a small amount – 30 to 45 mL (2 to 3 Tbsp) – of unsaturated fat each day. This includes oil used for cooking, salad dressings, margarine and mayonnaise.
• Use vegetable oils such as canola, olive and soybean.
• Choose soft margarines that are low in saturated and trans fats.
• Limit butter, hard margarine, lard and shortening.

Make each Food Guide Serving count…
wherever you are – at home, at school, at work or when eating out!

- **Eat at least one dark green and one orange vegetable each day.**
  - Go for dark green vegetables such as broccoli, romaine lettuce and spinach.
  - Go for orange vegetables such as carrots, sweet potatoes and winter squash.
- **Choose vegetables and fruit prepared with little or no added fat, sugar or salt.**
  - Enjoy vegetables steamed, baked or stir-fried instead of deep-fried.
- **Have vegetables and fruit more often than juice.**

- **Make at least half of your grain products whole grain each day.**
  - Eat a variety of whole grains such as barley, brown rice, oats, quinoa and wild rice.
  - Enjoy whole grain breads, oatmeal or whole wheat pasta.
- **Choose grain products that are lower in fat, sugar or salt.**
  - Compare the Nutrition Facts table on labels to make wise choices.
  - Enjoy the true taste of grain products. When adding sauces or spreads, use small amounts.

- **Drink skim, 1%, or 2% milk each day.**
  - Have 500 mL (2 cups) of milk every day for adequate vitamin D.
  - Drink fortified soy beverages if you do not drink milk.
- **Select lower fat milk alternatives.**
  - Compare the Nutrition Facts table on yogurts or cheeses to make wise choices.

- **Have meat alternatives such as beans, lentils and tofu often.**
- **Eat at least two Food Guide Servings of fish each week.***
  - Choose fish such as char, herring, mackerel, salmon, sardines and trout.
- **Select lean meat and alternatives prepared with little or no added fat or salt.**
  - Trim the visible fat from meats. Remove the skin on poultry.
  - Use cooking methods such as roasting, baking or poaching that require little or no added fat.
  - If you eat luncheon meats, sausages or prepackaged meats, choose those lower in salt (sodium) and fat.

Enjoy a variety of foods from the four food groups.

Satisfy your thirst with water!

Drink water regularly. It's a calorie-free way to quench your thirst. Drink more water in hot weather or when you are very active.

* Health Canada provides advice for limiting exposure to mercury from certain types of fish. Refer to www.healthcanada.gc.ca for the latest information.

Advice for different ages and stages...

Children

Following *Canada's Food Guide* helps children grow and thrive.

Young children have small appetites and need calories for growth and development.

- Serve small nutritious meals and snacks each day.
- Do not restrict nutritious foods because of their fat content. Offer a variety of foods from the four food groups.
- Most of all... be a good role model.

Women of childbearing age

All women who could become pregnant and those who are pregnant or breastfeeding need a multivitamin containing **folic acid** every day. Pregnant women need to ensure that their multivitamin also contains **iron**. A health care professional can help you find the multivitamin that's right for you.

Pregnant and breastfeeding women need more calories. Include an extra 2 to 3 Food Guide Servings each day.

Here are two examples:

- Have fruit and yogurt for a snack, or
- Have an extra slice of toast at breakfast and an extra glass of milk at supper.

Men and women over 50

The need for **vitamin D** increases after the age of 50.

In addition to following *Canada's Food Guide*, everyone over the age of 50 should take a daily vitamin D supplement of 10 μg (400 IU).

How do I count Food Guide Servings in a meal?

Here is an example:

Vegetable and beef stir-fry with rice, a glass of milk and an apple for dessert		
250 mL (1 cup) mixed broccoli, carrot and sweet red pepper	=	2 **Vegetables and Fruit** Food Guide Servings
75 g (2 ½ oz.) lean beef	=	1 **Meat and Alternatives** Food Guide Serving
250 mL (1 cup) brown rice	=	2 **Grain Products** Food Guide Servings
5 mL (1 tsp) canola oil	=	part of your **Oils and Fats** intake for the day
250 mL (1 cup) 1% milk	=	1 **Milk and Alternatives** Food Guide Serving
1 apple	=	1 **Vegetables and Fruit** Food Guide Serving

Eat well and be active today and every day!

The benefits of eating well and being active include:

- Better overall health.
- Lower risk of disease.
- A healthy body weight.
- Feeling and looking better.
- More energy.
- Stronger muscles and bones.

Be active

To be active every day is a step towards better health and a healthy body weight.

Canada's Physical Activity Guide recommends building 30 to 60 minutes of moderate physical activity into daily life for adults and at least 90 minutes a day for children and youth. You don't have to do it all at once. Add it up in periods of at least 10 minutes at a time for adults and five minutes at a time for children and youth.

Start slowly and build up.

Eat well

Another important step towards better health and a healthy body weight is to follow *Canada's Food Guide* by:

- Eating the recommended amount and type of food each day.
- Limiting foods and beverages high in calories, fat, sugar or salt (sodium) such as cakes and pastries, chocolate and candies, cookies and granola bars, doughnuts and muffins, ice cream and frozen desserts, french fries, potato chips, nachos and other salty snacks, alcohol, fruit flavoured drinks, soft drinks, sports and energy drinks, and sweetened hot or cold drinks.

Read the label

- Compare the Nutrition Facts table on food labels to choose products that contain less fat, saturated fat, trans fat, sugar and sodium.
- Keep in mind that the calories and nutrients listed are for the amount of food found at the top of the Nutrition Facts table.

Nutrition Facts
Per 0 mL (0 g)

Amount			% Daily Value
Calories 0			
Fat 0 g			0 %
Saturates 0 g			0 %
+ Trans 0 g			
Cholesterol 0 mg			
Sodium 0 mg			0 %
Carbohydrate 0 g			0 %
Fibre 0 g			0 %
Sugars 0 g			
Protein 0 g			
Vitamin A	0 %	Vitamin C	0 %
Calcium	0 %	Iron	0 %

Limit trans fat

When a Nutrition Facts table is not available, ask for nutrition information to choose foods lower in trans and saturated fats.

Take a step today…

- ✓ Have breakfast every day. It may help control your hunger later in the day.
- ✓ Walk wherever you can – get off the bus early, use the stairs.
- ✓ Benefit from eating vegetables and fruit at all meals and as snacks.
- ✓ Spend less time being inactive such as watching TV or playing computer games.
- ✓ Request nutrition information about menu items when eating out to help you make healthier choices.
- ✓ Enjoy eating with family and friends!
- ✓ Take time to eat and savour every bite!

For more information, interactive tools, or additional copies visit Canada's Food Guide on-line at:
www.healthcanada.gc.ca/foodguide

or contact:

Publications
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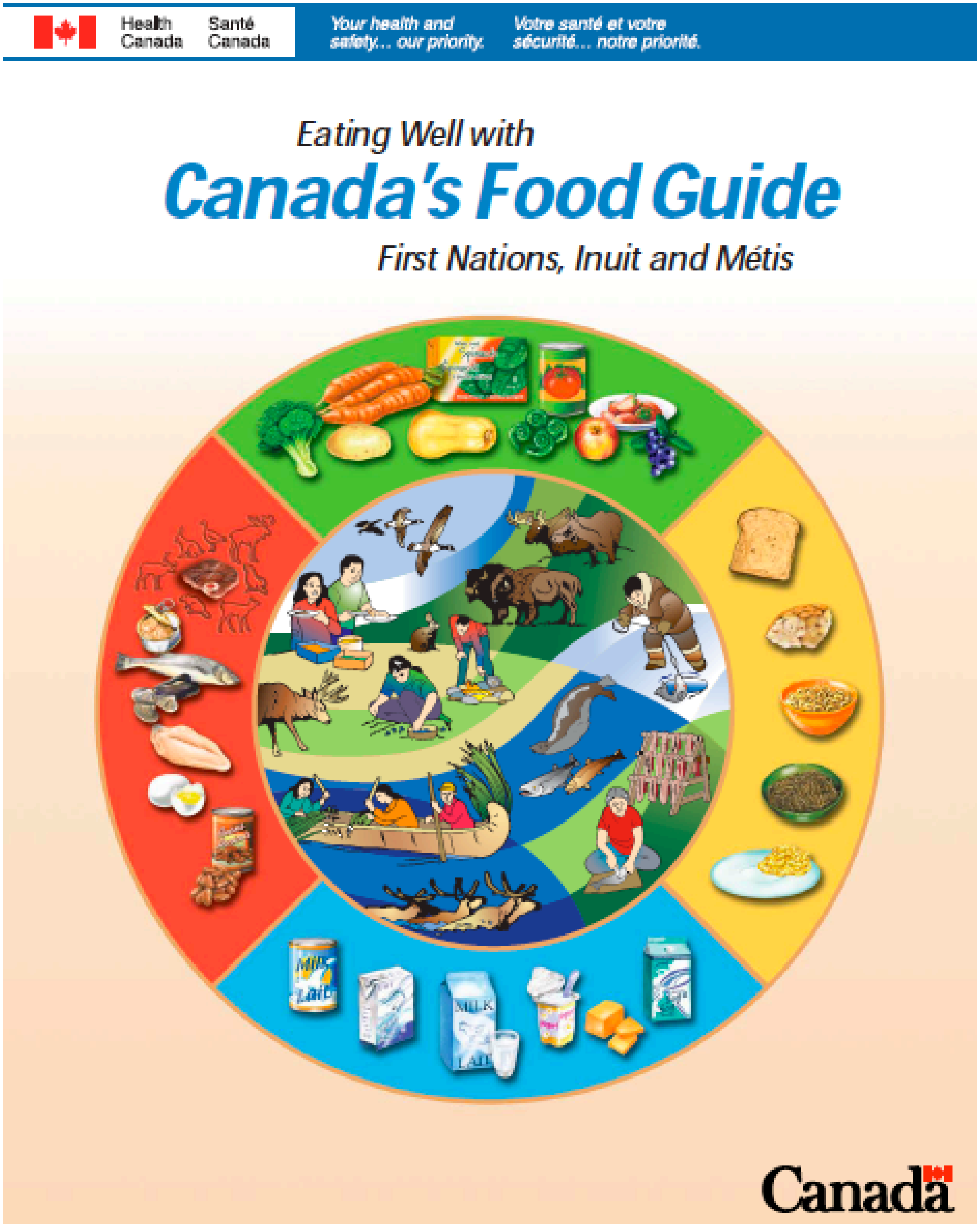
TTY: 1-800-267-1245

Également disponible en français sous le titre : *Bien manger avec le Guide alimentaire canadien*

This publication can be made available on request on diskette, large print, audio-cassette and braille.

HC Pub.: 4651 Cat.: H164-38/1-2007E ISBN: 0-662-44467-1

Canada's Food Guide for First Nations, Inuit, and Métis



How to use Canada's Food Guide

The Food Guide shows how many servings to choose from each food group every day and how much food makes a serving.

1. Find your age and sex group in the chart below.
2. Follow down the column to the number of servings you need for each of the four food groups every day.
3. Look at the examples of the amount of food that counts as one serving. For instance, 125 mL (1/2 cup) of carrots is one serving in the Vegetables and Fruit food group.

What is one Food Guide Serving?

Look at the examples below.

Eating Well Every Day

Canada's Food Guide describes healthy eating for Canadians two years of age or older. Choosing the amount and type of food recommended in Canada's Food Guide will help:

- children and teens grow and thrive
- meet your needs for vitamins, minerals and other nutrients
- lower your risk of obesity, type 2 diabetes, heart disease, certain types of cancer and osteoporosis (weak and brittle bones).

Recommended Number of Food Guide Servings per day

	Children 2-3 years old	Children 4-13 years old	Teens and Adults (Females)	Teens and Adults (Males)
Vegetables and Fruit (Fresh, frozen and canned.)	4	5-6	7-8	7-10
Grain Products	3	4-6	6-7	7-8
Milk and Alternatives	2	2-4	Teens 3-4 Adults (19-50 years) 2 Adults (51+ years) 3	Teens 3-4 Adults (19-50 years) 2 Adults (51+ years) 3
Meat and Alternatives	1	1-2	2	3

Vegetables and Fruit

Eat at least one dark green and one orange vegetable each day. Choose vegetables and fruit prepared with little or no added fat, sugar or salt. Have vegetables and fruit more often than juice.

Dark green and orange vegetables 125 mL (1/2 cup)
Other vegetables 125 mL (1/2 cup)
Leafy vegetables and wild plants: cooked 125 mL (1/2 cup), raw 250 mL (1 cup)
Berries 125 mL (1/2 cup)
Fruit 1 fruit or 125 mL (1/2 cup)
100% Juice 125 mL (1/2 cup)

Grain Products

Make at least half of your grain products whole grain each day. Choose grain products that are lower in fat, sugar or salt.

Bread 1 slice (35 g)
Bannock 35 g (2" x 2" x 1")
Cold cereal 30 g (see food package)
Hot cereal 175 mL (3/4 cup)
Cooked pasta 125 mL (1/2 cup)
Cooked rice: White, brown, wild 125 mL (1/2 cup)

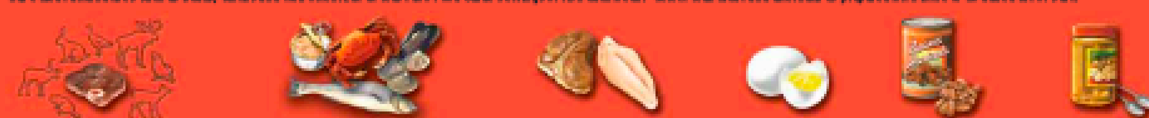
Milk and Alternatives

Drink 500 mL (2 cups) of skim, 1% or 2% milk each day. Select lower fat milk alternatives. Drink fortified soy beverages if you do not drink milk.

Milk, Powdered milk, mixed 250 mL (1 cup)
Fortified soy beverage 250 mL (1 cup)
Canned milk (evaporated) 125 mL (1/2 cup)
Yogurt 175 g (3/4 cup)
Cheese 50 g (1 1/2 oz.)

Meat and Alternatives

Have meat alternatives such as beans, lentils and tofu often. Eat at least two Food Guide Servings of fish each week.* Select lean meat and alternatives prepared with little or no added fat or salt.



Traditional meats and wild game 75 g cooked (2 1/2 oz.)/125 mL (1/2 cup)
Fish and shellfish 75 g cooked (2 1/2 oz.)/125 mL (1/2 cup)
Lean meat and poultry 75 g cooked (2 1/2 oz.)/125 mL (1/2 cup)
Eggs 2 eggs
Beans – cooked 175 mL (3/4 cup)
Peanut butter 30 mL (2 Tbsp)

When cooking or adding fat to food:

- Most of the time, use vegetable oils with unsaturated fats. These include canola, olive and soybean oils.
- Aim for a small amount (2 to 3 tablespoons or about 30-45 mL) each day. This amount includes oil used for cooking, salad dressings, margarine and mayonnaise.
- Traditional fats that are liquid at room temperature, such as seal and whale oil, or oolligan grease, also contain unsaturated fats. They can be used as all or part of the 2-3 tablespoons of unsaturated fats recommended per day.
- Choose soft margarines that are low in saturated and trans fats.
- Limit butter, hard margarine, lard, shortening and bacon fat.

*Health Canada provides advice for limiting exposure to mercury from certain types of fish. Refer to www.healthcanada.gc.ca for the latest information. Consult local, provincial or territorial governments for information about eating locally caught fish.

Respect your body... Your choices matter

Following Canada's Food Guide and limiting foods and drinks which contain a lot of calories, fat, sugar or salt are important ways to respect your body. Examples of foods and drinks to limit are:

- pop
- fruit flavoured drinks
- sweet drinks made from crystals
- sports and energy drinks
- candy and chocolate
- cakes, pastries, doughnuts and muffins
- granola bars and cookies
- ice cream and frozen desserts
- potato chips
- nachos and other salty snacks
- french fries
- alcohol

People who do not eat or drink milk products must plan carefully to make sure they get enough nutrients.

The traditional foods pictured here are examples of how people got, and continue to get, nutrients found in milk products. Since traditional foods are not eaten as much as in the past, people may not get these nutrients in the amounts needed for health.

People who do not eat or drink milk products need more individual advice from a health care provider.

Women of childbearing age

All women who could become pregnant, and pregnant and breastfeeding women, need a multivitamin with folic acid every day. Pregnant women should make sure that their multivitamin also contains iron. A health care provider can help you find the multivitamin that is right for you.

When pregnant and breastfeeding, women need to eat a little more. They should include an extra 2 to 3 Food Guide Servings from any of the food groups each day.

For example:

- have dry meat or fish and a small piece of bannock for a snack, or
- have an extra slice of toast at breakfast and an extra piece of cheese at lunch.

Women and men over the age of 50

The need for vitamin D increases after the age of 50.

In addition to following Canada's Food Guide, men and women over the age of 50 should take a daily vitamin D supplement of 10 μg (400 IU).

For strong body, mind and spirit, be active every day.

This guide is based on *Eating Well with Canada's Food Guide.*

For more information, interactive tools or additional copies visit Canada's Food Guide at: www.healthcanada.gc.ca/foodguide

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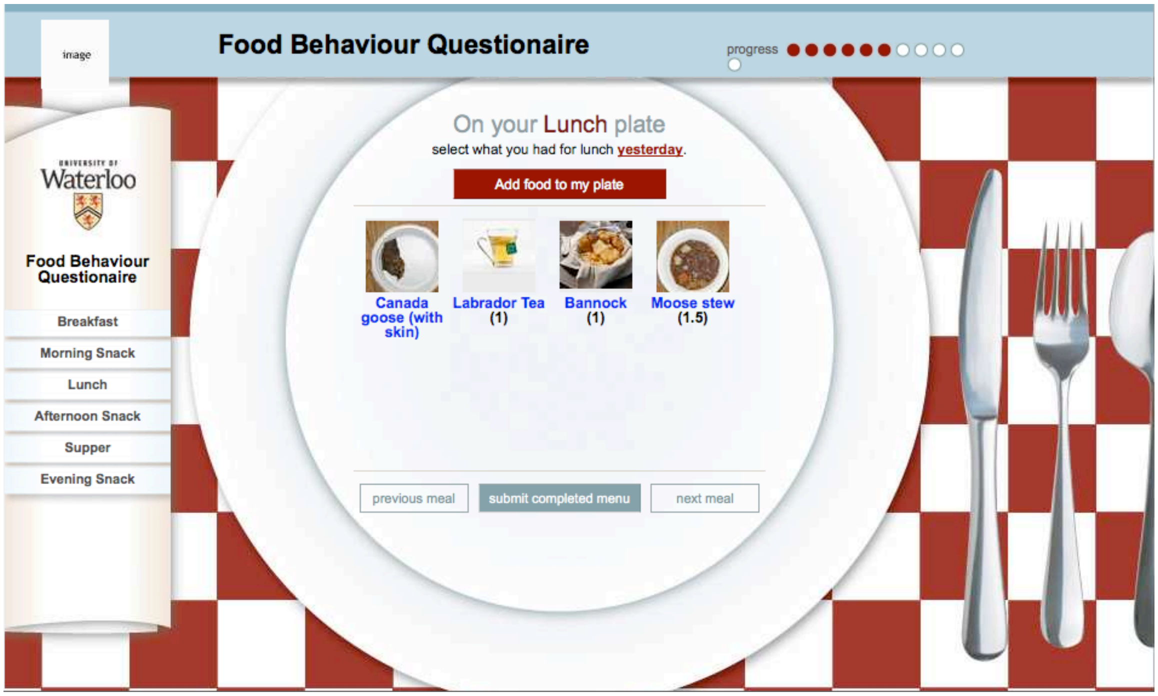
Appendix B: Questionnaires

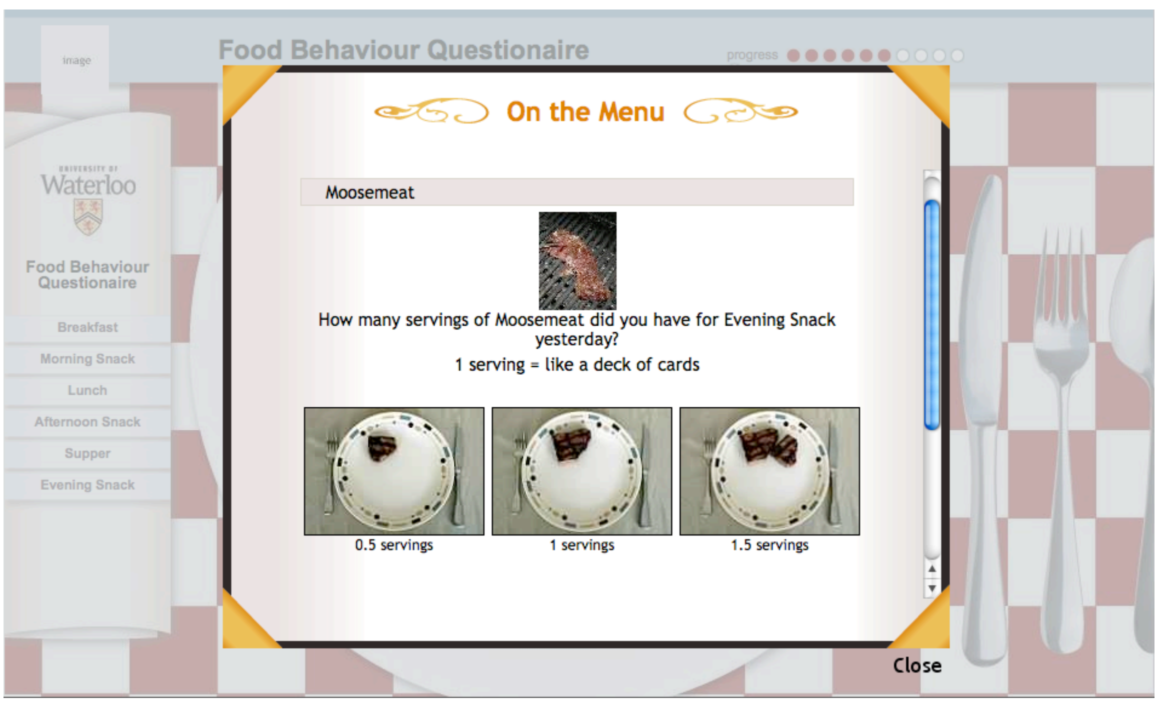
Web-based Eating Behaviour Questionnaire

Questionnaire screenshot – traditional foods on plate in the 24-hour recall

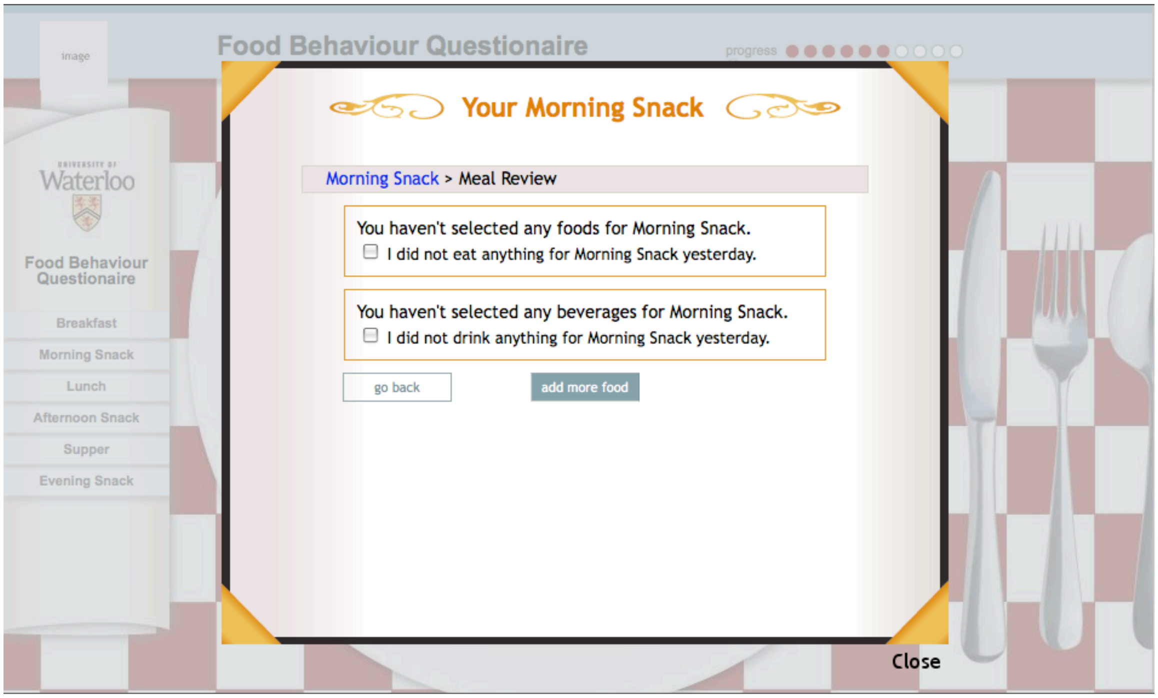


Questionnaire screenshot – selecting foods in the 24-hour recall

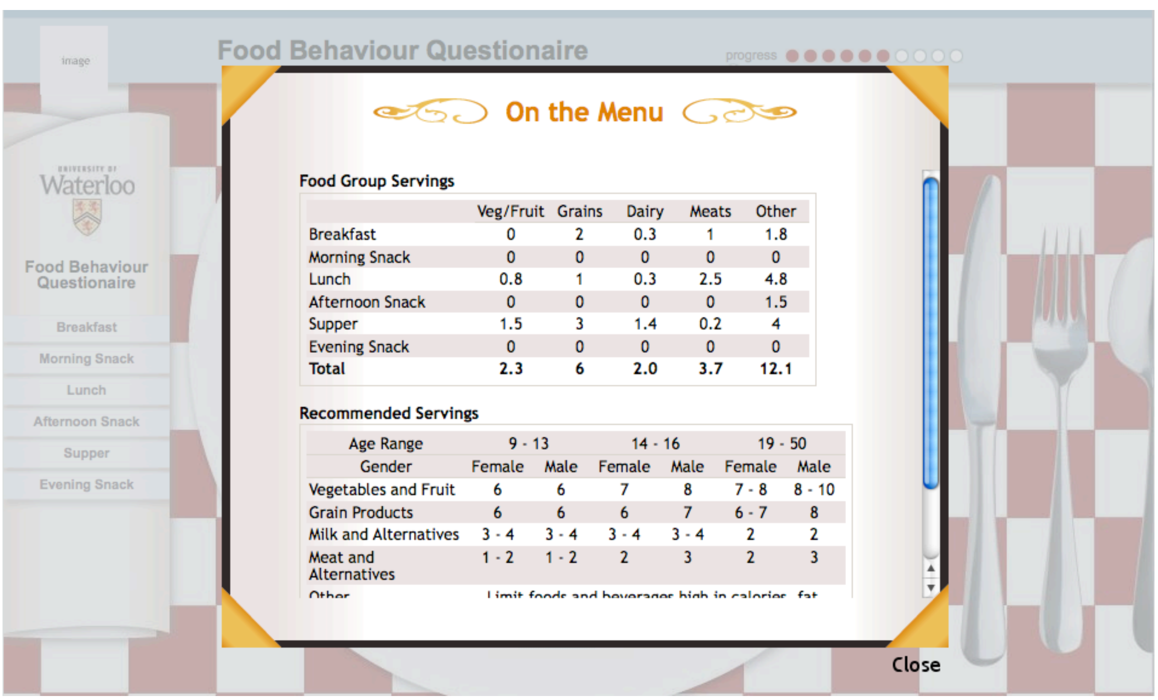
Questionnaire screenshot – choosing portion size using 3-D images



Questionnaire screenshot – prompts mimicking the multiple pass approach



Questionnaire screenshot – summary screen



Knowledge, Self-efficacy, and Intentions Questionnaire

Age::________________________
Date:________________________

Knowledge, Self-efficacy, and Intentions/Attitudes Questionnaire

Please take the time to answer the following questions. Your answers will be completely anonymous; no one at your school will be able to see your answers, and your name will never be associated with your answers. Thanks!

Note: milk & alternatives = milk and/or yogurt and/or cheese and/or soy beverage

1. Do you think that you eat/drink a lot or a little milk & alternatives?
- ❑ Very many milk & alternatives
- ❑ Many milk & alternatives
- ❑ Not many, not little
- ❑ Little milk & alternatives
- ❑ Very little milk & alternatives

2. Do you think that you eat/drink more or less milk & alternatives than most boys and girls your age?
- ❑ Much more
- ❑ Somewhat more
- ❑ The same
- ❑ Somewhat less
- ❑ Much less

3. How many milk & alternatives do you think you should eat/drink to have a healthy diet?
Note: a serving would be like 1 small milk carton, a piece of cheese the size of your thumb, or one small tub of yogurt (single serving).
- ❑ No milk & alternatives
- ❑ 4-6 servings per week
- ❑ 1-2 servings per day
- ❑ 3-4 servings per day
- ❑ 5 servings per day or more

4. Milk & alternatives are most important for (choose one):
- ❑ Healthy hair and nails
- ❑ Healthy bones and teeth
- ❑ Healthy skin
- ❑ Healthy heart and lungs

5. Important nutrients found in milk & alternatives are (choose one):
❑ Calcium and vitamin D
❑ Fibre and vitamin A
❑ Sugar and salt
❑ Vitamin C and vitamin E

6. A healthy snack using milk & alternatives would be (choose one):
❑ Milk chocolate bar
❑ Applesauce
❑ Granola bar
❑ Crackers and peanut butter
❑ Rice pudding

7. Which food group does ice cream fit into (choose one):
❑ Vegetables & fruit
❑ Grain Products
❑ Milk & alternatives
❑ Meat & alternatives
❑ None

How much do you agree with the following statements?:

8. Eating/drinking milk & alternatives every day makes me feel good
❑ I strongly agree
❑ I agree
❑ Not sure
❑ I disagree
❑ I strongly disagree

9. I like to eat/drink milk & alternatives every day
❑ I strongly agree
❑ I agree
❑ Not sure
❑ I disagree
❑ I strongly disagree

10. Milk & alternatives taste good
❑ I strongly agree
❑ I agree
❑ Not sure
❑ I disagree
❑ I strongly disagree

11. My best friends eat/drink milk & alternatives every day

- ❑ I strongly agree
- ❑ I agree
- ❑ Not sure
- ❑ I disagree
- ❑ I strongly disagree

12. My parents encourage me to eat/drink milk & alternatives every day

- ❑ I strongly agree
- ❑ I agree
- ❑ Not sure
- ❑ I disagree
- ❑ I strongly disagree
- ❑ I don't have/don't see my parents

13. It is hard for me to eat/drink milk & alternatives every day

- ❑ I strongly agree
- ❑ I agree
- ❑ Not sure
- ❑ I disagree
- ❑ I strongly disagree

14. If I decide to eat/drink milk & alternatives every day, I can do it

- ❑ I strongly agree
- ❑ I agree
- ❑ Not sure
- ❑ I disagree
- ❑ I strongly disagree

15. I want to eat/drink milk & alternatives every day

- ❑ I strongly agree
- ❑ I agree
- ❑ Not sure
- ❑ I disagree
- ❑ I strongly disagree

16. I am willing to try a milk or alternative (cheese, yogurt, milk…) that I have never tried before

- ❑ I strongly agree
- ❑ I agree
- ❑ Not sure
- ❑ I disagree
- ❑ I strongly disagree

17. Which of these milk or alternatives do you like or dislike?

	Like very much	Like a bit	Dislike a bit	Dislike very much	Have not tried
2 % UHT Milk					
2% fresh milk					
3.25% (whole) fresh milk					
Evaporated milk					
Chocolate milk					
Cheese (regular)					
Cheese string					
Yogurt in a cup					
Yogurt tubes					
Fruit Smoothies					
Soups made with milk					
Pudding made with milk					
Soy Beverage					

18. Are you allowed to eat/drink as many milk & alternatives as you would like at home?

❑ Yes, always
❑ Yes, most days
❑ Sometimes
❑ Rarely
❑ Never

19. Are you allowed to drink as much soft drinks (pop) as you would like at home?

❑ Yes, always
❑ Yes, most days
❑ Sometimes
❑ Rarely
❑ Never

20. Are there usually different types of milk & alternatives available in your home?

❑ Yes, always
❑ Yes, most days
❑ Sometimes
❑ Rarely
❑ Never

21. Do your parents (or other family members) serve you milk & alternatives between meals?

❑ Yes, always
❑ Yes, most days
❑ Sometimes
❑ Rarely
❑ Never

22. Can you get milk & alternatives at school either by buying them or getting them for free?

❑ Yes, always
❑ Yes, most days
❑ Sometimes
❑ Rarely
❑ Never

23. How much do you agree with the following statements?:

	I strongly agree	**I agree**	**Not sure**	**I disagree**	**I strongly disagree**
a) I do not eat/drink milk & alternatives because it takes too much time to eat/drink them					
b) I do not eat/drink milk & alternatives because they don't taste good					
c) I do not eat/drink milk & alternatives because my friends at school do not do it					
d) I do not eat/drink milk products because I am still hungry after eating/drinking them					

	I strongly agree	I agree	Not sure	I disagree	I strongly disagree
e) I do not eat/drink milk & alternatives because I want to eat/drink something else (e.g. sweets, soft drinks)					
f) I do not eat/drink milk & alternatives because I don't have any at home					
g) I do not eat/drink milk & alternatives because I am allergic/have intolerances to them					

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE!

Parent Impressions Questionnaire (Fort Albany)

Pilot Milk & Alternatives Education Program Questionnaire

Dear Parent or Guardian,

Please let us know what you thought about the milk/healthy bones education program at your child's school this winter/spring. Please return the questionnaire so that you can be entered in the raffle. Thank you!

***Milk & Alternatives = milk (dry, canned, fresh), cheese, yogurt, soy milk, etc.**

1. Did you know that there was a milk/healthy bones program at Peetabeck Academy?

- ☐ Yes
- ☐ No

2. Did you think that the handouts that your child brought home were sensitive to your culture?

- ☐ Yes
- ☐ No
- ☐ I did not receive the handouts

3. What type of information did you hope to receive but did not?

____

4. What information did you find was NOT very useful?

____

5. Did your child tell you about or ask you to buy any milk & alternatives they learned about at school?

- ☐ Yes
- ☐ No

6. Can you suggest what would help you to serve more milk & alternatives in the home?

____

7. What do you think are the major challenges to eating/drinking milk & alternatives?

- ☐ They are too expensive
- ☐ I don't know what to make with them/how to prepare them
- ☐ They do not taste good
- ☐ They are often not available at the store
- ☐ Other ____

8. Do you think the program should run again next year? Why or why not?

____

9. Please provide any other comments and/or suggestions. Your opinion is valuable!

____

____

May we use your comments in our research? (Your name will never be attached to any of your comments)

- ☐ Yes
- ☐ No

Thank you! Do not forget to return this questionnaire to be entered in the RAFFLE!

Appendix C: Passive Consent and Information Letters

Sample Letter Used in Attawapiskat

Dear Parent or Guardian,

Professors Rhona Hanning and Len Tsuji of the University of Waterloo are working with Ruby Edwards-Wheesk (Attawapiskat Health Services), the Attawapiskat First Nation Education Authority, and J.R. Nakogee Elementary School in partnership to understand children's food behaviour and physical activity patterns, and different aspects of the school snack program We would like to provide you with some information about the school survey we are conducting.

An internet survey from the University of Waterloo has been developed for grade 6 to 8 students through ongoing consultation with members of your community. The children would use the computer at J.R. Nakogee Elementary School and complete a 45-minute survey about their eating and physical activity habits, and school snack program. This internet computer survey is CONFIDENTIAL. Your child is given a number and not identified by name on the survey. Your child will have the opportunity to have their height and weight measured by a research team member. Height and weight measurements will be taken in privacy, and only the student will be told their height and weight. No records of height and weight measurements will be kept, other than that recorded on the anonymous web-survey. Once the surveys are completed, the information goes to the University of Waterloo where the data are summarized. Dr. Len Tsuji (or another member of the research team) will then bring a report to Attawapiskat Health Services, Attawapiskat First Nation Education Authority, and J.R. Nakogee Elementary School and give a presentation. The results will help your school and community to identify issues and seek additional funding to enhance community programs for healthy eating and activity.

This survey has been used with students across the Mushkegowuk Territory (Moose Factory, Fort Albany, Kashechewan, Peawanuck, and once before in Attawapiskat).

The survey will:

- Take one class period to complete; The survey will be completed at a time deemed appropriate for the teacher
- Ask the student participant to recall what s/he ate on the previous day; the student may omit questions or withdraw from participation at any time during the survey
- Provide immediate feedback on the student's diet when s/he finishes the survey

The survey is confidential

- The survey is completely confidential and poses no risk to your child
- Each student will have a unique ID and password and is not identified by name; only the university researchers will have access to individual surveys
- Results are published in group format; no individual results are shared
- Information will be stored in locked computer files
- These computers are located in locked offices at the Population Health Research Group, University of Waterloo.
- The data will be permanently stored on CD in electronic form.

What if you change your mind about your child's participation?

- The final decision to participate in this survey must be made by the student and the parent(s) or guardian(s). Your cooperation in permitting your child to take part in this is greatly appreciated. However, participation is voluntary and there is no penalty if your child does not participate.
- **If you and your child agree now to participate, but either of you change your minds later, your child can be withdrawn from the survey at any time, before submitting responses.**

- **A student will not be included in the study if a parent or guardian indicates that he or she does not want the student to participate, or if the student does not agree to take part. Students not participating will remain in their classroom with their teacher and participate in normal classroom activities.**
- **If you do NOT want your son or daughter to participate, please contact Ruby Edwards-Wheesk, Supervisor, Attawapiskat Health Centre at 997-2149.**
- **If we have not been contacted we will assume that you are permitting your son or daughter to participate.**

The survey is only for children Grade 6, 7, and 8, so it will not involve children in JK to Grade 5.

Along with health services approval, this project has also been reviewed by and received ethics clearance through the Office of Research Ethics at the University of Waterloo. If you have any questions or concerns about your child's participation in this study, please contact Dr. Susan Sykes in the Office of Research Ethics at 519-888-4567 ext. 36005.

Should you have any further questions, please do not hesitate to contact one of the team members below.

Thank you very much for your time.

Ruby Edwards-Wheesk
Supervisor
Attawapiskat Health Centre
997-2149

Dr. Rhona Hanning
Associate Professor of Nutrition
University of Waterloo
519-888-4567 x35685
rhanning@uwaterloo.ca

Dr. Len Tsuji
Professor of Environment and Health
University of Waterloo
519-888-4567 x32762
ljtsuji@uwaterloo.ca

Michelle Gates & Allison Gates
MSc Candidates
University of Waterloo
519-772-8686
m2gates@uwaterloo.ca, agates@uwaterloo.ca

Information Letter Used in Fort Albany

Dear Parent or Guardian:

Your child will be participating in a nutrition educational program at Peetabeck Academy that is given in conjunction with the breakfast/snack program. This nutrition educational program is being implemented by Professors Len Tsuji and Rhona Hanning of the University of Waterloo in partnership with the Mundo Peetabeck Education Authority. The program consists of educational modules that take approximately 8 weeks to complete and will focus on the benefits of fruits and vegetables, as well as milk products (the power 4 bones program). Your child will also have the opportunity to learn about a healthy diet, the importance of physical activity and taste a variety of different fruits and vegetables in the classroom.

If there are any health concerns, such as, **food allergies**, the student does not have to participate in the tasting portion of the program. Please notify the school of any food allergy.

The objective of the program is to increase the student's knowledge of nutrition with respect to fruits, vegetables, and calcium/vitamin D containing foods; as well as improve the student's intake of the related nutrients. A pre- and post-confidential evaluation of your child's current knowledge of nutrition will be done before and after participating in the nutrition educational program. There is no risk to your child. The information gathered from these evaluations will help to determine the effectiveness of the nutrition educational program. The end goal is to improve the health of the schoolchildren by not only offering healthy foods for breakfast and snacks at school, but also through teaching the schoolchildren the reasons why healthy eating is important.

The nutrition educational program is part of the school's breakfast/snack initiative and will:

- require a half-an-hour, 1-2 times a week
- take place within the classroom
- involve a number of fun activities, such as, games and drawings
- teach students about the nutrients from healthy foods and why these foods are considered a healthy choice
- give the students an opportunity to try new healthy foods.

The nutrition educational program will only include students from K to grade 8. If you have any questions or would like further information please contact any of the following team members listed below.

Thank you for your time.

Contact Information

Dr. Len Tsuji
Professor of Environment and Health
University of Waterloo
519-888-4567 x32762
ljtsuji@uwaterloo.ca

Andrea Isogai
Nutrition Educational Program Coordinator
278-3393 or 278-3340
University of Waterloo
adisogai@uwaterloo.ca

Dr. Rhona Hanning
Associate Professor of Nutrition
Population Health Research Group
University of Waterloo
519-888-4567 x35685
rhanning@uwaterloo.ca

Appendix D: Policy Implementation Documents

Snack Program Guidelines/Policy

Snack Program Guidelines for a Healthy School Environment

A Few Simple Rules:

- The **healthiest choices** should be served at least 80% of the time (4 days out of 5).
- **Less healthy choices** should be limited to being served once a week.
- Use **Nutrition Fact labels** on foods along with these guidelines to help you make healthy choices.

Food Group	Healthiest (at least 80%)	Less Healthy (at most 20%)	DO NOT SERVE
Vegetables & Fruit (1 item per day)			
Vegetables & Fruit	• Fresh vegetables & fruit • Canned fruit packed in its own juice or **light** syrup, unsweetened • Unsweetened applesauce • 100% unsweetened fruit juice • Dried fruits (raisins, apricots, etc.) or fruit leather ****On the package/label** • Vegetables or fruit should be the first ingredient **and** • Fat ≤3g **and** sodium ≤360 mg	• Canned fruit in syrup • Low sodium vegetable/tomato juice • Salsa ****On the package/label** • Vegetables or fruit should be the first ingredient **and** • Fat ≤5g **and** saturated fat ≤2g **and** sodium ≤480 mg	• Fruit drinks, cocktails, punches, "ades", or powders • Sweetened applesauce • Fruit roll-ups, fruit by the foot, fruit flavored gummies • Fruit or vegetable chips ****On the package/label** • Vegetables or fruit are **not** the first ingredient **or** • Sugar is one of the first ingredients **or**

			• Fat >5g **or** saturated fat >2g **or** sodium >480mg
Grain Products (optional)			
Breads	• **Whole grain** bread, buns, bagels, English muffins, pitas, or bannock ****On the package/label** • Whole grain is the first item on the ingredient list **and** • Saturated fat ≤2g **and** sodium ≤240 mg **and** fibre ≥2g	• Enriched white bead, buns, bagels, English muffins, pitas, or bannock ****On the package/label** • Saturated fat ≤2g **and** sodium ≤480 mg	• White breads that are higher in fat or sodium – cheese breads, scones, biscuits ****On the package/label** • Saturated fat >2g **or** sodium >480 mg
Baked Goods	• **Whole grain** muffins (bran or oat or whole wheat or cornmeal), **high-fibre** cereal bars or snacks ****On the package/label** • Fat ≤5g **and** saturated fat ≤2g **and** fibre ≥2g	• Some **whole grain** muffins or fruit loaves (banana, blueberry etc.) and **high-fibre** cereal bars or snacks ****On the package/label** • Fat ≤10g **and** saturated fat ≤2g **and** fibre ≥2g	• Croissants, danishes, cakes, cupcakes, doughnuts, pies, turnovers, pastries, cookies, squares, tarts, cinnamon rolls, pop tarts, muffins that are not whole grain, etc. ****On the package/label** • Fat >10g **or** saturated fat >2g **or** fibre <2g
Grain-Based Snacks	• Some **whole grain** crackers, **plain unsalted** popcorn or pretzels ****On the package/label** • Fat ≤3g **and** saturated fat ≤2g **and** sodium ≤240 mg	• Some crackers, popcorn, or pretzels ****On the package/label** • Fat ≤5g **and** saturated fat ≤2g **and** sodium ≤480 mg	• High-fat crackers or pretzels, buttered popcorn, or snacks high in sodium, corn chips, snack mixes ****On the package/label** • Fat >5g **or** saturated fat >2g **or** sodium >480 mg
Cereals	• **Whole grain, high-fibre** cereals ****On the package/label** • Whole grain is the first item on the ingredient list **and** • Saturated fat ≤2g **and** fibre ≥2g	• Some **whole grain** flake or crisp type cereals (corn flakes, rice krispies etc.), **not** sugar-coated ****On the package/label** • Whole grain is the first item on the ingredient list **and** • Saturated fat ≤2g	• Sugar-coated cereals or granola. ****On the package/label** • Whole grain is **not** the first item on the ingredient list **or** • Saturated fat >2g **or** fibre <2g
Milk & Alternatives (1 item per day)			
Milk	• White, chocolate, or flavored milk with **2% MF or less**, fresh or UHT or evaporated	• Homogenized **(3.25% MF)** milk, fresh, UHT, or evaporated	• Milkshakes, cream-based beverages
Yogurt, custards, puddings	• Plain or fruit yogurt, yogurt tubes, yogurt drinks (Yop), Minigo		• Custard, pudding, higher fat yogurts (Balkan)

	****On the package/label** • Fat ≤3.25% MF **or** ≤3g		****On the package/label** • Sugar is one of the first ingredients **or** • Fat >3.25% MF **or** >3g
Cheese	• **Lower fat and sodium** cheeses and cheese strings, including part-skim mozzarella, light cheddar. ****On the package/label** • Fat ≤20% MF **and** sodium ≤360 mg and calcium ≥20% Daily Value	• Most hard and soft **non-processed** cheese and cheese strings, including cheddar, mozzarella, brick, Monterey jack, havarti, gouda etc. ****On the package/label** • Fat >20% MF Sodium ≤480 mg **and** calcium ≥15% Daily Value	• **Processed** cheese slices, cheez whiz, cream cheese ****On the package/label** • Fat >20% MF Sodium >480 mg **or** calcium <5% Daily Value
Meat & Alternatives (optional)			
Nuts & Seeds	• **Preferably unsalted** peanuts, almonds, walnuts, sunflower seeds, peanut butter, etc. ****On the package/label** • Not coated with candy,		• Coated with chocolate, candy, sugar, and/or yogurt; Nutella or other chocolate spreads; sesame snaps; nut brittles; oil roasted, salted, or flavored nuts. ****On the package/label** • Coated with candy,

	chocolate, sugar, or yogurt **and** • Sodium ≤480 mg		chocolate, sugar, or yogurt **or** • Sodium >480 mg
Other Foods (use sparingly)			
Spreads, condiments, miscellaneous food items		• Low fat salad dressings or dips	• Butter, jam, jelly, syrup, honey • Soft drinks and diet soft drinks • Sports drinks and energy drinks • Marshmallows or marshmallow spread • Chocolate, candies, or chips • Jell-o • Full fat salad dressings or dips • Coffee, tea

Adapted by Allison & Michelle Gates from:

Ontario Ministry of Education. (2010). *Nutrition Standards for Ontario Schools.* Retrieved January 2010 from http://www.edu.gov.on.ca/extra/eng/ppm/150.html.

Ontario Society of Nutrition Professionals in Public Health School Nutrition Workgroup Steering Committee. (2004). *Call to action: creating a healthy school nutrition environment.* Retrieved June 2009 from http://www.osnpph.on.ca/pdfs/call_to_action.pdf.

Sample Shopping List

Sample Shopping List Using
Snack Program Guidelines for a Healthy School Environment

The following are examples of foods that fit into the Snack Program Guidelines for a Healthy School Environment. However, any food that fits the criteria is acceptable.

Food Group	Healthiest (at least 80%)	Less Healthy (at most 20%)	DO NOT SERVE
Vegetables & Fruit (1 item per day)			
Vegetables & Fruit	• Small box raisins • Apples • Bananas • Oranges • ½ cup grapes (palm sized) • 4 dried apricot halves • Celery sticks • Baby carrots • Green or red peppers • Any brand of unsweetened applesauce or applesauce blend – check the labels • Sun-Rype Fruitsource bars • Any brand of canned fruits in their own juice or light syrup – check the labels • 100% fruit juice – make sure	• Any salsa • Reduced sodium versions of vegetable or tomato juices – check the labels • Any brand of canned fruit in syrup	• Fruit drinks, cocktails, punches, "ades", or powders – check the labels for sugar, glucose, fructose, sucrose, or syrups in the ingredient list • Sweetened applesauce – check for no-sugar added versions • Fruit roll-ups, fruit by the foot, fruit flavored gummies – make sure fruits are the first ingredient • Fruit or vegetable chips

	there is no sugar added in the ingredient list		
Grain Products (optional)			
Breads	• **Whole grain** bread, buns, bagels, English muffins, pitas, or bannock	• Enriched white bead, buns, bagels, English muffins, pitas, or bannock	• White breads that are higher in fat or sodium – cheese breads, scones, biscuits
Baked Goods	• Small **whole grain** muffins (bran or oat or whole wheat or cornmeal) • Nature Valley Fibresource bars • All-Bran Chewy Bars (Chewy variety only)	• All-Bran bars (not the chewy) or bites • Nature Valley Crunchy granola bars • Quaker Oatmeal-to-Go squares • Kellogg's NutriGrain bars	• Croissants, danishes, cakes, cupcakes, doughnuts, pies, turnovers, pastries, cookies, squares, tarts, cinnamon rolls, pop tarts, muffins that are not whole grain, etc. • Any Quaker Chewy or Dipps granola bars • Any chocolate coated granola bars • Kellogg's Special K cereal bars • Fig Newtons
Grain-Based Snacks	• Red Oval Farms Stoned Wheat Thins • Premium Plus whole wheat or multigrain crackers • Whole wheat or 12-grain Melba Toast • Plain rice cakes or rice	• Nabisco Wheat Thins • Plain Melba Toast • Triscuit crackers • Honey Maid honey flavoured graham crackers	• Chocolate coated rice snacks • Any Breton crackers • Any Ritz crackers or other butter crackers • Cheese Nips, most cheese crackers

	snacks • Honey Maid low-fat honey flavoured graham crackers		
Cereals	• All-Bran • Fibre-One • Cheerios • Multi-Grain Cheerios • Quaker Corn Bran • Quaker Oatmeal Squares • Quaker Life cereal • Raisin Bran	• Puffed wheat or rice • Rice Krispies • Corn Flakes • Special K • Crispix	• Corn Pops • Lucky Charms • Reese Puffs • Honey Grahams • Cinnamon Toast Crunch • Flavoured Cheerios • Frosted Flakes • Granola • etc…
Milk & Alternatives (1 item per day)			
Milk	• White, chocolate, or flavored milk with **2% MF or less**, fresh or UHT or evaporated	• Homogenized (**3.25% MF**) milk, fresh, UHT, or evaporated	• Milkshakes, cream-based beverages
Yogurt, custards, puddings	• GoGurt tubes • Minigo • Yop • Most 100g yogurts – check the labels for %MF		• Liberte Mediterranean yogurt • Any Balkan-style yogurt • Check labels for %MF
Cheese	• Most low fat, part-skim cheeses – check the labels	• Cheese strings (check labels) • Most Black Diamond and Kraft cheeses – check labels for other brands	• Cheez Whiz • Velvetta • Any processed cheese slices/products • Any cream cheese

Meat & Alternatives (optional)			
Nuts & Seeds	• Any nuts, preferably unsalted • Regular peanut butter		• Oil roasted or flavoured nuts • Honey roasted nuts • Chocolate, candy, yogurt or sugar coated nuts • Nutella and other chocolate nut spreads • Sesame snaps • Nut brittles
Other Foods (use sparingly)			
Spreads, condiments, miscellaneous food items		• Low fat salad dressings or dips	• Butter, jam, jelly, syrup, honey • Soft drinks and diet soft drinks • Sports drinks and energy drinks • Marshmallows or marshmallow spread • Chocolate, candies, or chips • Jell-o • Full fat salad dressings or dips • Coffee, tea

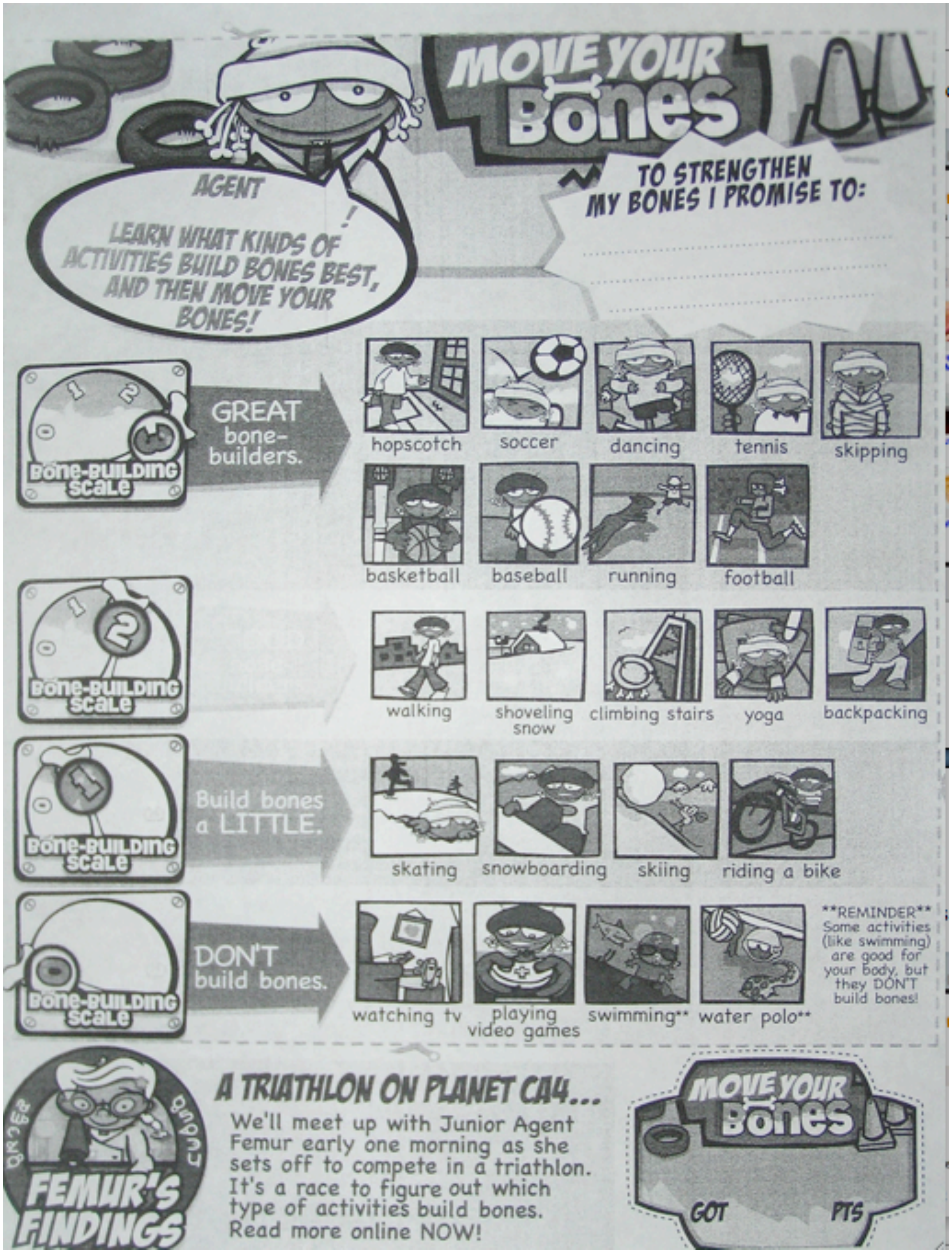
Allison & Michelle Gates, 2010

Appendix E: Nutrition Education Materials

Student Education Materials (In Class)

Week 1: Feed Your Bones Shopping Spree (Power4Bones)

Week 2: Move Your Bones Activity Sheet (Power4Bones)



Week 4: Calcium Collector Game (National Institutes of Health & National Institute of Child Health & Human Development, 2010)

milk matters
www.nichd.nih.gov/milk

Calcium Collector

Food List

Category 6	Calcium Points (Milligrams of Calcium)
Canned sardines with bones (3 oz.)	**325**
Cheese pizza (1 slice)	**182**
Fruit yogurt, low-fat (1 cup)	**345**
Milk, fat-free (1 cup)	**306**
Milk, 1% low-fat (1 cup)	**290**
Orange juice with added calcium (1 cup)	**351**
Plain yogurt, fat-free (1 cup)	**452**
Ricotta cheese, part skim (1/2 cup)	**335**
Sesame seeds, whole, toasted, and roasted (1 oz.)	**280**

Category 5	Calcium Points (Milligrams of Calcium)
American cheese, low-fat and fat-free (2 oz., about 3 slices)	**323**
Cheddar cheese, low-fat and fat-free (1 1/2 oz.)	**307**
Cottage cheese, low-fat (1/2 cup)	**69**
Milk, fat-free (1 cup)	**306**
Milk, 1% low-fat (1 cup)	**290**
Soy beverage with added calcium (1 cup)	**368**
Soybeans, cooked (1 cup)	**130**
Swiss cheese, low-fat and fat-free (1 1/2 oz.)	**336**

Category 4	Calcium Points (Milligrams of Calcium)
Baked beans (1 cup)	**154**
Blackstrap molasses (1 Tbsp.)	**172**
Bok choy, boiled (1 cup)	**158**
Broccoli, raw (1 cup, chopped)	**43**
Collard greens, frozen, boiled (1/2 cup)	**179**
English muffin, whole wheat (1 muffin)	**175**
Frozen yogurt, soft-serve vanilla (1/2 cup)	**103**
Macaroni and cheese (1 cup)	**92**
Salmon, canned with bones (3 oz.)	**181**
Spinach, cooked from frozen (1/2 cup)*	**146**
Tofu, firm, with added calcium sulfate (1/2 cup)	**253**
Tomato soup prepared with fat-free milk (1 cup)	**159**
Turnip greens, frozen, boiled (1/2 cup)	**125**

Category 3	Calcium Points (Milligrams of Calcium)
Almonds (1 oz., approx 23 nuts)	**70**
Black beans, boiled (1 cup)	**46**
Broccoli, cooked (1 cup, chopped)	**62**
Orange (1 medium)	**70**
Parmesan cheese, grated (1 Tbsp.)	**55**
Red kidney beans, boiled (1 cup)	**50**
Sardines (2 sardines)	**92**
Swiss chard, boiled (1/2 cup)*	**51**
Tortilla, corn (6")	**42**
Tortilla, flour (7")	**58**

milk matters www.nichd.nih.gov/milk

Calcium Collector

Food List (continued)

Category 2	Calcium Points (Milligrams of Calcium)
Cheese puffs (3 oz.)	**48**
Cupcake, chocolate, with frosting, low-fat (1 cupcake)	**15**
Fruit punch juice drink, from frozen concentrate (8 oz.)	**17**
Potato chips (3 oz.)	**7**

Category 1	Calcium Points (Milligrams of Calcium)
Chocolate bar (Mr. Goodbar™) (1 bar)	**54**
Chocolate chip cookies made from refrigerated dough (2 cookies)	**6**
Glazed doughnut (yeast) (1 doughnut)	**0**
Microwave popcorn with butter (1 cup)	**11**
Soda (Bottled carbonated beverage with caffeine, 16 oz.)	**10**

*Calcium from these foods may not be absorbed as well as from some other greens.

Calcium Collector

Scorecard

Player 1:________________

Food	Calcium Points

Player 2:________________

Food	Calcium Points

Family Involvement Material and Handouts

Week 1: Marvelous Milk Products (Dietitians of Canada)

Eat Well, Live Well

Brought to you by:
Dietitians of Canada
Les diététistes du Canada

Step Right Up to Healthy Eating

Marvelous Milk Products

"Drink your milk – it'll make your bones strong."
For decades, parents have spoken these words at the dinner table day after day after day, and it still holds true.

Milk and Alternatives are 1 of 4 important food groups in *Eating Well with Canada's Food Guide.*
Together with Vegetables and Fruit, Grain Products, and Meat and Alternatives, they form a tried and true blueprint for healthy eating.

Tasty and versatile!
Ice cold milk, smooth and creamy yogurt and cheese from around the world can be enjoyed on their own or combined with other foods to make everything from appealing appetizers and dips, salads and dinner dishes to delicious desserts.

Provide a variety of nutrients.
Milk, yogurt and cheese provide protein, vitamins including vitamin A and D and minerals including calcium, phosphorous and magnesium. It's important to have 500 mL (2 cups) of milk every day for adequate vitamin D for healthy bones. If you don't drink milk choose a fortified soy beverage.

Milk isn't just for kids!
Milk contains all the building blocks for healthy bones and teeth. Canada's Food Guide recommends 2-4 servings of Milk and Alternatives per day, depending on your age.

Age	# of Food Guide Servings of Milk and Alternatives
Toddlers 2-3 years	2
Children 4-8 years	2
Youth 9-13 years	3-4
Teens 14-18 years	3-4
Adults 19-50 years	2
Adults 51 years and older	3

For children and teens, Milk and Alternatives are great sources of the important building blocks for strong bones and teeth. And even though adult and senior bones don't appear to be growing, milk products provide essential nutrients that work to keep bones strong. Healthy eating along with regular weight-bearing exercise such as walking or dancing can help to prevent osteoporosis, a condition which leaves bones weak, thin and more likely to break.

Promoting Health Through Food and Nutrition **www.dietitians.ca/eatwell**

Eat Well, Live Well

Brought to you by:

Dietitians of Canada
Les diététistes du Canada

Tips for choosing and enjoying Milk and Alternatives

Compare your choices to Food Guide Servings!
One serving of Milk and Alternatives equals one 250 mL (8-ounce) glass of milk or fortified soy beverage, 2 slices of processed cheese, 50 g (1 1/2 ounces) of cheese (the size of 3 one-inch cubes) or 175 gm (3/4 cup) yogurt.

Chocolate and other flavoured milks contain all the nutrients of white milk, but with more sugar.

Make lower fat choices more often.
You will find %MF or %BF on food labels for milk, cheese and yogurt. The percentage of milk fat (%MF) or butterfat (%BF) is the amount of fat by weight in the milk product. For example, 3.25% (homogenized milk) has more fat than 2% or 1% milk. Skim milk has the least amount of fat with less than 0.5% fat. Regardless of the MF or BF content, all fluid milk contains the same calcium, vitamins and minerals.

Shake up a wonderful breakfast by whirling 1 cup (250 mL) yogurt, 1/2 cup (125 mL) orange juice, and 1 medium banana in the blender. Top it with some fresh berries for added crunch and color.

Use fluid milk instead of water when preparing canned cream soups. Or try adding skim milk powder to meat loaf, sauces or casseroles.

Use evaporated 2% or whole milk instead of whipping or cereal cream in cream sauces.
You'll get the velvety smooth texture, more calcium and save on added fat.

Cream cheese, ice cream and sour cream are calcium poor choices.
While made from milk, these foods contain less calcium than milk, yogurt or cheese.

If you don't drink milk enjoy fortified soy beverages. They are available in different flavours and can be used as a beverage, on cereals and for cooking and baking. If you drink less than 2 cups (500 mL) of milk or fortified soy beverage daily, you will probably need a vitamin D supplement.

If you are lactose intolerant, you can buy special milk in which the lactose has already been broken down. You can also use chewable lactase tablets. Try hard cheeses and yogurt, as they are often easier to digest for people who are lactose intolerant.

Other foods contain calcium, but don't provide all of the important nutrients found in milk products.
Vegetables such as bok choy, broccoli and kale and nuts such as almonds and sesame seeds contain calcium. However, you need to eat a large amount to equal the calcium from one glass of milk. For example, you would need to eat 750 mL (2 1/2 cups) of broccoli OR 250 mL (1 cup) of almonds OR 45 mL (3 tablespoons) of sesame seeds to obtain the calcium that is found in 250mL (1 cup) of milk. These foods also don't provide the vitamin D that is added to milk.

Dietitians provide food and nutrition information you can trust. Find a dietitian in your area at **www.dietitians.ca/find** or call **1-888-901-7776**.

This Factsheet distributed compliments of:

Promoting Health Through Food and Nutrition **www.dietitians.ca/eatwell**

Week 2: Canada's Physical Activity Guide for Youth

Dare to be Active!

Tune into physical activity to:

- Meet new friends
- Improve physical self-esteem
- Achieve a healthy weight
- Build strong bones and strengthen muscles
- Maintain flexibility
- Promote good posture and balance
- Improve fitness
- Strengthen the heart
- Increase relaxation
- Promote healthy growth and development

Let's Get ACTIVE!

Canada's Guidelines for **INCREASING** Physical Activity in Youth

This Guide will help you:

1. **INCREASE** time **CURRENTLY** spent on physical activity, starting with 30 minutes **MORE** per day (See CHART BELOW)
2. **REDUCE** "non active" time spent on TV, video, computer games and surfing the Internet, starting with 30 minutes **LESS** per day (See CHART BELOW)

Build up physical activity throughout the day in periods of at least 5 to 10 minutes

MONTH	Daily INCREASE in moderate* activity (Minutes)		Daily INCREASE in vigorous** activity(Minutes)		Total Daily INCREASE in physical activity (Minutes)	Daily DECREASE in non-active time (Minutes)
Month 1	at least 20	+	10	=	30	30
Month 2	at least 30	+	15	=	45	45
Month 3	at least 40	+	20	=	60	60
Month 4	at least 50	+	25	=	75	75
Month 5	at least 60	+	30	=	90	90

Congratulations!

Daily active time is part of a healthy lifestyle.

***Moderate physical activity examples**
- Brisk walking, skating, bike riding

****Vigorous physical activity examples**
- Running, supervised weight training, basketball, soccer

Here's the scoop!

– Combine three types of physical activity for best results:

1. **Endurance** activities that make you breathe deeper, your heart beat faster, and make you feel warm.
2. **Flexibility** activities like bending, stretching and reaching that keep your joints moving.
3. **Strength** activities that build your muscles and bones.

Here are some ideas to get you started

Decide to take the first step – It's all up to you – And YOU can DO it!

- Walk more – to school, to the mall, to the park, to your friend's house
- Walk, run or bike instead of getting a drive with mom or dad
- Take the dog for a walk
- Run, jump, skateboard, snow-board, ski, skate or toboggan
- Play sports
- Go skating, swimming, bike riding or bowling
- Rake the leaves, shovel snow or carry the groceries
- Take a class like yoga, hip hop, aerobics or gymnastics
- Check out some activities at the community centre
- Be active with your friends
- Put on some music and move
- Stretch your muscles every day
- Try something new like wall climbing or dance classes

Choose **activities you like or think you might like.**

Active bodies need energy

Follow *Canada's Food Guide to Healthy Eating* to make wise food choices

Healthy activity is safe activity

Canada

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Please use this Guide with additional support resources.
For more information: Call 1 888 334-9769
or visit www.paguide.com

Powerful Bones, Powerful Families

A GUIDE FOR FAMILIES

Taking care of our bones during childhood and the teen years is an important way to avoid bone fractures and osteoporosis (thinning of bones) later in life. It's so important that some people call osteoporosis a childhood disease with adult consequences.

DID YOU KNOW?

- Girls' bones grow the fastest between the ages of 11 and 14 and boys' bones grow fastest between the ages of 13 and 17. By age 20 the skeleton is almost complete.
- About 40% of bone mass is built during adolescence, making it the most critical time to get enough bone-building nutrients like calcium and vitamin D.
- Research done in 2002 showed that many Ontario kids aren't eating well enough or getting enough physical activity to keep their bones strong.*
- We need more than just calcium to build strong bones. Our bones also need vitamin D, protein, phosphorus, zinc, vitamin A and magnesium.
- You are a role model! Your children learn healthy habits by watching their greatest model in life: YOU! Enjoy calcium-rich foods in front of your children, and show them that bone-building physical activities are easy and fun.

*Hanning RM, Woodruff SJ, Lambraki I, et al. Nutrient intakes and food consumption among Ontario students in grades six, seven, and eight. Canadian Journal of Public Health 2007;98(1):12–16.

What YOU can do!

1. Get Moving with Bone-Building Activities

Weight-bearing activities are the only type of physical activity that builds strong bones. These activities make you push, pull or carry something, or make your body work against gravity, so that your feet, legs and arms support your body weight.

Examples of bone-building physical activities:

Hopscotch	Walking	Jogging/running	Skipping/jumping rope
Climbing stairs	Hiking	Inline or ice skating	Gymnastics
Racquet sports	Soccer	Basketball	Field hockey
Dancing	Volleyball	Baseball/softball	Pulling a wagon
Skiing/snowboarding	Carrying groceries	Pushing a swing	

There are lots of ways for your family to get active! Choose the activities that your family finds the most fun. Have your family mix and match two or more of these activities to build your own games!

2. Include Bone-Building Foods in Your Families Meals and Snacks

The easiest way to get enough calcium and other bone-building nutrients is to have bone-building foods every day, particularly foods from the Milk and Alternatives food group, including milk, cheese and yogurt. Energize your family with these bone-building tips:

- Add milk or powdered milk to recipes, meals and snacks. Try making soup, casseroles, muffins, desserts or oatmeal with milk instead of water.
- Stock up on calcium-packed snacks like white or chocolate milk, yogurt, cheese or pudding made with milk.
- Bone-building foods taste great, are fun to eat and easily fit into your fast-paced lifestyle. In a hurry? Think about fruit and yogurt smoothies, bean and cheese burritos, yogurt dips for vegetables or fruit, or grilled cheese sandwiches.

3. Final Action: Get Powerful Bones!

Set bone-healthy goals for your family involving both food and physical activity. Write your family's bone-health goals in the space below, then take action for powerful bones!

Step 1: Decide what specific action your family would like to have as your goal. Make sure it's realistic for your family.

Step 2: Decide when your family will start working on your goal. Post your goals on the fridge. Set a time frame so you can check your progress as a family. What is working? What is not? Revise your goal if you need to.

Step 3: Celebrate your family's successes in meeting your goals!

EXAMPLE GOAL:

Pack at least one (specific and realistic) calcium-rich food (give specific example) in everyone's lunch (specific and realistic) every school day for the next month (when).

GOAL 1 **(bone-building foods):**

GOAL 2 **(bone-building physical activity):**

Power4Bones is a bone-health program developed by the Registered Dietitians at Dairy Farmers of Canada with the support of a Provincial P4B Advisory Committee.

For more information on the Power4Bones program, or on nutrition and bone health, visit the Teachers and Parents section of power4bones.com.

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In partnership with:

Osteoporosis Canada
Ostéoporose Canada

Keep Your Bones Strong with Calcium and Vitamin D

Calcium and **vitamin D** are important for strong bones and teeth.

Kids need 3-4 servings of milk or calcium-rich foods each day.

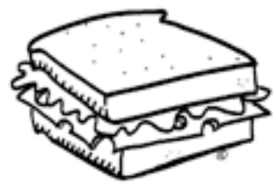
Adults need 2-3 servings of milk or calcium-rich foods each day.

Here are some ideas for calcium-rich meals:

BREAKFAST

- Pour milk in your breakfast cereal or oatmeal
- Enjoy a cup of low fat yogurt
- Make tea with milk
- Drink hot chocolate made with milk

LUNCH



- Add low fat cheese to a sandwich
- Have a glass of milk instead of soft drinks
- Have macaroni & cheese, pizza, or lasagna
- Make milk-based soups

DINNER

- Make a salad with dark green leafy vegetables
- Add some low fat cheese to your salad
- Serve broccoli or beans as a side dish
- Enjoy low fat yogurt for dessert

SNACKS

- Make a smoothie with fruit, ice, and yogurt or milk
- Drink milk, or you can try chocolate or strawberry milk
- Dip vegetables and fruits into yogurt
- Try low fat string cheese

Adapted by Michelle Gates from:
Nourish Interactive (2010). Chef Solus – Keep those bones growing strong with calcium and vitamin D. Retrieved January 2010 from http://www.nourishinteractive.com.

Choosing Milk & Alternatives over Sweetened Beverages

Choosing Milk & Alternatives

- Milk & Alternatives include milk, cheese, and yogurt.
- They are important because they provide protein and calcium which help bones stay strong and healthy.
- Try to choose the ones that are lower in fat to help cut down on the amount of fat eaten. Information on the **Nutrition Facts Label** can help you to choose the healthier ones.

Adapted by Michelle Gates from Cancer Care Ontario Fact Sheet (2010)

Choosing Drinks that are Low in Sugar

- Sugar is found in many sweetened drinks.
- Too much sugar is bad because it can cause cavities, and increases calorie intake, which can lead to becoming overweight and obese.
- Sugar can also replace some of the nutrients in a person's diet, making it harder for them to get all the nutrients they need to be healthy.
- Sweetened drinks should be avoided, try water or milk instead.

Examples of Drinks that are High in Sugar:

Pop
e.g. Coke, Sprite

Tang and
Kool-aid

Fruit drinks
e.g. Fruitopia

Sports drinks and
Energy drinks
eg. Gatorade, Red
Bull

****Milk and flavoured milk (chocolate, strawberry) are great replacements****

Added Sugar

There are many different names for sugar added to food items or drinks.
Avoid drinks that have these words first in the **ingredient list** on the package:

- Sugar
- Syrup (cane syrup, maple syrup, rice syrup, etc.)
- High-fructose corn syrup
- Fructose, sucrose

Adapted by Michelle Gates from Cancer Care Ontario Fact Sheet (2010)