Contribution of Foods to Nutrient Intakes of Grades 4-6 Students Participating in Kahnawake Schools Diabetes Prevention Project 1994, 1998 and 2002

By

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Abstract

This study assessed the diets of participants in the Kahnawake Schools Diabetes Prevention Project (KSDPP). Data were gathered from three cross-sectional surveys of students in grades four to six in the Mohawk community of Kahnawake. Single 24-hour recall interviews were conducted in 2002 (n=151), 1998 (n=153) and 1994 (n=164). Mean number of servings of Vegetables and Fruits (3.6 per day), Milk Products (1.6 per day), and Meat and Alternatives (1.5 per day) were found to be below ranges recommended by Canada's Food Guide to Healthy Eating. Correspondingly, mean intakes of fibre, calcium and vitamin D were found to be below Adequate Intake references. Positive changes detected include a decrease in soda consumption and a shift toward whole grains. Results indicate that improved nutrient intakes will require closer adherence to the principles of Canada's Food Guide to Healthy Eating. KSDPP intervention staff are using results as a basis for intervention.

Résumé

Cette étude a évalue l'alimentation d'enfants (4^{ième} a 6^{ième} annee) qui ont participé au Kahnawake Schools Diabetes Prevention Project (KSDPP), un programme communautaire de prevention de la diabète. Les données ont ete recueillies auprès de trois échantillons transversaux d'étudiants fréquentant les écoles de la communauté Mohawk de Kahnawake, a l'aide d'un seul rappel de 24 heures mené dans chacune des années 1994 (n=164), 1998 (n=153) et 2002 (n=151). Les résultats on demontré que la moyenne des quantités de portions de Légumes et Fruits (3.6 par jour), Produits Latiers (1.6 par jour) et de Viandes et Substituts (1.5 par jour) étaient inférieures à la gamme conseillée par le Guide Alimentaire pour Manger Sainement. En conséquence, les moyennes de l'apport de fibre, de calcium et de Vitamine D se sont avérees en dessous des niveaux de référence d'Apport Suffisant (AS). Certaines améliorations ont été detectées, telles une diminution de consommation de boissons gazeuses et une augmentation de consommation de produits a blé entier. Les résultats demontrent qu'afin d'améliorer l'apport d'éléments nutritifs, il faudra adhérer de plus près aux principes du Guide Alimentaire pour Manger Sainement. Les interventions effectuèes par le personnel du KSDPP se font actuellement sur la base de ces résultats.

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I Introduction

The Kanien'kéha:ka community of Kahnawake is located approximately 15 kilometres southwest of Montreal on the south shore of the St. Lawrence River. There are approximately 7,200 residents living within this 5,000 hectare Indian Act reserve. Despite being so close to the city of Montreal, this Mohawk Nation has retained a strong cultural and political identity. The community is quite distinct from neighbouring areas and is largely self-contained, with its own police force, hospital, financial institutions, post office, library, and educational system (Le Groupe Cleary, 1999).

Diabetes is a significant health issue in Kahnawake as it is in other Aboriginal communities. For clarification, Aboriginal is a term that includes First Nations (Canadian terminology), Métis and Inuit people. Kahnawake is a leader among First Nations communities in addressing such health issues. As an example of the control Kahnawa'kero:non (people of Kahnawake) exert over community health, they have mobilized significant resources in recent years to address the prevalence of Type 2 diabetes among members, present and future. Kahnawake Schools Diabetes Prevention Program (KSDPP) began in 1994 as a result of community awareness and motivation to prevent diabetes among Kahnawa'kero:non (Kahnawake Schools Diabetes Prevention Project, 2003). It aims to promote healthy eating, physical activity and positive attitudes using an innovative participatory approach (Macaulay et al, 1999). It exemplifies community-based prevention and is a forerunner in the evaluation of primary prevention of Type 2 diabetes.

Part of KSDPP involves studying the food intakes of schoolchildren to measure change over time and to describe the diet to aid the intervention team in designing their interventions. The present study determined the relative contributions to nutrient intake of foods consumed as well as overall dietary intake. The use of food categories allowed for assessment in terms of recognized food groups, i.e., those recommended by Canada's Food Guide to Healthy Eating, as well as closer examination of foods grouped for their similarities. In this last phase of the study (2002), data were combined and compared with data collected in 1994 and 1998. Consistent methods were used for the collection of all three sets of data making these comparisons possible.

II Literature Review

1. Diabetes Prevalence

Diabetes mellitus is a metabolic disease characterized by hyperglycaemia and both acute and chronic complications. Type 2 diabetes is most common, accounting for approximately 90% of all cases of diabetes in the general population or in Canada, and for virtually all cases in Aboriginal people. By conservative estimates, diabetes among First Nations people in Canada is three times more prevalent than among Canadians (Health Canada, 2000), has an earlier onset and results in more severe complications than in non-First Nations people (Young et al, 2000).

While the number of Aboriginal people with diabetes is unknown, estimates show that rates are high and increasing although prevalence rates are likely underestimated due to limitations in collecting such data. Controlling for age in the relatively young Aboriginal population heightens the prevalence rates in comparison to rates in the older Canadian population (Health Canada, 2000).

The Mohawk community of Kahnawake is not exempt from high prevalence rates. Results from a chart review conducted in 1981 showed a rate of type 2 diabetes of 12%, which was twice that of the general population at the time. To determine prevalence rates, medical records obtained from Kateri Memorial Hospital Centre in Kahnawake were reviewed by family physicians Montour and Macaulay. The 544 charts reviewed represented the records of 92% of 45 to 65 year old registered Mohawk Indians in the community (Montour & Macaulay, 1985). A subsequent study was conducted in 1985 to investigate the rates of diabetes-related complications among diabetics in Kahnawake over the age of 35. Results from medical chart review of eligible patients (n=132) showed high rates of ischemic heart disease (48%), cerebrovascular disease (14%) and peripheral vascular disease (12%). When compared to an age and sex-matched group of non-diabetics recruited from Kahnawake membership, rates were found to be significantly higher for these three complications (p=0.002, 0.036, 0.038 respectively). The odds ratio of people with diabetes developing these complications, after considering age, sex, hypertension and obesity were 3.56, 4.57 and 5.51 (6.44 for any one of three

conditions) compared to non-diabetics (Macaulay et al, 1988; Montour & Macaulay, 1988). Results from a more recent retrospective study in Kahnawake showed an improvement over time in incidence rates of diabetes for both males and females where the numbers of newly diagnosed cases from 1985 to 1997 were compared each year (Jacobs-Whyte et al, 2002). The number of men diagnosed with type 2 diabetes decreased from 7.1 per 1000 per year in the first time interval (1985-1997) to 2.5 per 1000 per year ten years later. Prevalence rates have remained stable since 1991 where age-adjusted prevalence for men was 6.5 percent for men and 5.9 percent for women in 1997 (Horn et al, 2004).

2. Primary Prevention

Primary prevention, by definition, is the prevention of disease by targeting or controlling modifiable risk factors in a population. Risk factors associated with increased diabetes include obesity, physical inactivity, and, to some extent, certain dietary factors. Since these factors are related to lifestyle habits that start early in life and often continue into adulthood, targeting children and youth is necessary. Older elementary schoolchildren are especially ready, developmentally, to establish healthy habits, especially if interventions involve skill building and family involvement (Story et al, 1999). Diet is a key target in both obesity and diabetes prevention, and school-based programming is a common avenue for intervention.

Lytle and Achterberg (1995) examined programs that targeted eating habits of children through school-based nutrition education, family-focused interventions, media messages and community-based interventions. These authors reviewed literature on programs that included outcome evaluations in peer-reviewed journals. The criteria they set for inclusion in their review were: that publications are more recent than 1980; that programs be conducted in the United States; that they focus on primary prevention; that they set the goal of behaviour change as an outcome; and that they include a control group. Six elements were identified as being part of successful programs: 1) behaviour-based and theory-driven approaches, 2) family involvement in elementary-aged children's programs, 3) middle-school children assessing their own health habits, 4) intervention in the school environment, 5) intervention in the larger community, and 6) intensive

instruction time. Unfortunately, there are only a small number of rigorously evaluated school nutrition programs that provide this evidence. More published outcome evaluations are needed.

Stewart (2001) summarized Lister-Sharp and colleagues' systematic review of publications containing evaluations of school-based health promotion in order to determine the effectiveness of such programs directed a school-aged children and youth. Few studies existed that met the inclusion criteria and they were of variable quality. All were controlled with a comparison group or before-and-after design but only two out of five randomized controlled trials were considered adequately powered. Five studies focussed on food and nutrition outcomes. Where healthy eating policies were implemented, healthier foods choices were observed within the school environment but these changes were not seen outside of school. Improvements in lipid profiles, food intake and nutrition knowledge, when measured, were shown for some but not all trials. There is little evidence on effectiveness of school-based interventions in terms of health behaviour as an outcome. Despite inconsistencies and limitations in evidence, health promotion strategies have showed promise. Results of the comprehensive review lead the author to recommend that multifaceted approaches be used including classroom education, changes to the school environment and family/community participation. The methodological issues of evaluating simultaneous interventions need to be addressed through further research.

The success of primary prevention programs in Aboriginal communities requires additional attention to community participation and ownership. It has been deemed essential to the success of interventions that community members be involved in all phases of planning, implementation and evaluation (Davis & Reid, 1999; Hood et al, 1997; Macaulay et al, 1999). It is only with this participation that primary prevention strategies will meet the specific needs of the community with cultural, social and geographic relevance. These considerations are especially important when researchers from outside the community are involved in measuring and interpreting program outcomes.

3. Primary Prevention Programs

Pathways is a primary prevention project that was initiated in response to high rates of obesity among American-Indian youth. It was developed through collaboration among four universities, six American-Indian nations, and nine elementary schools. Pathways is currently evaluating three school-based interventions: classroom curriculum, family education and school food service as a clinical trial on obesity prevention. Although the project was not initially designed to be participatory, the research team adopted this model and realized the benefit and necessity of community member and tribe leader support (Davis & Reid, 1999).

As part of a formative assessment, perceptions and beliefs about food behaviours were sought from children, caregivers and food service personnel to inform subsequent interventions in the schools, homes and community (Gittelsohn et al, 2000). Key food-related behaviours identified using qualitative and quantitative methods included an abundant intake of high-fat, high-sugar foods in children's diets and a limited availability of healthy choices. These findings informed the development of culturally appropriate health and nutrition promotion interventions in the school setting. A three-year healthy eating and physical activity curriculum was developed for third, fourth, and fifth grades which targeted the identified risk areas, with lessons on choosing lower fat, lower sugar food items, thereby increasing nutrition knowledge of students. Interventions into food service included training of food service workers on the preparation, selection and service of healthier choices to students at school meals. The sources of competitive (low-nutrient) foods identified in the schools and at home were also targeted for intervention, by means ranging from providing teachers with healthy food to use as rewards in the classroom to providing families with education on key health concepts and strategies for implementing them in the home.

A consistent finding among interviews with caregivers and foodservice workers was the reinforcement of rules regarding food waste. Past concern about food shortages tended to result in beliefs and values that translated into messages to consume more than is satisfying. Modifying food intake while respecting these beliefs was addressed by providing children with strategies such as paying attention to when they were full, saving and sharing foods, and serving themselves smaller portions. The serving of the healthiest

options for second helpings was a policy change in foodservice that respected the staff's desire to feed the children well (more) and the intervention goal of improving eating habits and preventing overweight. When children requested more food, fruits and vegetables, plain bread and low-fat milk were the only options. The study goal of reducing the rate of body fat gain in children receiving intervention was not realized. Although efforts to provide health-related knowledge and change the school food-service environment were successful, they did not result in changes to energy intakes or physical activity levels. Without a shift in energy balance (consuming fewer calories and/or expending more calories), no weight or fat loss was achieved (Caballero et al, 2003). It would be interesting to know the intakes of vitamins and minerals and perhaps fibre of these children since authors conclude that micronutrient intakes were maintained while fat intake was reduced.

The Child and Adolescent Trial for Cardiovascular Health (CATCH) evaluated effectiveness of school and family-based interventions to reduce cardiovascular disease risk in non-aboriginal communities. Numerous interventions were implemented involving physical activity promotion, food service changes, and community activities. This multi-site, randomized controlled field trial compared 56 intervention schools with 40 control schools and studied changes in nutrient levels in a cohort of children from third to fifth grade. After intervention, students in experimental schools had significantly lower intakes of energy, fat, saturated fat, and protein than students from control schools, as detected with single 24-hour recalls (Lytle et al, 1996). This suggests successful short-term modification of eating and physical activity habits within the school environment. More recently, long-term results suggest that changes in healthy eating behaviours made in elementary school can be maintained into adolescence (Nader et al, 1999). Dietary changes found in follow up of the CATCH cohort three years later included decreased fat intake, saturated fat intake and decreased energy intake that remained lower than in control subjects. These changes represent the difference between two 24-hour recalls conducted three years apart (grade 5 and grade 8). This long-term finding cannot be reinforced by body mass index (BMI) as anthropometric measures were not taken. However, the intervention students were found to be more active (according to self-

report) than control students. Vitamin and mineral intakes were not evaluated in this study, which leads to a question about potential low intakes of several nutrients.

3.1 Primary Prevention of Diabetes in Aboriginal Communities

Several primary prevention programs are ongoing in North America. Most relevant to this study are those being conducted in Aboriginal communities in Canada.

Examples of community-based primary prevention of Type 2 diabetes in Canadian Aboriginal communities include the Sandy Lake Health and Diabetes Project and the KSDPP. The programs are similar in that both follow the principles of participatory research, have strong university affiliations, and are research sites under the Canadian Institutes of Health Research's Interdisciplinary Health Research Team (Macaulay et al, 2003). The Mohawk community of Akwesasne has also initiated a program of awareness and education of diabetes prevention.

The Sandy Lake Health and Diabetes Project began in 1991 with the goals of determining the prevalence and risk factors for diabetes in this remote Northern Ontario community, and developing a culturally appropriate strategy for primary and secondary prevention of diabetes and its complications. The four components of the Sandy Lake School Program are: classroom curriculum, family outreach, peer activities, and changes in the school and community grocery store. Impact was measured using health knowledge and behaviour questionnaires which showed that nutrition knowledge increased after one year of intervention, as did confidence and intention to choose healthy foods. Results from 24-hour recall data showed a decrease in fat intake and an increase in fibre intake. The evaluation results are only published on their website (Sandy Lake Diabetes, n.d.), making it unclear how positive results can be attributed to diabetes prevention efforts, especially since no control group or community was involved. Also, it appears that only one day of intake data was collected which does not represent usual intake. This community continues to address individual and common influences on food choices and physical activity behaviours as means to prevent diabetes.

In light of the high diabetes rates in Kahnawake, it was viewed as important for children in this community to develop healthy eating and physical activity routines early

in life so that they would be less likely to develop diabetes in adulthood. A prevention program focusing on elementary school children, their families and the entire community was initiated in 1994. Beyond the initial response to community direction, the program continues to follow the ideals of community-driven research and enables community participation in all aspects of intervention and evaluation.

In partnership with education authorities on the territory, two noteworthy initiatives were undertaken. In order to promote healthy eating within the schools, the pre-existing nutrition policy was reinforced. The policy promotes healthy choices and lists foods that are not to be sold, distributed or consumed in the schools. A second initiative focuses on health promotion, via a curriculum that is taught in the schools. Lessons designed specifically for audiences in each grade (one to six) incorporate cultural components and traditional learning styles. The curriculum provides a hands-on, interactive environment for learning about diabetes, healthy lifestyles and the human body (Macaulay et al, 1997).

KSDPP has implemented literally hundreds of intervention activities, many of which are community-wide and family-oriented, such as various promotional events conducted within the school. These interventions are guided and implemented according to theoretical models for health promotion and have been evaluated in those terms (Macaulay et al, 1997). Impact has been measured by examining the relationship between exposure to the program and obesity, physical fitness and healthy eating. Taking the same anthropometric, fitness and dietary measurements from different cross-sections of children indicates change over time. Results from questionnaires determined that KSDPP programs influenced self-efficacy and parental support for healthy lifestyles. It was also determined that more healthy food choices were available within the school environment and at community events (Macaulay et al, 1997). More recent results measuring long-term change in eating and activity behaviours are mixed. From food frequency questionnaires it was found that while key high-sugar and high-fat foods were eaten less often, fruit and vegetables were eaten less often as well. Anthropometric data compared to a 1994 baseline cross-sectional survey show an increase in BMI in 1999 and 2002 and a percent of overweight children well above the provincial average. This rate of overweight has increased but not beyond the secular trend reported in the United States

(Ing, 2003). Dietary results based on 24-hour recall data for 1994 and 1998 are summarized in more detail in section five of this chapter.

The mixed results and the multiple, simultaneous interventions make it unclear whether the changes detected are caused by any specific diabetes prevention efforts. In practice however, the multi-component approaches are considered the most promising when compared to single interventions that occur in controlled conditions (Stewart, 2001). Furthermore, these multiple approaches and the overall shape of the research studies follow the community interests using an active participatory process considered essential to KSDPP existence.

In the neighbouring Mohawk community of Akwesasne, the diabetes prevalence rates were as high as they were in Kahnawake with the same associated complications. As awareness increased of this serious issue, a coalition of informed and influential people was developed to jointly work toward improvement in well-being. The health of children was of specific concern and planning was directed toward future generations (Hood et al, 1997).

Harvey-Berino et al, 1997, studied Mohawk children from Akwesasne (n=279). Energy and nutrient intake from single 24-hour recalls were compared among grades and genders. No significant differences were found in macronutrients except for higher protein intake in boys than girls. Results were compared to recommendations for children in the United States. Energy, fat and saturated fat intakes were higher than recommended, whereas protein, carbohydrate, cholesterol, fibre and sodium, which were also studied, were not taken in greater than recommended amounts. Food preferences, nutrition knowledge, attitudes and behaviour were also measured in these Mohawk children and multiple comparisons were conducted to determine which variables explained most of eating behaviour differences. "Good" eating behaviour was attributed more to food preference than nutrition knowledge. The authors contend that healthy eating intervention should go beyond nutrition education because nutrition knowledge does not predict food choices. They conclude that involving parents and community in modeling healthy eating practices and repeatedly exposing children to healthy foods will impact food preferences in the early years which will ultimately influence food choices.

4. Investigating Nutrition

The choices of methodology and research objectives correspond with the overall goal of a nutrition study. In this section, the relevant dietary assessment methods and approaches will be introduced including the 24-hour recall method of determining food intakes, the use of reference standards for evaluation of nutrients and food groups, and analysis of the contributions foods make to overall intakes. Used together these methods have the ability to provide a good description of the diets of a group. Also included in this section is a summary of literature to guide a choice of nutrient indicator. Low intakes of fibre and key vitamins and minerals have been found in certain groups of Aboriginal children suggesting a direction for nutrition assessment but results require careful interpretation.

4.1 24-Hour Recall

Dietary assessments may be conducted for different purposes such as: to provide a basis for dietary counselling, to investigate diet-disease relationships and to estimate nutrient intakes. The quantitative methods such as food recall interviews serve these purposes. One common method of dietary assessment is the 24-hour recall interview. It is conducted to determine the respondents' food intake over the entire preceding day. The 24-hour recall is often chosen because of its relative ease and speed for the interviewer. The standard format, its suitability for low literacy and the element of surprise may contribute to the respondent's compliance and acceptance of the method. Although one recall does not represent the habitual intake of individuals, when used to estimate the mean intake of a group, it is considered reliable and has been validated for use with children (Emmons and Hayes, 1973). It has been shown that, in general, increasing the number of assessed days serves to decrease the random error or increase the precision of food intake estimates (Gibson, 1993) but that the number of days measured depends on the objectives of the study, feasibility (i.e. easing the burden on subject may be a high priority), and variability in the diet. Disadvantages of the 24-hour recall method are that errors may be introduced because of its reliance on the respondent's memory and the ability to report accurate portion sizes, i.e., subjects may

intentionally over or underreport their intake. These sources of error are the same for children's recollections of their intake. Error can be reduced by using standardized techniques, trained interviewers, visual aids, and appropriate probes for eliciting responses. Children may have less knowledge of food ingredients, preparation methods and amounts; however, at ten years of age children should report their own intake for two reasons: 1) children at this age generally have adequate cognitive ability; and 2) parental recalls are increasingly inaccurate as children make more independent food choices (Crawford, 1994). The type of portion-size measurement aid used does not make a significant difference in estimates of food quantity (Cypel et al, 1997).

4.2 Adequate Intakes

The dietary assessment methods chosen dictate the analyses that are possible. The single 24-hour recall method does not allow for valid assessment of individual dietary intakes, although it does provide accurate group means (Beaton, 1982). Therefore, assessment of individual intakes according to reference values based on a single day of intake will yield inaccurate results. Even when considering intakes averaged for a large group, intra-individual variation is unsuitably large for determining adequacy of intake. For instance, use of the Dietary Reference Intakes (DRIs) for the assessment of a group's nutrient intake allows for the proportion of a group with inadequate intakes to be estimated. This is only appropriate, however, when a recognized adjustment for within-person variation has been done using replicate measurements collected from a sub-sample of the group under study (Barr et al, 2002). For several nutrients, an adequate intake (AI) has been established that approximates the amount of a nutrient sufficient to carry out one or several of its key functions. The AIs indicate probable adequacy but cannot be used to indicate levels of inadequacy because of the limited data on which they are based.

4.3 Nutrient Intakes of First Nations Children

The intent for this section is to summarize a few studies of the diets of Aboriginal children where nutrients of concern have been identified. Groups under study differ in

ancestry, age range, traditions and dietary practices, making comparisons problematic. Differences in study design and nutritional assessment methods preclude generalizable conclusions about the diets of Aboriginal peoples. However, these studies have consistently shown low levels of certain nutrients. Findings regarding nutrient inadequacy should be interpreted with caution as the conclusions often extend beyond what is appropriate given the limitations of dietary assessment methodology.

First Nations children of two communities in northern Alberta were studied to determine their nutrient intakes and the contribution of the lunch provided by the school lunch program in one of those communities (Wein et al, 1993). Four 24-hour recalls were performed per subject, providing a good estimate of usual intake allowing for assessment of nutrient adequacy for most nutrients (Wein et al, 1993). Intakes of nine nutrients were assessed and inadequacy of intake was defined as mean intake below two-thirds of the 1990 age and sex specific Recommended Nutrient Intakes (RNIs), on the basis that RNIs exceed the actual needs of most individuals. Of concern were the low daily intakes of calcium, folate, zinc and vitamins A and D, with many individuals consuming less than two-thirds of the RNI for these nutrients. Nutrient densities (nutrients per unit of energy) were compared as a measure of diet quality. After adjusting for energy intake in this way, Aboriginal children's diets in the community with the school lunch program were higher in carbohydrate, sugar, dietary fibre, calcium, potassium, zinc, folate and vitamin D while fat intake was lower than for those without the lunch program. When these Aboriginal children were compared to non-Aboriginal children in the same community, the Aboriginal children showed significantly worse intakes of fibre, calcium, phosphorus, riboflavin, folate and vitamin D. This finding reflects differences in foods eaten outside of school. The school lunch improved the nutrient density of the diets as it contributed less than one third of energy but more than one third of these same nutrients (e.g., fibre 42%, calcium 41%, folate 34% and vitamin D 43%). The non-Aboriginal girls obtained a greater percentage of their nutrients from foods eaten at home. Authors acknowledge the limits placed on their findings of low folate and vitamin A intake because analytic data on food composition of these nutrients is very limited. They also noted that the variability of intakes by individuals from day to day make dietary data somewhat unreliable for vitamin A.

In 1997, Ballew et al. reported the findings of the Navajo Health and Nutrition Survey conducted in 1991-1992. The purpose of the nutrition study was to assess nutrient intakes and the main sources of nutrients of participants over the age of 12. Single 24-hour recalls were conducted with 947 participants between October 1991 and December 1992. Overall, the survey indicted that key nutrients were consumed in less than recommended amounts by some population subgroups. Inadequacy was not considered per se as the RDA exceeds the requirements of most people; however median intakes were compared against the age and gender-specific RDAs. Results from the youngest age group (12-19 year olds) were reported separately. Among males and females in this age group, median intakes of vitamin A, folate, and calcium were below RDAs while iron was below the RDA for females only. The use of median intakes for comparison accounts for the fact that the mean is more influenced by extreme values. In the case of nutrients noted above, the mean values were pulled above the median values by high intakes, resulting in intake values further below the RDA than if the mean was used. For vitamin A, with one 24-hour recall, the median will be low but the potential for a weekly dose of food concentrated with vitamin A should not be ignored.

In an effort to characterize the diet of Ojibwa-Cree residents in a Northern Ontario community, Wolever et al (1997a) conducted single 24-hour recalls with 718 volunteers ten years of age or older representing over seventy-percent of community residents. Analyses on macronutrients revealed that mean saturated fat intake was above the recommended level at 13%, simple sugars contributed 22% of energy intake, and dietary fibre intake was low at 11 grams per day. Intakes of selected micronutrients were also low with high proportions of the population at risk of consuming inadequate amounts of vitamin A (77%), calcium (58%), vitamin C (40%) and folate (37%). Vitamin D and calcium had the highest proportion of people at risk at 36% and 73%. Micronutrient intakes in absolute amounts were compared against age and sex specific Recommended Nutrient Intakes (RNIs) using the probability method to determine inadequate intakes. Beyond their recognition that collecting only single 24-hour recalls results in variable means, the authors do not rationalize how they are able to quantify the extent of nutrient inadequacy. With only one day of intake data per person, even intakes for a group should

not be used for this purpose so conclusions must be interpreted as overestimates of inadequacy.

Brown and Brenton, in 1994, reported the results of their dietary assessment of elementary students in fifth and sixth grade from the Hopi reservation in Arizona. Three-day food records were collected from 96 participants. Macronutrients as a percentage of energy intake reported were 35% fat, 48% carbohydrate, and 17% protein. The mean intake as a percentage of Recommended Dietary Allowance (RDA) was considered for all analyzed vitamins and minerals. Except for vitamin D, calcium and zinc, all nutrients exceeded 97% of RDA. The mean intakes for these nutrients represented 36%, 73% and 77% of the RDA, respectively. The percents of RDA for vitamin C, folate and iron were 244, 146 and 172. Low calcium intake was attributed to a historically higher prevalence of lactase deficiency among Native Americans, but no study demonstrating this prevalence was cited.

Berti et al (1999) evaluated the dietary intake of Baffin Inuit. This study was conducted to determine the contribution of locally harvested food to nutrient intakes of 164 subjects aged 3 to 18. While the diets of this Inuit population may be less comparable to the diets of Aboriginal children mentioned so far, nutrients of concern were the same. For children in the 10-15 year old age group for whom 3 days of data were collected, vitamin A and calcium were low. The mean and variance of requirements is unavailable for vitamin A and calcium, so adequacy of these nutrients was expressed as a mean percentage of the RNI. Mean intakes of both these nutrients were below the recommended level. The means were used as they were presumed to be closer to true intakes than the medians.

Story et al (1986) collected food questionnaires and a series of three 24-hour recalls from grades 8-10 students of a Cherokee high school. The purpose of this study was to determine energy and nutrient intakes but also to compare food intake practices between students considered lean and fat according to anthropometric cut-offs. Although there were some sex differences, iron, calcium, vitamin A and vitamin C were considered to be low compared to 1980 Recommended Dietary Allowance (RDA) values. When categorized as lean and fat according to triceps skinfold measurement, there was no difference in energy or nutrient intakes between individuals in the lower tertile of skinfold

versus those in the upper tertile with the exception of higher vitamin C intake in leaner students.

4.4 Contribution of Nutrients

Investigating contribution to nutrient intake by food types or groups enables the identification of important sources of nutrients that are relevant to the study participants. Subsequent nutrition interventions including the development of educational materials can then use knowledge on which foods are currently providing the most of a specific nutrient to further promote those foods that people recognize and find acceptable (Block et al, 1995). Comparing these food group contributions at different time points can reveal shifts in food choices, which is useful for evaluation and intervention purposes. The calculation of the contribution of nutrient intake from food groups has been recommended by Willet (1990) as an "...intermediate solution to the problem posed by the complex interrelationships among foods". It has also been suggested that using food grouping techniques results in a better characterization of usual intake when using one day of intake data. This is because variation in food group use may be less than variation in nutrient intake. Moreover, it has been demonstrated that change in food group use over time may be detected when no significant variation in nutrients exists. Similarly, different populations with comparable nutrient intakes may be consuming very different kinds of foods (Brewer et al, 1987).

Lytle et al, 2002, evaluated the diets of children from Apache, Lakota, Navajo and Tohono O'odham [Native American] communities. This was done as part of the Pathways obesity prevention study. The intakes of 80 third grade students were analyzed for nutrient content and food contributions to mean energy and fat intakes. This was done separately for foods eaten at school, outside school and all times combined. Authors concluded that nutrient intakes met or exceeded RDA and DRI values. Since only one day of intake was collected and there was no mention of adjusting for usual intake, any conclusions from DRI comparison should not be considered accurate. In addition, the recommended intakes cited for calcium, vitamin A, folate and fibre are for four to eight year old children whereas the study population included nine year olds as well. By

considering only the estimated requirements of the younger life stage group, the conclusion that there is no evidence of deficient intakes is mistaken.

In terms of food-level data, foods were rank ordered and the top 10 contributors of energy and fat were reported, although the method of grouping foods into categories was not described. For boys and girls combined, the foods that provided the highest proportion of their energy were breads (6.2%), 2% milk (6.1%) and sweetened beverages (6.1%). Also in the top ten were: pizza (5.3%), beef dishes (4.5%), fruit (4.3%), and 1% milk (3.9%). Pork and burgers each contributed 3.2% and pasta dishes 3.1%. The top fat contributors were many of the same groups. The beef dish group was the number one group (7.0%), 2% milk was second (6.6%), pork and pizza each contributed 5.6% and to round out the top five fat contributors, burgers provided 4.9%.

The results of the school versus out of school nutrients and foods illustrate how food-level data can highlight qualitative differences in food choices where nutrient differences are not detected. Nutrients obtained from foods consumed in school were not significantly different than those obtained from out of school (after energy-adjustment) despite different food choices. For example, milk provided the highest total energy of school foods whereas sweetened beverages provided the most energy at home.

It is of concern when poor food choices appear as top contributors of energy [and macronutrients] thereby displacing more nutritious choices. It is interesting, however, that the authors evaluate the children's diets and the success of the school lunch program based on micronutrient intakes whereas their suggestions for improving the diets of these children focus on way to decrease energy and fat intakes which were not found to be high. Perhaps a beneficial analysis would have been to determine the contribution of foods to nutrients so that sources of vitamins and minerals of concern could be highlighted.

Berti et al (1999), grouped market and traditional food items in order to compare their relative contributions to the energy intakes of 164 Baffin Inuit children and adolescents. The percentage energy, vitamin A and calcium contribution of food groups were reported as these nutrients were consumed in the lowest amounts relative to recommendations. Market food groups included grains and tubers, mixed dishes, dairy products, meat and meat alternatives and fruits and vegetables. A low nutrient dense

(LND) group included items such as condiments, soda, sugar, candy and chips. Traditional food groups were marine and land mammal groups, fish, plants and fowl and egg groups. The LND foods were of concern because of the high proportion of total energy contributed by this group. Foods from market and traditional categories contributed Vitamin A, whereas calcium was derived primarily from market foods. An interesting and useful finding from the contribution analysis is the difference in calcium sources observed for different age groups. For children under six years, dairy products provided approximately 50% of mean calcium intake. Dairy product contribution to calcium intake dropped to 23% in 7-9 year olds and further decreased for older age groups (10-15 and 16-18 years). In these older age groups, girls derived more of their calcium from dairy products than boys (17-20% for girls and 7% for boys). So, older children were meeting a smaller proportion of calcium requirements than younger children, which can be explained in part by the smaller contribution of dairy products to overall calcium intake.

Ballew et al, 1997, analyzed the sources of several nutrients that have been known to be low previously in the Navajo people of Southern United States. The percentage of total nutrient intake contributed by various food groups was reported. Foods were grouped according to the Food Guide Pyramid with more specific subgroups including pastries and desserts, legumes, and snack foods such as chips and popcorn. Mixed dishes were included in groups according to the main ingredient and were not split into component parts. Despite the contribution of fruits and vegetables to total intakes of fibre (25%), vitamin A (34%), vitamin C (57%) and folate (31%), they were consumed less than twice per day per person making the overall intakes low. Likewise, dairy products which were consumed less than once per day yet contributed 26% of total calcium. Traditional sources of calcium i.e., ash in tortillas prepared from cornmeal, were not reported frequently enough to make up for low intakes reported. Recommendations for improving the nutrient intakes considered the existing food consumption patterns and other limitations. Ready-to-eat cereal, cost permitting, was suggested as a non-perishable means of getting many nutrients; buying canned fruits and vegetables and fruit juices were thought to be affordable, nutritious, and shelf-stable alternatives to fresh; and dried

milk plus traditional sources, i.e., ash in cornmeal were suggested as means to improve calcium intake.

4.5 Food Guidance

The recommended diet for school-age children is one that is based on Canada's Food Guide to Healthy Eating (CFGHE). This guide provides recommendations for healthy eating that apply to adults and children as young as two years of age. For children, the focus for eating should be on eating a variety of foods from each of the food groups, making food choices that optimize nutrient intake, eating complex carbohydrates predominantly and matching amounts of food consumed with needs for growth and development (Chicago Dietetic Association, 2000). CFGHE was developed in 1992 based primarily on recommendations made by Health and Welfare Canada's Scientific Review Committee. It was designed to be a user-friendly summary of the desirable characteristics of a healthy diet. Insofar as the messages are relatively general, the guide is meant to be for healthy people over the age of four. It can, however, be adapted for two to four year-olds such that servings are more appropriately sized. Adaptations may also be necessary to ensure cultural relevancy. Various First Nations groups have taken the messages provided in the guide and designed their own food guides with more meaningful representations of foods.

CFGHE servings have recently been used as an indicator to evaluate the intake of a sample of adults and adolescents in the Food Habits of Canadians study. Starkey et al (2001), compared food intake of 1,543 randomly selected adults and 178 adolescents in the sampled households with Canada's Food Guide to Healthy Eating food groups. Food intake data were collected via 24-hour recalls conducted by trained interviewers. Intakes of all CFGHE groups were considered either marginal or low when the mean numbers of servings were compared against recommendation ranges. When the proportion of individuals eating below the minimum number of servings was calculated, it was shown that over 50% had not met the minimum amount for milk products, vegetables and fruit and meat and alternatives. This finding was in line with available data from provincial surveys that discovered poor intakes of calcium, folate and iron—nutrients provided by

these groups. Other foods not included under the main categories contributed 30% of fat intake for most age and sex groups with the exception of 18-34 year old males who derived 25% of their energy from other foods.

Starkey and Kuhnlein (2000) used CFGHE groups as a tool for evaluating the intake of Montreal food bank users. Their intention was to use a familiar resource that was applicable to diverse audiences. A sample of 428 men and women was randomly selected from 20 food banks. They translated intake data from four 24-hour recalls into CFGHE portions that were used for the Quebec Nutrition Survey. The mean number of CFGHE servings per day was determined as well as the percentage of individuals with intakes below the recommended ranges. Only 21% of this study population obtained the recommended two servings of milk products (mean intakes were 1.3 and 1.2 servings for males and females respectively). Approximately 49% of this population was consuming the minimum vegetable and fruit servings. Meat and alternatives servings were consumed in amounts below the two serving minimum more so for younger males than older (24% versus 9%) whereas for females, the proportions of under consumption were 41% and 49% for younger and older women respectively. Age ranges used were 18-49 years and 50 plus.

5. Diets of Kanien'kéha:ka Children

The diets of Kanien'kéha:ka schoolchildren have been studied twice previously with similar objectives and methodology. In 1994, the dietary study was intended as a baseline assessment so subsequent analyses could contribute to evaluation of KSDPP community-based interventions. Energy, macronutrients and sucrose intakes were evaluated and foods sources of energy and macronutrients were described (Trifonopoulos, 1995; Trifonopoulos et al, 1998). A follow up study was conducted in 1998, which compared the diets of children participating in 1994 (before intervention) to the comparable participants in 1998 (after four years of intervention). Changes in energy, fat and sucrose were measured along with food groups that indicated diet quality. Dietary intakes for both years were evaluated by use of a single 24-hour recall using identical interview techniques. All data were coded according to the University of California, Berkeley Minilist. The Minilist provides nutrient values for groups of similar foods that

are categorized based on how alike they are in nutrient content. e.g., pears and apples are in one group. The Centre for Indigenous People's Nutrition and the Environment adjusted this American nutrient database to meet Canadian fortification standards (Jimenez et al, 2003).

In 1994, children consumed enough energy for growth according to the reference standard and had a level of fat consumption below the United States standard of less than 35% calories from fat. Several top contributors to fat intake were also top contributors of protein, e.g., beef and milk. The study reported that sugar intake, as indicated by percent energy from sucrose, was 16.5%. This was high according to World Health Organization guidelines (1990), which state that less than ten percent of energy should come from sucrose. Sucrose has often been used as an indicator for poor diet yet it is not possible to distinguish between added and naturally occurring sources using this measure alone. Therefore, it is useful to know which foods (and beverages) are contributing to sucrose intake. It was observed that several of the top contributors to carbohydrate were simple sugars including cola as the second largest source. It was also noted that when a sugar food group was developed that included such sources as sugar in cereal, candy, icing and slush drinks, it was the second most frequently mentioned food. Vegetables were not highly preferred relative to other food items (i.e., apples, meat pie, milk, cornbread, spaghetti and pizza) and were not consumed frequently.

In 1998, sugar consumption as indicated by percent calories from sucrose was unchanged at 17.3% and the sugar group remained the second most popular in terms of the percent of children reporting eating any. This is in contrast to the increase in sugar intake in the United States from the 1989-1991 to 1996 as determined by United States' Continuing Survey of Food Intakes by Individuals (CFSII) which measured several forms of sugar except lactose and fructose (Forshee & Storey, 2001). No significant differences were found in terms of energy or fat intake between 1994 and 1998 and fat intake was close to recommended amounts for both years (Jimenez, 1999). Some changes between 1994 and 1998 intakes were detected at the level of food and food groups when means were compared across different categories. Soft drink consumption decreased in frequency and amount while fruit was eaten more frequently but in smaller amounts.

Whole milk, considered a high-fat food, was consumed less frequently; however it was consumed in higher amounts.

Recently, a secondary analysis of 1994 and 1998 data was conducted in order to examine determinants of healthy lifestyle, including a healthy diet which was defined as the top two tertiles of fruit and vegetable intake and the bottom two tertiles of sucrose intake (Adams et al, 2003). Note that the two-thirds cut offs used to indicate healthy eating did not match recommended intake levels but were meant to differentiate between diets for comparison to other variables. Data from both years were first combined to examine the relationships among various lifestyle variables (i.e., television viewing and physical activity). The high diet quality indicator was found to be significantly associated with less television watching and more physical activity. The two years were then compared to find differences corresponding with intervention activities. No changes in diet were detected nor was body mass index (BMI) significantly different between 1994 and 1998. A closer examination of sucrose revealed sugar beverages were the major source of sugar for both years. This highlights the value of looking at foods in addition to nutrients, in order to focus interventions on foods that will potentially make a difference to nutrient intakes.

These results have been useful in providing KSDPP the tools to improve the diets of Kanien'kéha:ka children. The 1994 and 1998 studies did not consider micronutrients in their analysis, nor did they attempt to determine the food sources of micronutrients, especially nutrients suspected to be low. Such analysis would provide additional information for KSDPP intervention planning, and would constitute a new approach to the assessment of Kanien'kéha:ka children's diets.

6. Anthropometry of Kanien'kéha:ka Children

Anthropometric measurements including height and weight have been collected periodically from Kanien'kéha:ka children as part of KSDPP evaluation since the program was initiated. Changes over time have been evaluated in a similar manner as dietary change by comparison of cross-sectional data. Where overweight is defined as being beyond the 85th percentile of body mass index (BMI) distribution, the percentage of

overweight children has increased. In 1994, the percentage of overweight Kanien'kéha:ka children was 19%. In 2002, this percentage increased to 25%. Secular trends observed in 9 year-old Quebec children also reveal an increase in percent of overweight, however for comparison, the 1999 percent of overweight children was only 8.9% (Ing, 2003).

III Purpose

1. Rationale

Results from this study will serve to characterize the diets of Kanien'kéha:ka schoolchildren in grades 4-6 in terms of food choices they are making, and how those choices influence their nutrient intakes. This will provide a means to guide the ongoing KSDPP diabetes primary prevention efforts and will contribute to planning relevant nutrition intervention activities.

2. Objectives

For data collected in 1994, 1998 and 2002 the objectives are as follows:

- To describe nutrient intakes including macronutrient and micronutrient intakes and to compare means for absolute intakes and energy-adjusted intakes for three years of data to identify significant differences.
- To describe the frequency of use of specific foods and foods grouped by their similarities in order to see current patterns and shifts in choices over time.
- To describe food intake in terms of Canada's Food Guide to Healthy Eating servings and determine if change has occurred from previous years.
- To determine the contributions of foods and food groups to energy and nutrient intakes comparing three years of data.

IV Methods

1. Approval Processes

1.1 KSDPP Code of Research Ethics

In accordance with KSDPP Code of Research Ethics, researchers are required to follow an approval process that ensures full participation and acceptance of a research project and protocol by the community (KSDPP, 1997). In addition to conducting competent academic research, investigators are obligated to ensure that the project is culturally relevant to the Kahnawake community. In general, the code offers direction for participatory research projects, the principles of which are: collaboration between researchers and researched; two-directional sharing of knowledge and education and; production of local knowledge within the community (Macaulay et al, 1998). Specifically, the code requires collaboration on the design of the study including potential analyses as well as how, and when the results are disseminated. For this project, the Community Advisory Board (CAB) and the Kahnawake Combined Schools Committee gave ethical approval after they were presented with the proposed study. CAB consists of 20 volunteers representing different sectors within the community. It was created so that community members would have representation within KSDPP and its functions. Monthly meetings to oversee projects, influence decision-making and give feedback ensure that the needs of the community are addressed. Preliminary results were presented at a Community Advisory Board meeting in order to keep members informed and to seek feedback. Final results were also presented at a CAB gathering.

Ethical approval was also granted from the Human Ethics Review Committee of McGill University (see Appendix A).

1.2 Parental Consent and Confidentiality

Active parental consent was obtained for every child. A presentation letter that accompanied the consent form provided a summary of the study and the procedures to be

followed (see Appendix B). It noted that there were no direct risks or benefits to participation and all study data would be kept strictly confidential. Consent forms were distributed at school and were sent home with children. Presentations were made to the teaching staff at both schools before the consent forms were distributed and radio presentations promoted awareness of school data collection. Each element of the data collection, including the dietary interview, was explained along with its relevance to the school, parents and the children. Children were encouraged to return the form whether or not consent was granted. The children for whom parents did not return forms were assumed not to have parental consent and were not included in the study. No attempts were made to follow up with the parents, out of respect for their preference and privacy. This follows the philosophy of KSDPP research and the wishes of CAB members.

All people participating in KSDPP were guaranteed confidentiality. This included students, parents and teachers. Identification numbers were assigned to children and names were not included on data forms. Only the project coordinator had access to name coding files, and individuals coding and cleaning data only worked with data after name identifiers had been removed. At the request of CAB made at the beginning of the project, data from children in both schools was combined and the two schools were not compared. According to the code of research ethics, all data belong to the community and should always be presented in grouped format.

2. Study Population and Design

This is a cross-sectional study with data collected at three distinct points over eight years: 1994, 1998 and 2002. The population studied and the research design was identical for all three years. The study population was composed of students in grades four, five and six from two elementary schools in Kahnawake. Since 90% of school-aged children in Kahnawake attend either Kateri or Karonhianónhnha (Kanien'kéha immersion) schools, a representative number of children in this age range in the community were studied. There was no sampling and there were no inclusion or exclusion criteria, per se. All students with parental consent participated in the study. Potential differences between students who participated and those who did not was not considered in this study because it would be inappropriate to investigate characteristics of

students for whom consent was not given. The participation rates are high so the total population is well represented by those who participated in the study. It is possible that some children were included in two years of samples if they spent four years in grades 4, 5 and 6 and thus were captured in the grade four in one sample and grade six in the next. The finite sample correction was not used in this study.

Dietary interviews were conducted in coordination with other data collection activities. During the same time period, the KSDPP research team took anthropometric measurements, administered in-class questionnaires for knowledge, perceived parental support, and 7 day food frequency and physical activity, facilitated interactive computer-based activity questionnaires and conducted shuttle run fitness tests. All elements of data collection were completed in the fall of 2002. The author, in cooperation with the KSDPP evaluation team, school principals and classroom teachers, coordinated dietary data collection. Using class lists provided by the schools, students for whom consent had been received were interviewed. Completed dietary recall forms containing identification numbers and birth dates were checked against the master list before personal identifiers were removed.

3. Twenty-Four Hour Recall Interview

The author, L.S, interviewed participating children. To ensure consistency of methods she received specific training from Mary Trifonopoulos, M.Sc, P.Dt. who collected baseline data in 1994. Mary also trained Michelle Jimenez prior to the follow-up assessment conducted in 1998 to ensure consistency of methods. As in 1994 and 1998, a standardized protocol similar to that of Gibson (1993) was followed. Children were taken out of their classrooms individually during regular instruction time (excluding physical education, Kanien'kéha, and recess and lunch periods) to a quiet area nearby that was set with a table and two chairs. Children did not know in advance when they would be interviewed, although efforts were made to ensure teachers knew when to expect interruptions. When children were absent, interviews were conducted when they returned. During the interview, attempts were made to establish a rapport with the child and make them feel comfortable to ask questions or continue the interview. It was made especially clear that the information provided would be anonymous and confidential and

the importance of providing accurate and detailed information was emphasized. Detail was sought by asking the child to remember and report everything they had to eat and drink the previous day, starting when they woke in the morning and ending when they went to bed at night. To assist recollection of meals and snacks, time and place questions were asked about the day being recalled. Specific descriptions and amounts were then obtained and confirmed through a final review. Food description included, if possible: cooking methods, brand names, and food ingredients. Portion size estimates were obtained with the aid of graduated serving dishes and measuring implements (cups, spoons, and ruler). Throughout the interview, friendly but determined probing that was not leading or judgmental was used to enhance recall. Interviews took an average of 20 to 25 minutes including time spent escorting students to and from their classroom. All interviews were completed before the end of October, when intake was expected to be atypical because of Hallowe'en. See Appendix C for 24-hour recall form.

4. Coding and Data entry

Data collected were coded and entered into a database using CANDAT nutritional analysis software. CANDAT is a research oriented nutrient calculation computer program that accesses nutrient information from a database (CANDAT, 1985-2000). CANDAT was used as the data entry program and source of the nutrient database because it has a wide range of foods with available nutrient values. It is especially suitable for research because of its ability to analyze data from a large number of subjects.

CANDAT uses a food file structure that enables users to access different sources of nutrient information. The main source is the Canadian Nutrient file (CNF), a computerized database that contains data on up to 115 food components (i.e., nutrients) for each food item. Most of the values in the CNF were derived from the United States Department of Agriculture (USDA) database, Handbook No. 8. Numerous adjustments and additions have made the resource relevant to Canadian users in terms of fortification, regulatory standards and Canadian-only foods (Nutribase, 2003). At the time of analysis, McGill had added 898 codes to supplement the 4668 existing CNF codes.

The food code assigned to a food was based on a best match between descriptions on the recall with the descriptions of the foods contained in the database. The keyword

search feature provided a list of food items to choose from that contained the keyword entered from the recall. The program then provided a list of valid units specific to that food. For foods with inadequate descriptions on the original recall form, standard assumptions were made and used consistently throughout coding. New food codes were created for some Kahnawake foods for which recipes were obtained from the earlier studies. These user-defined food codes were used consistently for all children that reported eating those items.

Individual subject files were created within CANDAT that included identification number, date (and day of the week) of recall, foods, and food quantities. Subject files then underwent the validation task to ensure the food code existed and the food unit entered was applicable. For quality control, reports listing foods as entered were double verified against original recall sheets both to ensure accuracy and consistency among recalls.

In order to enable analysis across the three study periods, data collected in 1994 and 1998 was re-entered into the CANDAT database using identical methods. L.S., author, entered data with assistance provided by KSDPP. A Kahnawake community member was hired and trained in data entry in agreement with the organization's goal of recruiting local people and providing opportunities for skill development.

5. Food Group Development

The food category feature in CANDAT allows all the foods in the database to be assigned to user-defined groups based on criteria that suits the study's purpose. For each grouping scheme, a different category file is created that can be applied independently to subject intake data. Two food grouping systems or categories were used for this study, each with different purposes. The first was based on similarities of foods and is used to illustrate the contribution that various types of foods make to nutrient intakes. The second is based on CFGHE groups and enables assessment of intake in terms of the recommended servings of each group.

5.1 Similar Foods Scheme

The foundation for this grouping system is the same as for previous studies that have analyzed the contribution of food groups to nutrients. In general, categorization begins with major groups such as fruits and vegetables, meat, dairy products and grains. Sub-division is done in different ways depending on the study goals. For instance, Brewer et al (1987), investigating the contribution to fats and cholesterol of various food groups created sub-groups that differentiated between types of fat and fat content of meats, milk products and desserts. In the current study, vegetables are sub-divided based on color, (i.e., orange and green), and botanical classification, (i.e., roots/tubers and sprouts/fungi). Various forms of tomatoes (e.g., raw, sauce) are also sub-divided. Fruits are divided into citrus and non-citrus, canned, orange-coloured, and juice groups. Milk products are divided by fat content; meat products are divided by animal origin or are designated as a meat alternative; and grains are divided into cereals, breads, pasta and crackers with further differentiation according to fibre content. Mixed dishes are separated into groups based on the main ingredient of the item, e.g., meatloaf is considered a mixed beef dish, whereas lasagne is considered a mixed pasta dish.

The similar foods category was developed by adapting an existing CANDAT category file. A file containing 123 food groups defined by Heidi Ritter (2000) was modified to create a new file containing 96 food groups. The changes made to Ritter's food groups reflect differences in the populations studied and foods consumed by the study participants. Since the participants of the current study were children, the food groups containing alcoholic beverages were deleted, as was the group containing baby food products. Some food groups were deleted because no items in that group were consumed, e.g., cottage cheese, cream soups, egg substitute, calcium-enriched milk, and milks other than cow's milk. Other food groups were combined due to the lack of detail in the recall interviews. Children, for the most part, were unable to provide specific data on the amount of fat contained in natural cheese, processed cheese, and yogourt. Also, the cuts of meat were not divided by fat content. The food groups and contents of each are listed in Appendix D.

5.2 Canada's Food Guide to Healthy Eating Scheme

Foods have also been grouped in a manner that is consistent with Canada's Food Guide to Healthy Eating (CFGHE) food groups: grain products, vegetables and fruit, milk products and, meat and alternatives. Items not considered part of these groups are "Other Foods" and are grouped as such. Under each of these CFGHE headings, several sub-groups containing foods with similar density have been created to enable the estimation of intakes by serving sizes.

This grouping system was originally developed for analysis of The Food Habits of Canadians Survey data by Starkey et al (2001). The CANDAT category file used for that study was copied for this study and modified slightly. First, it was necessary to update the file to assign foods recently added to the database to the appropriate groups. Secondly, some changes were made to the original vegetable groups so that potatoes and fried potatoes could be differentiated.

6. Analysis

A selection of nutrients was made from those available in CANDAT. These nutrients of interest include the micronutrients and minerals: calcium, iron, zinc, vitamins A, C and D. Although folate was of interest, it was not possible to measure accurately. Mandatory folic acid fortification began in 1998 but nutrient intakes from all three years are based on 1997 food composition data. This would provide consistency across the three years of study but would not reflect true intakes. Energy, fibre and the macronutrients (fat, protein and carbohydrate) were also selected. Values for these nutrients were generated for each food reported in the amount consumed. Appendix F provides a summary of the nutrients selected, the units they are reported in and the percentage of food items in CANDAT for which a value is reported for that nutrient. The food categories were merged with the subject intake data and were exported along with nutrient, meal, date and food description data to SAS version 8, the statistical software. Descriptive and analytic statistics were performed. Outliers and skewness were checked before reporting means and standard deviations. Assumptions of normality, equal group

variances and group independence were met before reporting group comparisons. The remaining sections of this chapter correspond with the objectives of this study.

7. Nutrient Intake

The intakes of all nutrients selected, including energy, were determined for each year of study by sex, both in absolute amounts and per 1000 kilocalories to adjust for variation in energy intakes. The means and standard deviations of these variables were calculated using SAS univariate statistical procedures. Analysis of variance with a Scheffe's multiple comparisons test was used to establish differences among years of study. Carbohydrate, protein and fat were calculated as percentages of energy intake. The main focus of the nutrient intake analysis is to compare intake over time and not to compare to recommendations, although the adequate intake (AI) reference amounts (for nutrients that have them) provide a way of putting mean values into context.

8. Frequently Consumed Foods

The most frequently reported foods were examined, in order to characterize and describe the diets of participating children for all three years. Given the large number of food codes used for data entry, it is not feasible to report all food items consumed and preferable to combine food codes into similar groups. Based on the similar foods scheme described in 5.1 of this chapter, all food codes were assigned to a food group so it was possible to determine the frequency that each group was mentioned. The number of times foods were recorded in the recall interviews provides valuable information about the food habits of the children. Types of foods that are mentioned often represent foods that are provided or available to children. This analysis lists the regular or popular choices are but not the amount consumed.

For food group frequencies, the sum numbers of mentions for foods in each group were calculated separately for 1994, 1998 and 2002. Food items were counted each time they were mentioned even if by the same child more than once. As an extension of the diet description using food groups, the frequency of individual food items was calculated in order to illustrate popular choices or staples in the groups' diet with greater detail. For

instance, the varieties of cold cereals (including brand names), single bread products, i.e., white versus whole wheat, and varieties of soups.

Traditional food use was determined as the frequency of mention of foods considered traditional/cultural as defined for the 1994 and 1998 studies. Appendix H lists and describes these foods. Traditional food use follows seasonal patterns; therefore it is only appropriate to compare data collected at the same time of year. All three sets of data were collected in the fall from mid-September through October.

9. Canada's Food Guide to Healthy Eating Servings

Single serving sizes that approximate those suggested by CFGHE have been calculated in grams for sub-groups of similar density. For example, for the Milk Products sub-group, 175 grams of yogourt is considered one serving of Milk Products. Likewise, each of 9 fruit sub-groups has a designated gram weight representing one serving of Vegetables and Fruit. Mixed dishes containing ingredients from more than one CFGHE food group have been assigned to individual groups based on the relative contribution of those groups to the mixture. For each of these groups, the serving size weight would indicate one or part of a serving for more than one CFGHE group. For example, 200 grams of lasagne with meat is considered one Grain Products serving, 0.25 servings of Vegetables and Fruit, 0.5 servings of Milk Products and 0.5 servings of Meat and Alternatives. Serving sizes have not been established for items considered "Other Foods" so they are not part of this analysis. The CFGHE sub-groups and the serving size weights used for this study are summarized in Appendix E. The mean number of servings from each group is reported by gender for each year of study. Analysis of variance with a Scheffe's multiple comparisons test was used for each sex stratum to establish differences among years of study.

10. Contributors of Nutrients

For food group contribution analysis, the mean nutrient values were determined for each of the initial 96 food groups. These values were calculated separately for each year of data and for each sex. The contribution by foods was a product of the amount in

each food within a category and the total amount of those foods consumed. For all nutrients and energy, the food groups that cumulatively contributed over 50% of the total intake of that nutrient were determined and were ranked according to their relative contributions. The percent contribution of the top 10 foods provided an additional reference point for describing the concentration of nutrients in foods.

V Results

1. Participation

The proportion of those students returning a signed consent form for all three years was high (Table 1). For 1994, the consent rate was 89%, for 1994 it was 86%, and for 2002 it was 74%. The final participation remained high after taking into account children who were not interviewed or those who provided unusable data (76%, 79%, and 73%). No attempts were made to determine the reason for non-consent or the potential differences from students for whom consent was not received. The age and gender distribution of participating children for three years of study are shown in Table 2. The average age of participating boys and girls was 10 years, with no difference by year. The high rates combined with the high proportion (90%) of children in this age range that attend the two participating schools, demonstrate that the total population is well represented and for the intent of this study is considered a near census as there was no sampling done. A third school that serves the community has only 55 students in total and few students in grades four, five and six.

Two recalls were not coded because comments written on the original recall form by the interviewer indicated that the recall was clearly not suitable. More general comments did not provide reason to exclude a recall. Comments such as "poor memory", "probably underreporting", and "slow" reflect the nature of performing recalls in children more than the suitability of any particular recall. Recalls with notations such as these were flagged however, and two of these were eliminated from the analysis as they showed extreme nutrient values consistent with the comments.

Table 1 Number and Percent of Students Participating in 1994, 1998 and 2002

	1994	1998	2002	TOTAL
Students	216	194	207	617
Parental Consent	193 (89%)	167 (86%)	153 (74%)	513
Recalls Done	166 (77%)	153 (79%)	153 (74%)	472
N analyzed	164 (76%)	153 (79%)	151 (73%)	**468**

(% of students)

Table 2 Mean Age and Distribution of Sex and Age for Participants in 1994, 1998 and 2002

	1994		1998		2002	
age	**M**	**F**	**M**	**F**	**M**	**F**
8	3	1	2	3	1	1
9	21	28	15	20	28	18
10	27	24	26	26	19	28
11	26	28	30	21	23	20
12	3	2	6	4	8	4
13	-	-	-	-	-	1
Mean (SD)	10.1 (0.9)	10.0 (0.9)	10.3 (0.9)	10.0 (1.0)	10.1 (1.0)	10.2 (1.0)

2. Nutrient Intake

The mean nutrient intakes, including energy for three years are presented in absolute amounts for boys and girls. Table 3 and Table 4 summarize results of this analysis and show that for girls, absolute energy, carbohydrate, calcium, zinc and vitamin C intakes decreased from 1994 to 2002 at a significance level of $p<0.05$. For boys, there was no significant change over time in the nutrients tested.

With only one day of intake data, it is not possible to assess intake according to reference values. The mean nutrient intakes are shown here to describe the diets but comparing mean values to the recommended dietary allowances (RDA) and/or calculating the percent below the RDA has been deemed inappropriate (Barr, 2002). For several nutrients, adequate intake (AI) values have been set. For children aged nine to thirteen, the amount of fibre thought to be adequate for the population in question is 31 grams for boys and 26 grams for girls. The AI for calcium is the same for boys and girls and is set at 1300 milligrams. The adequate intake level of vitamin D is 5 micrograms for boys and girls. The mean intakes of Kanien'kéha:ka children are below these recommended intake levels. While it cannot be said that these children absolutely require these nutrients in the amounts quantified by the AI, it is the estimated value for a population in good health. Having a mean below this value indicates that some children may not be meeting their requirements. Suggesting an increase in intake would be wise.

Table 3 Mean Nutrient Intakes for Boys in 1994, 1998 and 2002

Nutrient	1994 n=80	1998 n=79	2002 n=79	ANOVA
	Mean (SD)	Mean (SD)	Mean (SD)	p-value
Energy (kcal)	2129 (742)	2246 (878)	2046 (816)	0.3017
Carbohydrate (g)	307 (99)	315 (109)	281 (119)	0.1303
Protein (g)	77 (42)	84 (47)	78 (43)	0.5643
Fat (g)	69 (37)	75 (43)	70 (33)	0.5379
Calcium (mg)	876 (472)	807 (443)	787 (469)	0.4421
Fibre (g)	12 (9)	14 (8)	12 (8)	0.5132
Iron (mg)	15 (7)	16 (7)	16 (9)	0.6374
Vitamin A (RE)	914 (1277)	893 (1147)	648 (433)	0.1804
Vitamin D (µg)	4 (4)	3 (3)	3 (3)	0.2312
Vitamin C (mg)	166 (149)	154 (103)	130 (115)	0.1741
Zinc (mg)	11 (8)	11 (6)	10 (5)	0.8234

Table 4 Mean Nutrient Intakes for Girls in 1994, 1998 and 2002

Nutrient	1994 n=84	1998 n=74	2002 n=72	ANOVA
	Mean (SD)	Mean (SD)	Mean (SD)	p-value
Energy (kcal)	**2229 (794)**	2090 (722)	**1888 (744)**	**0.0205**
Carbohydrate (g)	**316 (122)**	291 (102)	**271 (97)**	**0.0344**
Protein (g)	79 (35)	75 (33)	66 (31)	0.0629
Fat (g)	75 (34)	73 (33)	63 (38)	0.0716
Calcium (mg)	**896 (485)**	814 (495)	**683 (372)**	**0.0154**
Fibre (g)	13 (9)	12 (7)	13 (7)	0.5734
Iron (mg)	16 (7)	15 (6)	14 (5)	0.1049
Vitamin A (RE)	958 (1410)	732 (578)	695 (751)	0.2025
Vitamin D (µg)	4 (4)	4 (4)	3 (2)	0.0606
Vitamin C (mg)	**197 (181)**	147 (107)	**120 (80)**	**0.0014**
Zinc (mg)	**11 (6)**	10 (5)	**9 (5)**	**0.0248**

Bold indicates significance at $p<0.05$ level

For girls, absolute energy intake decreased in 2002 and therefore, several other nutrients levels decreased as well. Due to the association between energy and nutrient intakes, the nutrient density was determined for each nutrient for boys and girls separately. This calculation adjusts for energy intake and highlights whether differences in nutrient intake are due to quantity or quality of foods eaten. Adjusting in this way should compensate for errors in reporting food intake, i.e., over or under, provided that misreporting is not selective to certain foods (Flegal, 1999). When nutrient density was

compared among the three study years for boys and girls separately, no differences between nutrients were found to be significant ($p<0.05$). However, when boys and girls were pooled for comparison of nutrient density, significant decreases in vitamin C intakes from 1994 to 2002 were detected (Table 5).

Table 5 Mean Nutrient Intakes per 1000 kcal for Boys and Girls

Nutrient	1994 n=164	1998 n=153	2002 n=151	ANOVA
	Mean (SD)	Mean (SD)	Mean (SD)	p-value
Carbohydrate (g)	145 (24)	143 (23)	142 (24)	0.5839
Protein (g)	35 (10)	36 (9)	37 (10)	0.5671
Fat (g)	32 (8)	33 (8)	33 (8)	0.7172
Calcium (mg)	406 (178)	376 (171)	384 (183)	0.2808
Fibre (g)	6 (3)	6 (3)	6 (4)	0.3631
Iron (mg)	7 (2)	7 (2)	8 (2)	0.1317
Vitamin A (RE)	427 (568)	387 (452)	365 (400)	0.5035
Vitamin D (μg)	2 (1)	2 (1)	2 (1)	0.7013
Vitamin C (mg)	**87 (77)**	75 (56)	**66 (51)**	**0.0135**
Zinc (mg)	5 (2)	5 (2)	5 (2)	0.9299

Bold indicates significance at $p<0.05$ level

Mean carbohydrate, protein and fat intakes as a percentage of energy are presented in Table 6 for boys and girls for three years of study. In 2002, percentage of energy from carbohydrate, protein and fat were 57%, 15% and 30% respectively. There has been no change in the macronutrient profile over time and values are well within Acceptable Macronutrient Distribution Ranges (AMDR). AMDRs represent a range of intakes that are likely to enable adequate intake of essential nutrients and to prevent chronic disease (Trumbo et al, 2002). For children four to eighteen years of age, the AMDRs have wide ranges and are 45-65% for carbohydrate, 10-30% for protein, and 25-35% for fat.

Table 6 Macronutrients as Percents of Energy Intakes for Boys and Girls in 1994, 1998, and 2002

Macronutrient	1994		1998		2002	
	Boys n=80	Girls n=84	Boys n=79	Girls n=74	Boys n=79	Girls n=72
Carbohydrate (%kcal)	59	57	58	56	55	58
Protein (%kcal)	14	14	15	14	15	14
Fat (%kcal)	28	30	29	31	31	29

3. Frequently Consumed Foods

A selection of the most frequently reported foods is presented in Table 7 for three years of study. Foods have been grouped according to the similar foods scheme described previously. The numbers in the cells represent the total number of reports for items in the food groups listed for all children of that year (n). Thus all items included in the food groups would have been counted even if the same child reported them more than once. The most frequently reported food group was punch drinks/iced tea. For beverage frequency, regular carbonated drinks ranked second, water ranked third and citrus juice ranked fourth. There has been a decrease however in the number of carbonated drink choices from previous study years. In 2002, 2% milk remained the most frequently chosen type of milk, whole milk was chosen less often in 2002 and 1998 than in 1994. Skim milk was chosen rarely. When all milk-types are combined, the frequency of mention has decreased over time. Both processed and natural cheese varieties were used less in 2002 than previous years. Refined yeast breads such as white loaf bread and crusty bread were reported less often in 2002 than in previous years and whole grain breads were reported more often. Low fibre cold cereals are eaten often whereas high fibre cereals were one of the least frequently reported foods, only mentioned 3 times in 2002 and 5 times in 1994 and 1998 (results not shown). Legumes including baked beans were only mentioned 5 times in 2002 (4 times in 1994 and 2 times in 1998). From the table slight shifts in the frequency of some snack choices can be seen. For example, chips, candies and chocolate bar groups were mentioned less often in 2002 than 1998. Popcorn and pretzels increased slightly over this time frame. Fish and seafood (including tuna) was reported with low frequency and beef cuts were reported less frequently in 2002 than in 1994 and 1998. Note that the total number of mentions for each year listed on Table 7 represents greater than 75% of all food mentions.

Table 7 Numbers of Mentions of Most Frequently Reported Food Groups in 1994, 1998 and 2002

Food Group	1994 n=164	1998 n=153	2002 n=151
Beverages			
Punch drinks/ice tea	124	142	129
Regular carbonated drink	122	118	71
Water—bottle/tap	101	76	78
Citrus fruit juice	92	86	64
Non-citrus fruit juice	63	50	48
Milks and Cheeses			
2% white milk	122	100	110
Whole milk	69	27	25
1% white milk	4	29	16
Skim milk	5	7	7
processed cheese	30	17	19
natural cheese	22	25	17
Breads, Pastas and Cereals			
Refined yeast breads	124	136	110
Whole grain yeast breads	20	28	45
Plain pasta	33	42	47
Mixed pasta dishes	39	43	45
Pizza/pizza pockets	40	22	25
Low fibre cold cereal	87	77	82
Snacks			
Cakes/cookies	55	47	56
Fried potatoes/hash browns	42	33	34
Chips/cheesies/bugles	41	47	32
Candy/marshmallow/gum	35	55	24
Chocolate bars/syrup/frosting	19	47	19
Popcorn/pretzels/baked tortillas	13	15	20
Main Dishes			
Kahnawake recipes	24	27	24
Chicken cuts	15	19	22
Mixed chicken/fried chicken	18	15	21
Beef cuts	33	21	13
Mixed beef dishes	13	22	17
Fish and seafood	10	10	7
Soup	51	55	45
Crackers	38	35	21
Lunch meats	44	47	41

The frequency of mention of fruit and vegetable group intake, regardless of portion size reported, are listed in descending order for 2002 in Table 8. Some of the less frequently reported fruits were canned fruit (8 mentions in 2002), and dried fruit (3 mentions in 2002). This finding has implications for fruit consumption so promotion of these forms as alternatives to fresh fruits may improve overall fruit intake. Yellow and orange fruits and vegetables could be promoted as frequencies of these are low as well and they would provide valuable nutrients such as vitamin A.

Table 8 Frequency of Fruit and Vegetable Food Group Mentions in 1994, 1998 and 2002

Food Group	1994	1998	2002
non-citrus fruit	105	89	87
fried/hashbrown potatoes	42	33	34
tomato sauce/salsa	16	7	21
roots/bulbs/tubers	14	15	18
citrus fruit	15	20	17
lettuce cabbage greens	21	21	12
carrots/carrot juice	15	15	11
berries	5	3	8
boil/bake potato	13	11	8
canned fruit	5	5	8
non-leafy green vegetables	8	12	8
dark yellow/orange vegetables	8	9	7
mixed vegetables	13	7	7
raw/cook/paste tomatoes	10	7	7
mashed potato	17	22	6
botanically grouped vegetables	7	13	5
dried fruit	-	2	3
dark yellow/orange fruit (non-citrus)	2	2	2
melon	3	2	1
tomato/clam/vegetable juice	-	2	-

Findings regarding individual food items provide an illustration of food choices within similar food groups. The frequency of consumption of cold cereals reveals that common choices include pre-sweetened cereals with relatively low fibre content (Appendix G Cereal Choices). The most frequently reported soup was chicken noodle, which represented over half of all soup choices in 2002. The nutritional differences between chicken noodle and other varieties of soups, e.g., vegetable, could well be promoted within the community. It is important to note that the frequency analysis does

not indicate the amount of food that was eaten on any one occasion or the number of individuals that reported eating a food.

The number of times the Kahnawake recipes were mentioned is summarized in Table 9. There was little difference among the three years of study with the exception of an increase in Meat Pie which was less frequently reported in 1994. Fricassee and La Sauce were only mentioned in 1994 (see Appendix G for definitions). It may be that children do not commonly refer to these items by name and described them during the interview. La Sauce occasions may have been coded as gravy if that is how children described them.

Table 9 Frequency of Mention of Traditional Kahnawake Recipes in 1994, 1998 and 2002

Food Item	1994	1998	2002
Cornbread	11	12	10
Meat Pie	5	12	13
Deer Meat	1	2	2
Corn Soup	1	3	1
Chicken and Dumplings	3	-	2
Fricassee	4	-	-
La Sauce	2	-	-

It is interesting to note that the traditional foods: corn, beans and squash known as the Three Sisters from Mohawk legend were consumed very rarely by children. In fact, only one child mentioned squash in the three years of data collection.

4. Canada's Food Guide Food Groups

The numbers of servings for each of CFGHE groups are presented in Table 10 for boys and Table 11 for girls. The recommended ranges for each food group are as follows: Grain Products 5-12 servings, Vegetables and Fruit 5-10 servings, Milk Products 2-3 servings for children aged 4-9 years and 3-4 servings for children aged 10-16 years. By eating according to these guidelines, children should be able to meet their nutritional needs (Health Canada, 1992). From the tables it is evident that boys and girls' intake of these groups is below the range of recommended servings of Vegetables and Fruit, Milk Products, and Meat and Alternatives.

Foods not included in the four main CFGHE food groups are termed Other Foods. These foods are mostly fat, mostly sugar, fatty, salty snacks, beverages such as tea and coffee, and flavouring such as condiments and spices. The specific recommendations for this category are to eat fatty foods in moderation and to reduce sugar consumption (Health Canada, 1992). Since no serving amount has been designated for these foods, they are provided in terms of their contribution to mean energy intake. Boys and girls are considered separately for each study year. Other foods then contributed to 24% of energy for boys and 21% of energy for girls in 2002. In previous years the contribution of other foods to energy was 26% for boys and girls (1998) and 24% for boys and 23% for girls (1994).

Comparison among three years of study revealed significant decreases in girls' intake of vegetable and fruit servings from 1994 to 1998 and from 1998 to 2002 ($p<0.05$). Girls in 2002 consumed less fruit juice than girls in 1998 and 1994. This accounts for approximately 1.5 vegetable and fruit servings (1994 to 2002). Boys had a tendency to decrease their fruit juice consumption observed as approximately three-quarters of a serving. Since the fried potato group is included as a vegetable for this analysis, the slight decrease in french fry consumption accounts for part of the difference but only 0.18 servings. Although the milk products group did not decrease significantly for boys or girls ($p=0.16$ and $p=0.09$), there was a tendency toward a downward shift in fluid milk consumption observed as accounting for approximately 0.4 servings in boys and 0.45 servings in girls. Almost one quarter of meat and alternatives difference can be attributed to a shift from meat cuts to mixed dishes with proportionally less meat per portion.

Table 10 Number of Servings Reported by Boys of Canada's Food Guide Food Groups

Food Group	1994 n=80	1998 n=79	2002 n=79	ANOVA p-value
Grain Products	5.3	5.9	5.9	0.3523
Vegetables and Fruit	4.8	4.5	3.6	0.1003
Milk Products	2.0	1.6	1.6	0.1621
Meat and Alternatives	1.7	2.2	1.9	0.2523

Table 11 Number of Servings Reported by Girls of Canada's Food Guide Food Groups

Food Group	1994 n=84	1998 n=74	2002 n=72	ANOVA p-value
Grain Products	5.0	5.0	5.4	0.6860
Vegetables and Fruit	**6.1**	**4.2**	**3.9**	0.0003
Milk Products	1.8	1.7	1.4	0.0905
Meat and Alternatives	2.0	1.8	1.5	0.1885

Bold indicates significance at $p<0.05$ level

5. Contribution to Nutrients

The mean and percent contributions of foods to energy and 11 nutrients are summarized in Appendix I where, for each nutrient of interest, the top food group contributors are listed in descending order for boys and girls for each study year. To avoid cumbersome tables, only the top ten contributors are listed and the foods that provide 50% of mean intake are indicated. Tables for which ten foods provide less than 50% of intake have all foods required to exceed 50% of intake listed.

Batcher et al, 1984, identified "good" and "important" sources of nutrients in the following terms: "good" sources contain relatively high amount of a nutrient whereas "important" sources are those that contain a relatively lower amount of a nutrient but are eaten frequently or in considerable amounts thus providing a good source of the nutrient. This analysis will illustrate where good nutrient sources are used. Where good sources are lacking, the contribution of unconventional sources become more important and provide a higher percentage of the total intake for the nutrient.

5.1 Weight, Energy and Macronutrient Contributions

The foods that contribute the most to mean weight, energy and macronutrient intakes of Kanien'kéha:ka children represent the foods that are eaten in the largest amounts. Shifts in food choices over time can be seen by comparing results from each study year. In 2002, carbonated drinks, referred to as soda in the community (cola, root beer, etc.), contributed less to mean carbohydrate intake than in previous study years, in

fact this group moved from the first contributor in 1994 (9.7% of boys intake and 8.4% of girls intake) to the seventh for boys (4.4%) and girls (4.5%). While soda was consumed in the highest amount by weight in 1994, girls and boys decreased their consumption in 1998 and further still in 2002 when soda was surpassed by punch drinks and 2% milk in the amount consumed. Punch drinks were predominant carbohydrate contributors in 1994 and remained so in 1998 and 2002 when the punch drink group was the top contributor at 9.3% for boys and 7.3% for girls. In terms of energy, boys and girls derived approximately half as many kilocalories from soda in 2002 as they did in 1994. The contribution of the punch drink group to energy did not see the same change although a slight decrease was observed in girls' intake. A slight increase was observed for boys.

Protein sources have shifted somewhat for children since 1994. Various cuts of beef provided the largest proportion of protein for boys and girls in 1994 but for boys this group decreased to one third of the 1994 contribution. The top contributors to mean fat intake were a variety of mixed dishes, snack foods, milk and spreads such as margarine and butter. There were no large shifts in the relative contributions of these food groups over time.

5.2 Fibre and other Nutrient Contributions

Fibre

The top contributor of fibre for boys and girls for all three years of study was the non-citrus fruit group, which includes apples (the most frequently reported fruit). In 2002, these fruits contributed 12% of boys' and 16% of girls' total fibre intake. Another prominent fibre contributor was the group of Kahnawake recipes which provided 7% and 11% of boys and girls intake respectively. High fibre cereals do not appear on the list of top ten contributors. This group contributed to only 1.3% and 0.9% of mean fibre intakes for boys and girls.

Calcium

The top contributor to the calcium intakes of boys and girls was 2% milk. This was true for children studied in 1994, 1998 and 2002. 2% milk alone represents the most important source of calcium to this group of children and in 2002 boys obtained

approximately 21% of their calcium intake and girls 25% of their intake from 2% milk. The contribution of 2% milk combined with other milks (homogenized, 1% and skim) contribute over one third of the calcium intake overall. The contribution of milks, however, in mean milligrams and percent of total calcium intake decreased over time. To illustrate this, in 1994, milks contributed close to one half of total calcium (48% or 429 milligrams) whereas in 2002 it was closer to one third (35% or 286 milligrams). As noted in section two of this chapter, the absolute intake of calcium has decreased for girls. It seems three-quarters of the decrease in calcium in girls from 1994 to 2002 can be explained by a decrease in fluid milk consumption. Other contributors to calcium intake were cheeses both natural and processed. Mixed dishes containing cheese such as pizza/pizza pockets, mixed pasta dishes, and mixed potato dishes containing cheese were among the top 10 sources of calcium. Yogourt was not a prominent source, despite its concentration of calcium per serving, because of the small amounts consumed. The pizza/pizza-pocket food group contributed 2.8% and 2.5% in 1994 and 1998 respectively, and 4.9% for girls in 2002. Alternatively, breads were important contributors by virtue of the amount consumed and not their calcium content. This increase in calcium contribution by pizza was not seen in boys. In fact, in 2002 the pizza group contributed only 2.0% of calcium for boys. Milk has traditionally been recommended as a source of calcium because of how much calcium it contains per serving. Reducing dairy products and milk in particular would result in a serious challenge in obtaining adequate calcium from alternative sources.

Vitamin D

Two percent milk was the top contributor of vitamin D for all years for both boys and girls. Combined with other milks, contribution by milk was 65.8 percent for boys and 66.5 percent for girls in 2002. Margarine was the next most important source of vitamin D at 8.7 and 12.2% for girls and boys respectively. These are the traditional sources that are recommended without which the dietary intake of vitamin D would be extremely low. For example, without the milk and margarine sources the intake of vitamin D for boys would have been 0.7 micrograms when 5 micrograms are recommended for dietary intake.

Vitamin C

As expected, citrus fruit juice was the top contributor of vitamin C for boys and girls in 1994 and 1998 and also for girls in 2002, although it contributed less in 2002 than in previous years without a corresponding increase in other fruit juices. In 2002, the punch drink group moved ahead of citrus fruit juice in contribution to boys' vitamin C intake. Many punch drinks are a source of vitamin C but they are not considered a suitable alternative to juice.

Iron

Cold cereals consistently contribute the largest percentage of boys and girls iron intake. The next most important source of iron for these children was refined yeast breads/rolls. It is important to recognize the importance of cereal consumption to the iron intake of girls and boys but also that the iron sources are primarily from sources providing the less bioavailable non-heme variety which is a concern for girls especially who require more iron as they move out of childhood.

Zinc

As expected, zinc contribution is primarily from beef cuts and dishes containing beef. Milk has also contributed a lot to zinc intakes. For boys in 2002, mixed pasta dishes and low fibre cold cereals surpassed beef cuts and milk in relative contribution of zinc.

Vitamin A

The carrot/carrot juice group provided the most vitamin A for boys and girls in 1994. In 1998, this group was the top contributor of vitamin A for boys and the third highest contributor for girls. Carrots are very concentrated source of vitamin A. The contribution of milk to vitamin A intake has decreased as it has to other nutrient intakes due to decreased volume of consumption over time.

VI Discussion

This descriptive study has provided valuable information about the diets of Kanien'kéha:ka children. The high consent rates and participation of the schools allows the study to go beyond sampling a subset of the population of children and generalizing conclusions to a wider group. This study was able to conduct a census by interviewing virtually the entire population making the results truly representative. This is a strength that signifies community involvement and acceptance of the KSDPP initiative.

It was not practical to measure usual intake because of increased complexity, cost and inconvenience. To minimize the burden on community participants, only one day of intake data was collected from children. With one day's data, intakes were necessarily grouped for analysis and it was not possible to associate nutrition variables with anthropometric data or physical activity data. As with all studies that rely on self-reported food intake data, an unavoidable limitation is that there may be underreporting of food intake due to either selective reporting of better food choices or to generalized memory lapse. In general, Kanien'kéha:ka children were eager to report their intakes and the interview protocol (see Methods) was followed closely in order to get the most accurate reports of intakes.

The objectives of this study were to analyze data from three study years in order to characterize the diets and inform further intervention activities. Key findings regarding the 2002 data will be discussed first according to the main study objectives. Notable changes that have occurred over time will follow.

- Nutrient data provides evidence of the need for dietary change in order to meet requirements without increasing (and preferably decreasing) energy intakes.
- The food guide analysis provides a general yet clear message about the quality of the diets of children.
- Contribution analyses demonstrate from which foods children derive their nutrients and interpretation tells us whether these sources are of good quality.
- Frequency results clarify the picture by putting intakes in the context of what foods are commonly provided or on hand for children.

Overweight is a problem in Kanien'kéha:ka children. In 2003, it was reported that the rate of overweight children in Kahnawake increased over previous years and rates continue to be greater than the provincial and national averages (Ing, 2003). This is important to recognize in nutrition intervention since for many children the goal will be to decrease energy intakes. Promotion of healthy foods that improve nutrient intakes will have to consist of ways of including lower energy-dense foods.

A general measure of diet is the percent of kilocalories provided by the macronutrients carbohydrate, protein and fat. The intakes of these macronutrients, expressed as a percent of energy intake, are well within recommended ranges. Because the macronutrients tend to work in concert, upper and lower ranges are necessary in order to achieve a balance whereby too much of one does not compromise another. For example, fat is recommended in amounts that would allow foods with required nutrients to be consumed while limiting the amount of total fat (Trumbo et al, 2002). The Continuing Survey of Food Intakes by Individuals (CSFII), 1994 to 1996 estimated total fat intake to be over 30% of energy. This was less than that reported in the previous CFSII conducted from 1989 to 1991. A large proportion of the fat was described as discretionary fat which is defined as fat in excess of the small amounts of fat that people would consume if their food choices were among the lowest in each food group (Dixon & Ernst, 2001). This implies, however that in order to decrease discretionary fat one must limit meat and diary choices. To use discretion in the case of Kanien'kéha:ka children may mean to consider a wider range of choices in these two food groups in order to obtain required nutrients. In the Food Habits of Canadians study, the percent of energy from fat (29-31%) was close to the recommended value of 30% and saturated fat represented approximately 10% of energy intake. Fat reduction has continually been a goal of KSDPP interventions; however, fat alone should not be a priority target for dietary change, especially without careful consideration of the nutritional merits of foods that are targeted. For example, before suggesting that cheese and meats be restricted because of fat content, consideration must be given to the nutrients these foods provide (calcium, iron, etc.) and whether substitutions that compensate for lost nutrients are reasonable and/or likely in the community.

Another useful measure of diet is based on a way of eating consistent with CFGHE which is the tool of choice for KSDPP intervention staff and other nutrition professionals in the community. It has guided the community-based nutritionists in healthy eating promotion at an individual level in nutrition counselling, and in the community at large such as at health fairs and where food is provided. In the schools it has been the basis for nutrition lessons in the health curriculum. The key messages of the guide have been reinforced including choosing a variety of foods with all food groups represented and choosing lower fat foods more often. Based on this familiar reference, it was seen that children were not obtaining an optimum balance of healthy foods in their diets. CFGHE provides recommended ranges of food groups which are designed to achieve adequate intakes of required nutrients (Health Canada, 1992), however, consumption of servings from the Vegetables and Fruits, Milk Products, and Meat and Alternatives groups were below the minimum ranges (see Table 10 and Table 11). In particular, vegetables and fruits are important sources of nutrients and have shown to reduce the risk for chronic diseases yet the average intake for Kanien'kéha:ka children was less than four servings per day. These generally low kilocalorie foods can be added to diets with little contribution to total energy intake. Intake in the United States as measured by the CSFII conducted in 1994 to 1996 was 4.9 servings per day (Krebs-Smith et al, 1996). Adolescents involved in another study, the Food Habits of Canadians (FHC), had intakes at the low end of recommended portions as well with boys consuming 5.0 servings and girls 5.7 servings per day. It is suspected that there was some degree of overestimation in that study due to low response rate and respondent bias. Bias may have occurred where households with adolescents with higher social and economic status and potentially higher quality diets responded more readily to the survey (Starkey et al, 2001). It should be noted that it is difficult to compare the intake data for food groups across different studies because grouping and quantification methods are not consistent and different dietary assessment methods result in variable estimates. Also note that fried potatoes were included as a vegetable in the current study in the same manner as the two studies cited above. The low frequencies of vegetables and fruit choices as summarized in Table 8 corroborate the findings from CFGHE analysis. The need to promote fruits and vegetables is clear, including yellow and orange varieties that

are especially nutrient dense and canned and dried fruits that were rarely chosen. Block et al, 1985 identified important vegetable sources in the U.S. Hispanic population. As in the current study, mixed dishes and soups added more vegetables to the diet than separate vegetable items. Authors suggested promoting an increase in the amount that is eaten of already common items. In the case of Kanien'kéha:ka children it may be more feasible to see an increase in common fruits such as apples and oranges as well as increasing vegetables in soups and mixed dishes.

The Other Foods category of CFGHE includes anything that does not fit under the four main food groups. For boys and girls in 2002, Other Foods contributed 24% and 21% of their kilocalories. This category represents the foods that Kanien'kéha:ka children should cut down on. In the FHC study, food choices from the Other Food group contributed more than 25% of adult energy intake. Berti et al (1999) determined the relative energy contribution of food groups to intakes of Baffin Inuit children. Foods classified as having low nutrient density in a manner similar to CFGHE Other Foods included candy, chips, soda, condiments, spreads and sauces. This food group was the greatest source of energy second to the grains and tubers group. This was true for both genders and all ages studied except for 16-18 year-old boys. Older girls (16-18 years old) consumed especially high amounts from this group for a contribution of 27% of their energy intake. It is important to recognize that the other foods category represents food choices that can add to satisfaction with a diet without necessarily compromising the health of it. Condiments, spices and sauces are included in this category as are high fat and high sugar items such as margarine and syrup. It is not be feasible or advisable to avoid these items entirely, especially if they are used moderately and complement a balanced meal. Buttering whole grain toast and serving gravy with cornbread are appropriate and expected uses of Other Foods. Alternatively, for some items it may be desirable to see reduced consumption. Potato chips and soft drinks are examples of snacks and beverages with few nutrients and considerable caloric content. These compromise intakes of more nutritious options and as they are eaten frequently (Table 7), they tend not to complement the diet beyond providing extra energy. Therefore, promotion of healthy eating according to CFGHE Other Foods should focus on practical substitutions of meal and snack items as opposed to suggesting a total reduction of the

category's contribution. However, the food guide principle of moderation should not be considered an endorsement of these foods; rather, Other Foods should be considered areas of potential improvement in the diet, especially for foods that have more nutritious alternatives, particularly given the level of overweight in the community. Despite the fact that obesity is a problem in the community, we did not have good measures of individual intake (because of only one day of data); therefore, no attempts were made to conclude anything about the diets of individual children according to their anthropometric measurements.

As expected, corresponding with the low intakes of CFGHE food group servings are low intakes of key nutrients provided by these groups. For boys and girls, the fibre, calcium, vitamin D intakes are below the values thought to be adequate for this age group. The proportion of children that are not meeting their requirements cannot be calculated with accuracy without performing a recognized adjustment to intakes, yet the magnitude of the discrepancy between adequate and mean intakes is a definite cause for concern. In terms of fibre, for children the convention has been that total fibre intake should equal 5 grams per day plus the age of the child in question. That translates to approximately 15-20 grams for this population of children. More recently, the DRI for total fibre was set as 14 grams per 1000 kilocalories of intake, the level observed to protect against coronary heart disease in adults (Institute of Health (IOH), 2001). Despite a shift toward more brown bread versus white, Kahnawake children consumed less than half that amount of fibre. The consequences of poor intakes of these nutrients may not be fully recognized. An association between low fibre intake and risk of type 2 diabetes has been reported (Wolever et al, 1997b) and several epidemiological and intervention studies are being considered to further support higher fibre recommendations (IOH, 2001). Calcium and vitamin D play a role in the development of bone mass and low intakes have been implicated in development of osteoporosis and subsequent bone fracture particularly when these nutrients are derived from milk (Kalkwarf et al, 2003). Recently, calcium intake has been associated with weight modulation and decreased obesity rates. Heaney (2002) reanalyzed data from six observational studies and three controlled trials and concluded that increasing calcium intake by approximately two dairy servings per day may reduce the risk of overweight considerably. From a population perspective, he

postulated that even the relatively small influence observed in studies could have a larger impact on the incidence of obesity if calcium intakes were at recommended levels. It appears that even when calorie intake is factored in, weight loss is accelerated in people losing weight while body composition may shift when caloric intake is stable (Teegarden & Zemel, 2003). Calcium and other dairy constituents are thought to be responsible for modulating body weight. Although intakes could not be compared against nutrition requirement distributions to establish inadequacy, the results of this study may bring awareness to what constitutes a healthy diet by evaluating the diet in terms of nutrients that play important roles in the health and long-term prevention of chronic disease for children later in their adult lives.

The results of the contributions analysis are summarized in a series of tables (Appendix I) that list, for each nutrient, the foods that account for over half of the mean intakes. The lists of foods that contribute the most to energy and macronutrients provide a gauge of the main foods in the diet. The weight in grams accomplishes this also although beverages and foods with high water content tend to rank higher than drier foods. Overall, these analyses revealed that children obtain the majority of their food by weight from sweetened drinks. As well, punch drinks provided the most kilocalories and the most carbohydrate of all beverages and were surpassed in energy contribution only by refined breads, pastas and cereals. From frequency analysis it can be seen that beverages in this group were reported more often than any other food or drink. In practical terms, there are more soda and punch items than would account for every child drinking either of these on the day of their interview. Conversely, there were only enough fruit juice counts for ¾ of children. The sweetened beverages are among the most extreme examples of "empty calories" in the sense that they contribute excessively to energy intake and minimally to nutrients. These are kilocalories that Kanien'kéha:ka children cannot afford given the prevalence of obesity in the community and shortcomings in their nutrient intake. The decrease in soda drinking is a welcome positive change which may see further improvement with continued targeted intervention. Adams and her colleagues reported in 2003 that for Kanien'kéha:ka children studied before 1998, greater milk consumption was associated with decreased soda consumption. This finding provides further evidence to support the current intervention direction to improve milk intakes and

decrease soda drinking. Protein was provided by the typical sources of meat, milk and mixed dishes. Fat was distributed among many of these same mainstay groups but fat was also provided by snack foods such as chips, cakes and cookies that contribute fewer nutrients suggesting that there were more valuable fat-containing foods which ought to be differentiated from less valuable ones.

The foods that supply fibre, vitamins and minerals to Kanien'kéha:ka children's diets may be good nutrient sources but their appearance on the list of top contributors is a function of the amount that is eaten. Interpreting these results requires determining where the good food sources place relative to poor food sources and intervention should aim to improve these rankings so that overall intake can be increased. Few high fibre foods are consumed and/or they are consumed in such small quantities that they contribute very little to mean fibre intakes. Examples of good sources that provide relatively high amounts of fibre per serving such as whole grains, high fibre cereals and legumes were not being eaten by children. Instead, foods with relatively low fibre content were collectively providing most of the fibre for children in minute amounts per serving. The under-use of these good nutrient sources results in a shortfall in fibre intake. CFGHE recommends that whole grain and enriched products be chosen more often. A previous campaign slogan "three are key" suggests eating three servings of whole grain per day. Recommended increase in whole grain consumption is based on research that associated high whole grain intake with lower risk for diabetes, cardiovascular disease and some forms of cancer (Kantor et al, 2001). Non-citrus fruits, i.e., apples, were the exception to low intakes and show how fruit can contribute to fibre when eaten in sufficient quantities. Kahnawake recipes such as cornbread are also evident on the list of top contributors which is a positive finding worth commending and promoting further.

Milk is the known as the most significant source of calcium and vitamin D and the results of this study support that notion. These nutrients that are provided by milk are not easily obtained from alternative food sources, i.e. vegetables. To illustrate this, it is interesting to look at the lists in Appendix I for calcium and vitamin D. For these nutrients, good sources are relatively concentrated, therefore, the numbers of foods that provide 50% or more of intake are few and the top ten contributing foods provide most of the groups mean intake. This can be contrasted with other nutrient contribution lists that

require more foods to reach 50% of mean intake. Despite the importance of this food group, promoting it is a challenge in communities where lactose intolerance is a perceived deterrent to consumption. This perception needs to be investigated further as there has been little documentation of diagnosed lactase deficiency sufferers in Aboriginal communities to date. One study, conducted in Manitoba found a relatively low prevalence of milk intolerance in a population of Indian school children. Only 5 of the 104 children studied (5-19 years old) were considered lactose malabsorbers although only two had symptoms. Authors concluded that promotion of milk products was feasible as part of school-based nutrition programming (Ellestad-Sayed et al, 1980). Ellestad-Sayed (1978) also studied Inuit children in the Canadian North and found 73% of subjects were lactose malabsorbers. Even where high rates such as these are known to exist, school milk programs should offer lactose-hydrolyzed milk, especially where alternative calcium and vitamin D sources are limited. In Kahnawake, nutrition education regarding the benefits of milk and other milk products should highlight the key nutrients it provides and how superior these sources are in their concentration of nutrients. Vigilance is required in order to challenge beliefs that lead to milk and milk product avoidance and/or necessary, acceptable alternatives must be provided.

There have been both positive and negative changes in the diets that can be seen by comparing the 1994, 1998 and 2002 data. Meaningful comparison is possible because of the consistency of methods used in the collection, coding and analysis of these data. Since the original 24-hour recall forms from all three years were coded together, any differences in results do not reflect changes in the nutrient database or coding protocols. In terms of evaluation, lack of a control group and the number of interventions implemented precludes stating that changes detected in dietary behaviours are due to the intervention efforts of KSDPP. However, positive changes and resistance to negative secular shifts are reason for optimism.

An important trend has been a decrease in consumption of beverages over time. It seems that children are drinking less of every beverage category. It cannot be established whether water drinking is making up for the downward trend in other beverages because it was not possible to measure it accurately. Anecdotally however, water bottles are more prevalent in the community indicating a potential substitution of water.

One area of very positive change is the frequency and amount of soda reported. Children in 2002 obtained only half as many kilocalories from soda as they did in 1994. This is a welcome change that was possibly initiated by KSDPP interventions and their consistent messages over the years to limit intakes. Other Aboriginal communities have not reported improvements in this measure. Consumption of all varieties of milks also saw a decline both in frequency and amount. A sharp drop in use of whole milk in 1998 from 1994 was not compensated by increase in use of other varieties. Increased frequency of 1% milk in 1998 from 1994 was counterbalanced by a decreased frequency of 2% milk. The amount of the decrease in fluid milk represents about one-fifth and one-quarter of what boys and girls would have obtained if they had maintained previous intakes. According to CFGHE however, this would still not be enough to reach minimum recommended levels. The decrease in whole milk was a positive change documented previously when fat was the primary indicator of diet quality and intervention messages were aimed at consuming less fat-containing foods (Jimenez, 1998). In light of the findings from the current study, there is reason to be especially focussed on the CFGHE message to include low fat milk products in a daily pattern of eating. The decreased contribution of milk to necessary nutrients (calcium, vitamin D, and vitamin A) as a result of an overall decline in milk products highlights the importance of milk to nutrition. As well, the potential for milk to modulate weight and ward off obesity is a promising advance worth following.

Citrus fruit juice and non-citrus fruit juice were both reported less often in 2002 than 1998 and 1994. The amounts consumed also went down resulting in smaller contributions to mean vitamin C intakes. This was primarily due to change in citrus fruit juice, the usual source of these nutrients. Since fruit juice is included as a fruit according to CFGHE food groups, these drops in intake account for part of the deficit in vegetable and fruit servings compared to recommendations. In fact, the significant decrease observed for girls in 2002 is almost entirely explained by decreased fruit juice consumption. It is uncertain whether decrease in fruit juice was a matter of attitude toward it or availability of other choices. For people with diabetes, emphasis is placed on its sugar content for glucose management reasons. It is important that these cautions regarding juice do not crossover into healthy eating messages for children. Associations

have not been clearly established between juice and poor growth or juice and obesity (Dennison, 1996). Cost may be another consideration as the less nutritious beverages are often less expensive than 100% juice. The challenge will be preventing the shift seen in other populations from 100% juice consumption to less nutritious beverages like soda as adolescence is approached (Skinner & Carruth, 2001; Rampersaud et al, 2003).

An increase in whole grain breads and a decrease in refined breads is another very positive change that corresponds with interventions directed at those choices. A slight shift toward lower fat snack choices may also be a sign of successful KSDPP healthy eating promotion.

VII Conclusion and Implications for Intervention

At the time of this data collection KSDPP had been striving for eight years to improve the diets of the Kanien'kéha:ka schoolchildren with mixed results. Evaluation is complicated by multiple interventions and limitations in study design, however, the combined school-based initiatives and community focus are the avenues that are recommended for primary prevention of disease in children. Only small if detectable dietary changes can be expected with this type of intervention while influences on diet are extremely complex and difficult to control.

This study involved a detailed analysis and comparison of three years of data collected in 1994, 1998 and 2002. The objectives of this study go beyond what was studied previously and include analysis of particularly relevant vitamins and minerals, as well as fibre. These comparisons over time and, where appropriate, against dietary recommendations reveal numerous characteristics of the diets of Kanien'kéha:ka schoolchildren. The detailed results provide evidence of positive change that can be validating for intervention staff, teachers and parents who are incorporating healthy eating messages into their patterns of daily living. The results also suggest areas for further improvement and ways that KSDPP can build on the community accomplishments.

Positive findings consistent with KSDPP intervention messages were the dramatic decrease in soda consumption, a shift from white bread to brown bread, and a change in snack choices toward lower fat options. In contrast, the intakes of fibre, calcium and vitamin D are low. These nutrients have not been highlights in previous intervention efforts; however they deserve recognition as essential nutrients that play a role in the long-term health of children. Previously, a focus on fat and sugar intakes as indicators of poor quality diet has resulted in foods being evaluated in those terms. Considering key nutrient sources and contributors expands this focus. Working toward a balanced way of eating will require following the principles of Canada's Food Guide to Healthy Eating more closely. Food groups of particular concern are Vegetables and Fruit, and Milk Products. Hopefully, the key nutrients provided by these groups would improve as a result of such KSDPP interventions.

Food choices that improve intakes of these nutrients must necessarily be promoted to displace poor choices containing few nutrients so that recommendations can be met without taking in excess kilocalories. For example, children need to obtain more fibre by: eating whole grains instead of refined varieties whenever possible; eating high fibre cereals instead of highly sweetened and low fibre brands; and eating beans promoted as a traditional food item and a dense nutrient source. Fruits and vegetables, including 100% juice should be consumed in greater variety and quantity for a more optimal balance of nutrients and energy. Milk and milk products should be promoted as reputable and necessary sources of nutrients. Beverages need to be limited to the nutritious kind, i.e., juice and milk, in order to see an overall improvement in the diet. It is important to recognize that the food choices of children partially reflect their growing independence and individual responses to external influences. However, for these children, the foods that are provided ultimately remain the choice of caregivers. KSDPP is continuing to make progress with children and families on establishing healthier eating habits. This is in keeping with the Mohawk tradition to care for future generations.

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Appendices

Appendix A Ethical Approval

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Fax/Télécopieur: (514) 398-

September 10, 2002

Dr. Ann C. Macaulay
Kahnawake Schools Diabetes Prevention Project
P.O. Box 1000
Kahnawake Education Centre – 2nd Floor
Kahnawake Territory
Quebec J0L 1B0

Dear Dr. Macaulay,

We have received your request for review by the Institutional Review Board of an amendment to the study AØ3-B09-02A entitled **"Kahnawake Schools Diabetes Prevention Project"**.

We are pleased to inform you that full Board approval for the addition of a 24-Hour Dietary Recall method to the protocol (August 27, 2002) was provided on September 9, 2002.

Yours sincerely,

J. Lawrence Hutchison, M.D.
Chair,
Institutional Review Board

cc: A03-B09-02A

Appendix B 2002 Presentation Letter for Parents

KAHNAWAKE SCHOOLS DIABETES PREVENTION PROJECT

Kahnawake Education Center (2nd Floor) P.O. Box 1000
Kahnawake, Mohawk Nation via Qc, Can J0L 1B0
Tel.: (514) 635-4374 Fax: (514) 635-7279

Participation in the Study

We ask your permission to have your child participate in this project. Taking part in this project is voluntary. You or your child are free to withdraw at any time. If you wish your child to participate, please complete and sign the form on the next page and have your child return it to his/her teacher by **Wednesday, September 11, 2002**.

Confidentiality

All of the information that will be collected will be kept strictly confidential. To ensure confidentiality, we will use a unique identification number. Your name or your child's name will never be used during the project. Only members of the project will have access to the information after the identification number has been assigned.

Risks and Benefits

There are no risks known to be associated with the interviews by questionnaire, the fitness test or the measurements of height, weight, or skinfold thickness. There is no direct benefit for participating in the project. Through the participation of young children, the project will increase knowledge about the effect of the prevention project. In the future, this knowledge could help you, your child or other members of the community to live healthier lives and reduce your chance of developing diabetes, heart disease or high blood pressure.

Additional Information

If you have any comments or concerns, need any additional information, or feel that you or your child have been treated unfairly during the project, contact Tracee Diabo or Jonathan Salsberg (see letterhead). During the study, you and your child will receive updates about the activities associated with the project. At the end of the study, a summary of the results will be published in the Eastern Door.

Statement of Consent

Please read the above description of the study and explain it to your child. You have the opportunity to ask questions about it to be fully informed. You or your child may refuse to participate and you or your child may withdraw or be withdrawn from the study at any time without affecting your or your child's present and future care. Please understand that all information about you or your child will be kept strictly confidential, and only summaries of the results obtained without any identifying information will be discussed by persons others than the investigators.

Appendix C 24-Hour Recall Form

DATA COLLECTION FALL 2002
24-HOUR RECALL

Respondent's Name: _____

Class: _____

Done: _____

DATA COLLECTION FALL 2002
24-HOUR RECALL

School: _____ (1=Karonhianonhnha, 2=Kateri)
Grade: _____ (4, 5 or 6)
Gender: _____ (1=female, 2=male)

Respondent's ID: _____
Date of Birth: _____/_____/_____ month / day / year

Date of Interview: _____/_____/ 2002 month / day / year
Age: _____ (years)

Day of the week recalled: _____

Time	Food	Description	Amount

Appendix D Examples of foods grouped by similarities

Food Group	Contents of Food Group
1. carbonated beverages, diet	aspartame sweetened cola and non-cola carbonated drinks
2. carbonated beverages, regular	cola, cream soda, ginger ale, grape soda, lemon-lime soda, orange soda, root beer
3. coffee/tea	brewed coffee, tea and herb tea
4. cocoa/chocolate milk powder	powdered chocolate flavour beverage mix, unenriched cocoa mix, strawberry flavour mix
5. drinks/punches	Fruit cocktails, fruit drinks, juice-drinks and thirst quenchers, canned, bottled powdered or frozen concentrate, with and without vitamin C.
6. water-bottle/tap	bottled mineral water, municipal water
7. other bread products	Stuffing, breads, croutons, Shake and Bake
8. high fibre cold cereals (>= 4g fibre)	Bran flakes, Shreddies, Shredded wheat, Shredded wheat (spoon size), Oat Bran Flakes and Raisins, Wheat Flakes, Corn Bran, Raisin Bran
9. low fibre cold cereals (< 4g fibre)	Frosted Cheerios, Special K regular and Red Berries variety, Froot Loops, Rice Krispies, Cheerios (Honey Nut, Apple-Cinnamon and Multigrain), Frosted Flakes, Corn Flakes, Corn Pops, Sugar Crisp, Cap'n Crunch, Life, Mini Wheats (white and brown frosting), Special K, Cinnamon Toast Crunch, Cocoa Pebbles, Cocoa Puffs, Honey Comb, Puffed Wheat, Alpha Bits, Golden Grahams, Lucky Charms, Trix, Chocolate O's, Cruncheroos (Apple-Cinnamon and Natural Honey), Just Right, Oatmeal Crisp (Maple Walnut), Vector, Reese Peanut Butter Puffs
10. hot cereals/grains	All oat, wheat, barley and hominy hot cereals, regular and instant.
11. refined quick breads	Muffins, waffles, biscuits, pancakes, banana bread, fry bread, taco, shells and tortillas, ready to eat, from complete mix or from recipe.
12. refined yeast bread/rolls	Plain bagels with seeds, raisins and/or flavouring, french/Vienna/sourdough/Italian/pumpernickel, raisin, white breads and rolls, English muffins, hot dog, hamburger and kaiser buns.
13. whole grain quick breads	oatmeal muffins and wheat bran muffins (prepared from dry mix)
14. whole grain yeast breads	whole wheat bagels and dinner rolls, whole wheat/cracked wheat/rye/mixed-grain (7-grain) bread
15. crackers/bread sticks/melba	All soup and snack crackers, plain, cheese, buttery, low-salt or cheese/peanut butter filled, melba toast and bread sticks
16. natural cheeses	cheddar, grated parmesan, mozzarella (22.5%, 25%, 16.5% B.F.)
17. processed cheese	Processed swiss, mozzarella and cheddar slices, spreads and cheese foods.
18. pickles/olives	pickles, cucumber, dill (incl Kosher + Polish), canned ripe olives
19. spices/herbs	ground cinnamon, black pepper, table salt

20. cakes/cookies/squares	Chocolate, sponge, snack, yellow and devil's food cake, with or without icing/whipped cream, hard and soft chocolate chip, oatmeal, peanut butter, crème-filled sandwich, marshmallow, raisin, cookie dough, baked sugar, macaroon, ladyfingers and molasses cookies, with or without chocolate coating, animal and graham crackers, plain, sugar and waffle cones, brownies, Rice Krispie squares and apple crisp
21. candy/marshmallow/gum	Hard candies, chewy candies, marshmallows, licorice, chewing gum, Skittles, fruit leather rolls, caramel spread, candied fruit.
22. chocolate-bars/syrup/icing	Chocolate syrups, icing, fudge, milk and dark chocolate chips, bars, and coated peanuts.
23. gelatin/frozen ices	gelatin dessert prepared from dry mix with water, frozen ice pops
24. granola/nutrigrain bar	Crunchy and soft, regular and low fat, fruit, nut and cereal-type bars, with and without chocolate/chocolate coatings.
25. pie/doughnut/danish	Turnovers, glazed, chocolate coated and plain cake doughnuts, fruit, pumpkin and meringue pies, fast food pies, toaster pastries.
26. sugar/jam/syrup	Pancake, corn and maple syrups, fruit jams and preserves, honey, brown and granulated sugars.
27. butter	Regular butter
28. margarines	tub margarine (unspecified vegetable oils, soybean, canola/soya oil), I can't believe it's not butter
29. mayonnaise-type dressing	commercial mayonnaise/salad dressing (35%, 65% oil), fat free mayonnaise, spinach dip
30. oils	canola oil
31. salad dressing	Kraft Rancher's Choice and Creamy Caesar, homemade oil and vinegar dressing, commercial regular Italian and French dressing.
32. berries	raw blueberries, frozen unsweetened blueberries, raw raspberries, raw strawberries
33. canned fruit/sauces	canned fruit cocktail in light syrup and canned pineapple and canned peach halves/slices in juice and canned in light syrup (solids+liquid), sweetened or unsweetened canned applesauce.
34. citrus fruit	raw commercial orange varieties, raw tangerines (mandarins), white, pink, red raw grapefruit
35. dried fruit	seedless (sultana) raisins, dehydrated cooked apples (sulphured)
36. citrus fruit juice	Raw, chilled, canned and frozen concentrated orange and grapefruit juice, sweetened and unsweetened.
37. non citrus fruit juice	Frozen concentrated, canned and bottled grape, pineapple, apple, raspberry, banana-orange-strawberry, passion fruit, tropical fruit and berry blend.

38. non-citrus fruits	Raw pears, bananas, grapes, plums, apples, fresh fruit salad, boiled sliced apples.
39. melons	honeydew, cantaloupe, watermelon
40. yellow/orange non-citrus	raw peaches, raw pineapple
41. pastas/noodles	cooked Chinese or chow mein noodles, ramen noodles spaghetti noodles, with and without added salt.
42. white rice	long-grain and medium-grain rice, cooked
43. other rice-brown, wild, fried	medium-grain brown rice, wild rice, fried rice with meat, meatless fried rice
44. legumes	Canned and home-made baked beans with pork, or vegetarian, boiled black, red kidney and dark kidney beans and Mexican tostada beans and cheese.
45. ground beef	pan-fried medium ground beef (well done or medium), pan-fried regular ground beef (well done)
46. other beef cuts	Hip, chuck, loin and composite cuts, lean and lean plus fat, roasted, cooked, braised, simmered and broiled
47. chicken cuts	Air or water-chilled broiler and roasting chickens, all cuts, meat and skin or meat-only, roasted.
48. eggs	whole hard-cooked chicken egg (boiled in shell), whole poached chicken egg
49. fish and seafood	Whitefish, canned tuna (in oil and water) and tuna salad, fish sticks, flatfish, squid, salmon and battered, fried or breaded fast food fillets.
50. lunch meats/spreads	Beef and pork bologna, salami, luncheon sausage and pepperoni, thin-sliced beef luncheon meat, cured beef pastrami and extra-lean sliced ham.
51. nuts/seeds/coconut	Dry and oil roasted sunflower seed kernels and peanuts, walnuts, pumpkin and squash seeds and regular trail mix, without or without added salt.
52. peanut butter	chunk type (fat and sugar added), smooth type (+fat, sugar, salt), smooth-type (+fat, sugar)
53. organ meats	braised veal heart
54. other meats	Duck, deer, beaver meat, caribou bone marrow, breaded frog legs, moose meat and lamb.
55. pork and ham	Ham, cured and fresh pork, all cuts, bone-in and boneless, excluding bacon.
56. bacon and simulated bacon	cooked bacon bits, pan-fried or roasted/broiled cured pork (bacon)
57. sausages	Pork and beef weiners, links, Italian and fresh sausages.
58. turkey cuts	All cuts, with or without skin.
59. mixed beef dishes	Meatballs, shepherd's pie, meatloaf, cabbage rolls, canned or fast food chili con carne with beans, fast-food Mexican burrito or

	enchilada with beef and/or beans and/or cheese, Mexican nachos with beef, peppers and/or beans and/or cheese.
60. mixed bread dishes	meatless egg roll, french toast, coldcut submarine sandwich, english muffin with egg/cheese/sausage, nachos with cheese, plain hotdog, corndog
61. mixed egg dishes	egg salad, fried egg, omelet, scrambled egg
62. hamburger/cheeseburger	All hamburgers and cheeseburgers, including bun and toppings
63. Kahnawake Recipes	Cornbread, meat pie, corn soup, chicken and dumplings, fricassee, La Sauce
64. pasta dishes	Kraft Dinner, Hamburger Helper, Noodles and Sauce, macaroni salad, meat or meatless lasagna, meat-filled ravioli, canned or homemade spaghetti with and without meatballs, pasta and rice with seasonings
65. pizza/pizza pockets	All pizzas, all toppings and Pizza Pockets.
66. mixed chicken dishes	Chicken chow mein, burgers, cream sauce casseroles, fast food breaded and fried, spicy wings, batter and flour dipped legs, wings and breasts and egg rolls.
67. ice cream/frozen yogourt	Ice cream, milk and yogourt, hard or soft serve, all flavours, and all ice cream bars and sticks.
68. puddings	Bread pudding from recipe, chocolate, rice, vanilla from dry mix or ready to eat.
69. chocolate milk/shakes	Chocolate milk or beverage, hot cocoa, prepared or fast food milk shake (all flavours).
70. skim white milk	Lactaid skim milk, skim milk (fluid)
71. 1% white milk	partly skimmed 1% B.F. milk
72. 2% white milk	partly skimmed 2% B.F. milk
73. whole white milk	pasteurized homogenized whole 3.3% B.F. milk
74. yogourt/yogourt drinks	All stirred, fruit bottom, swiss style yogourt and yogourt beverages.
75. meal replacements	Instant Breakfast powder, Instant Breakfast with milk added
76. gravies	All beef, pork, turkey and chicken gravies
77. sauces	Ketchup, mustard, relish and oriental, barbecue, cranberry and cocktail sauces.
78. soups	Canned and dehydrated beef, chicken, pea, vegetable, egg and wonton soups.
79. sour cream/cream cheese	Herb and Spice dip (Kraft), cream cheese, sour cream dip-buttermilk/onion
80. snacks-chips	Corn chips, puffs, twists and cones and potato and tortilla chips, plain, cheese and flavoured.
81. snack-smoked meat sticks	smoked meat-based sticks, beef jerky

82. snacks-popcorn/pretzels	Baked chips, oil, microwave and air popped popcorn, Bits and Bites and pretzels.
83. botanic-grouped vegetables	raw cucumber, raw mushrooms, raw cauliflower, raw alfalfa seeds (sprouted), raw mature soybeans (sprouted), canned mushrooms, boiled mushrooms, boiled cauliflower
84. lettuce/cabbage/greens	iceberg, romaine and radicchio, raw and boiled cabbage
85. non-leafy dark green	Peas, snap beans, broccoli, green peppers and asparagus.
86. potatoes	Potato flesh and skin baked or boiled and baked skin.
87. french fries/hashed browns	Frozen, fast food or home-prepared fried or baked French fries and hash browns.
88. mashed potato	Home-prepared with milk and butter or milk only.
89. mixed potato dishes	home-prepared scalloped potatoes, poutine
90. roots/bulbs/tubers	Raw onions, radishes, garlic, celery, and boiled turnips, onions and beets.
91. raw/cooked/ paste tomatoes	raw red ripe tomatoes, canned stewed red ripe tomatoes
92. tomato/vegetable juice	canned tomato juice, canned vegetable juice cocktail
93. tomato sauce salsa	Canned and homemade salsa and canned spaghetti sauce.
94. carrots/carrot juice	Raw and boiled carrots and canned carrot juice.
95. other dark yellow/orange	Corn, sweet frozen kernel corn, raw, canned cream-style, acorn squash and sweet red peppers.
96. mixed vegetables	Frozen mixed vegetables, fast food vegetable salad, coleslaw and onion rings, snap beans, hot chili peppers.

Appendix E Serving Weights for Foods Included in Canada's Food Guide Subgroups

Sub-Group	Serving Weight	CFGHE Group
1. barley/bread stuffing	120 g	GP
2. whole grain bread	30 g	GP
3. white bread	25 g	GP
4. cold cereal	30 g	GP
5. hot cereal	188 g	GP
6. crackers	20 g	GP
7. croissants	45 g	GP
8. muffins	43 g	GP
9. pancakes	32.5 g	GP
10. pasta	70 g	GP
11. apples	135 g	VF
12. bananas	150 g	VF
13. berries	70 g	VF
14. grapefruit	235 g	VF
15. orange citrus fruit	115 g	VF
16. pears	180 g	VF
17. dried fruit	15 g	VF
18. fruit juice	120 g	VF
19. other fruit	100 g	VF
20. other soups	505 g	VF
21. vegetable soup	505 g	VF
22. tomatoes	240 g	VF
23. tomato paste	55 g	VF
24. tomato sauce	100 g	VF
25. broccoli	90 g	VF
26. carrots	75 g	VF
27. vegetable juice	128 g	VF
28. other vegetables	85 g	VF
29. peas	80 g	VF
30. fried potatoes	70 g	VF
31. other potatoes	190 g	VF
32. lettuce salads	138 g	VF
33. other salads	120 g	VF
34. string beans	70 g	VF
35. squash	115 g	VF
36. cottage cheese	500 g	MP
37. cheese	50 g	MP
38. ice cream	400 g	MP
39. fluid milk	250 g	MP
40. evaporated milk	100 g	MP
41. milk shakes	600 g	MP
42. yogourt	175 g	MP

43. cream soups	520 g	MP
44. legumes	245 g	MA
45. meats	75 g	MA
46. beef	75 g	MA
47. beef coldcuts	68 g	MA
48. other coldcuts	68 g	MA
49. eggs	50 g	MA
50. peanut butter	30 g	MA
51. nuts and seeds	124 g	MA
52. sausages	88 g	MA
53. beef sausages	88 g	MA
54. tofu	100 g	MA
55. mixed dish with milk products + vegetables	250 g	1 VF 1 MP
56. mixed dish with grains + milk products	200 g	1 GP 0.5 MP
57. mixed dish with grains and meat or alternative	100 g	1GP 1 MA
58. mixed dish with grains + meat or alternatives + milk products	100 g	1 GP 0.5 MP 0.5 MA
59. mixed dish with grains + vegetables	300 g	2 GP 1 VF
60. mixed dish with grains + vegetables + milk products	200 g	1 GP 1 VF 0.5 MP
61. mixed dish with grains + vegetables + meats or alternative	200 g	1 GP 1 VF 0.5 MA
62. mixed dish with vegetables + meat or alternative	250 g	1 VF 1 MA
63. mixed dish with every group	200 g	1 GP 0.25 VF 0.5 MP 0.5 MA
"Other Foods"		NO GROUP

Appendix F Percent of Foods for which CANDAT Provides Nutrient Values

Nutrient	Unit	Master Food File % of Foods	Institute File % of Foods
Protein	g	100.00	83.74
Fat (Total Lipids)	g	100.00	82.85
Carbohydrate (Total by Difference)	g	99.96	84.63
Energy (Kcal)	Kcal	100.00	85.08
Energy (KJ)	KJ	100.00	83.41
Fibre (Total Dietary)	g	65.36	57.80
Calcium	mg	96.42	82.96
Iron	mg	96.44	78.84
Zinc	mg	88.90	73.05
Vitamin D [1] (Micrograms)	µg	3.15	21.16
Vitamin A (Retinol Equivalents)	RE	94.07	70.04
Vitamin C	mg	90.81	66.15

[1] Note: few foods contain vitamin D so values are not reported for foods that are not expected to contain any.

Appendix G Cereal Choices

1994		1998		2002	
Cereal	**#**	**Cereal**	**#**	**Cereal**	**#**
Rice Krispies	14	Fruit Loops	12	Corn Pops	9
Corn Flakes	13	Frosted Flakes	9	Frosted Flakes	8
Fruit Loops	10	Rice Krispies	9	Honey Nut Cheerios	8
Cheerios	8	Honey Nut Cheerios	8	Fruit Loops	6
Cap'n Crunch	8	Corn Pops	4	Corn Flakes	4
Honey Nut Cheerios	7	Cheerios	4	Mini Wheats	4
Frosted Flakes	6	Corn Flakes	3	Cheerios	3
Corn Pops	4	Special K	3	Cocoa Puffs	3
Honey-Comb	3	Raisin Bran	2	Life	3
Life	3	Bran Flakes	2	Rice Krispies	2
Mini wheats	2	Frosted Cheerios	2	Cap'n Crunch	2
Corn Bran	2	Cap'n Crunch	1	Raisin Bran	2
Frosted Cheerios	1	Alpha-Bits	1	Special K	2
Bran Flakes	1	Multigrain Cheerios	1	Sugar Crisp	2
Apple Cinnamon Cheerios	1	Chocolate O's	1	Vector	2
Cocoa Pebbles	1	Cinnamon Toast Crunch	1	Frosted Cheerios	1
Cruncheroos	1	Cocoa Pebbles	1	Bran Flakes	1
Cruncheroos with Honey	1	Golden Grahams	1	Special K Red Berries	1
Golden Grahams	1	Just Right	1	Apple Cinnamon Cheerios	1
Puffed Wheat	1	Life	1	Cinnamon Toast Crunch	1
Shredded Wheat	1	Mini Wheats	1	Cocoa Pebbles	1
Shreddies	1	Mini Wheats Brown Sugar	1	Oat Bran Flakes	1
Special K	1	Puffed Wheat	1	Oatmeal Crisp	1
Sugar Crisp	1	Shredded Wheat	1	Puffed Wheat	1
Trix	1	Shreddies	1	Reese Peanut Butter Puffs	1
		Lucky Charms	1	Shreddies	1
		Sugar Crisp	1	Lucky Charms	1
		Wheat Flakes	1	Trix	1

Appendix H Traditional Food List

Food	Description
Cornbread	Staple food made from a mixture of cornmeal, oats and kidney beans, to which water is added and formed into round dense cakes, which are then boiled.
Meat Pie	Festive cultural food, which consists of a pastry filled with ground pork and mashed potatoes.
Deer Meat	Venison
Corn Soup	Basic ingredients today are hominy corn, red kidney beans with a meat garnish of salt pork. Other vegetables (turnips, cabbage, carrots) are also added.
Chicken and dumplings	Chicken stew with flour dumplings added to the boiling stock.
Fricassee	Cooked ground beef simmered with onions and potatoes and thickened with flour.
La Sauce	Cooked ground beef with sauce-like consistency due to the addition of flour and water.

Appendix I Mean and Percent Contribution of Top Food Group Contributors to more than 50% of Intake

Energy (kilocalories)								
Boys 1994	**Mean**	**%**	**Boys 1998**	**Mean**	**%**	**Boys 2002**	**Mean**	**%**
2% white milk	121	5.5	refined yeast bread/rolls	144	6.2	mixed pasta dishes	132	6.2
regular carbonated drink	120	5.5	mixed pasta dishes	118	5.1	white/semolina/egg pastas	127	5.9
refined yeast bread/rolls	111	5.0	white/semolina/egg pastas	117	5.0	low fibre cold cereal	123	5.7
mixed pasta dishes	105	4.8	regular carbonated drink	103	4.4	punch drinks/ice tea	109	5.1
punch drinks/ice tea	103	4.7	punch drinks/ice tea	101	4.4	refined yeast bread/rolls	102	4.7
mixed bread dishes	102	4.6	Kahnawake recipes	92	3.9	Kahnawake recipes	85	4.0
low fibre cold cereal	99	4.5	2% white milk	85	3.7	cakes/cookies	80	3.7
white/semolina/egg pastas	91	4.1	low fibre cold cereal	81	3.5	mixed chicken-fried/dish	73	3.4
citrus fruit juice	89	4.0	chocolate bars/syrup	73	3.2	2% white milk	71	3.3
other cuts of beef	81	3.7	mixed bread dishes	67	2.9	mixed bread dishes	63	3.0
Top ten foods		**46.4**	**Top ten foods**		**42.3**	all soups	57	2.6
homo white milk	67	3.0	citrus fruit juice	62	2.7	**Top ten foods**		**47.6**
Kahnawake recipes	62	2.8	other non-citrus	62	2.7	other non-citrus	51	2.4
50% of intake		**52.2**	chips/cones/puffs/twists	64	2.7	**50% of intake**		**50.0**
			50% of intake		**50.4**			
Girls 1994			**Girls 1998**			**Girls 2002**		
refined yeast bread/rolls	109	4.8	refined yeast bread/rolls	144	6.2	refined yeast bread/rolls	113	5.8
regular carbonated drink	106	4.7	mixed pasta dishes	118	5.1	Kahnawake recipes	96	4.9
punch drinks/ice tea	99	4.3	white/semolina/egg pastas	117	5.0	white/semolina/egg pastas	85	4.4
citrus fruit juice	98	4.3	regular carbonated drink	103	4.4	low fibre cold cereal	83	4.3
cakes/cookies	94	4.2	punch drinks/ice tea	101	4.4	punch drinks/ice tea	80	4.1
2% white milk	91	4.0	Kahnawake recipes	92	3.9	mixed pasta dishes	79	4.1
mixed pasta dishes	90	3.9	2% white milk	85	3.7	pizza/pizza pockets	79	4.1
white/semolina/egg pastas	82	3.6	low fibre cold cereal	81	3.5	other non-citrus	73	3.8
low fibre cold cereal	74	3.2	chocolate bars/syrup	73	3.2	2% white milk	72	3.7
other non-citrus	73	3.2	mixed bread dishes	67	2.9	all soups	67	3.5
Top ten foods		**40.3**	**Top ten foods**		**42.3**	**Top ten foods**		**42.7**
non-citrus fruit juice	72	3.1	citrus fruit juice	62	2.7	cakes/cookies	53	2.7
homo white milk	71	3.1	other non-citrus	62	2.7	regular carbonated drink	49	2.5
all soups	62	2.7	chips/cones/puffs/twists	64	2.7	mixed beef dishes	48	2.5
Kahnawake recipes	60	2.6	**50% of intake**		**50.4**	**50% of intake**		**50.4**
50% of intake		**51.9**						