

ORIGINAL RESEARCH

Impact of a school snack program on the dietary intake of grade six to ten First Nation students living in a remote community in northern Ontario, Canada

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ABSTRACT

Introduction: School snack and breakfast programs may be especially important in remote northern communities where many households are food insecure. Despite the strong potential for school programs to improve the dietary intake and eating behaviours of children and youth, very few studies have reported on the effects of school nutrition programs in Aboriginal communities. The purpose of this study was to examine the impact of a school snack program on the dietary intake of grade six to ten First Nation students living in a remote community in northern Ontario.

Methods: Data were collected in November 2004 and December 2007 with grade six to ten (aged 10-18 years) students ($n=63$ and $n=50$, respectively) using a validated web-based 24 hour diet recall survey, the WEB-Q. Food group consumption and nutrient intake of students participating in the school snack program on the previous day were compared with students who chose not to participate. In each year, ANOVA was used to assess differences between participants and non-participants, genders, and grade groups. The second data collection in December of 2007 included five questions asking students about their participation, preferences, and impressions of the snack program.

Results: Students participating in the snack program during the 2004 data collection (37%; $n=23$) compared with those who did not (63%; $n=40$) had significantly ($p<0.05$) higher mean intakes from the 'Vegetables and Fruit' food group (7.5 vs 3.4 servings),



folate (420 vs 270 µg), dietary fiber (18 vs 8 g), vitamin C (223 vs 94 mg), calcium (1055 vs 719 mg) and iron (16.5 vs 11.7 mg). For the 2007 data collection, snack program participants (52%; $n=26$) had higher intakes from the 'Milk and Alternatives' food group (3.3 vs 2.2 servings), vitamin A (697 vs 551 RE [retinol equivalents]), calcium (1186 vs 837 mg), and vitamin D (6.9 vs 4.4 µg) and significantly lower intakes of 'Other' foods (6.0 vs 7.2 servings) compared with non-participants (48%; $n=24$). For 2004 and 2007, differences in intake also occurred by gender and grade groupings, with no interaction effects between snack participation and gender or grade. With the exception of 'Meat and Alternatives' in 2004, there was a trend for a higher percentage of students to meet dietary recommendations if they participated in the snack program. Students indicated that the three things they liked most about the school snack program were the juice (50%), that the program kept them from feeling hungry at school (40%), and that they got a snack at school every day (32%). Students indicated that the snack program helped them to eat healthier by motivating them (74%), eating more fruit (86%), and making better dietary choices (68%).

Conclusions: Given the positive impact of the program on the food and nutrient intake of school snack program participants, qualitative feedback will be used to enhance the program and participation. Clearly, school snack programs can be an important venue to address the nutritional vulnerability of First Nation youth living in remote communities.

Key words: adolescent, Canada, child, First Nations, food habits, nutritional status, program evaluation, schools.

Introduction

Aboriginal peoples is a collective name for the original peoples of North America and their descendents. Over the last few decades, rapid cultural change has occurred in many Aboriginal populations affecting their dietary patterns; transitioning from locally harvested traditional foods to a diet of primarily market food purchased from stores^{1,2}. In particular, Aboriginal youth have departed greatly from traditional food consumption patterns¹. Traditional foods such as game meat, fish, berries and plant foods have been replaced by processed foods, high fat meals, and added sugars; especially in Aboriginal adolescents³⁻⁶. Numerous studies have reported low consumption of vegetables and fruit and dairy products by Aboriginal children^{3,7-9}. Nutrient inadequacies in Aboriginal children and adolescents from certain communities have been documented for iron, folate, vitamin D, calcium and vitamin A^{6,7,10}.

Recent studies have found associations between overall diet quality and academic performance¹¹, and a systematic review found that school breakfast programs can have positive effects on academic performance¹². Schools are an ideal setting for

promoting healthy eating due to the number of weekday hours that students spend there and the opportunity to teach children and youth about healthy foods and eating behaviours. Eating habits start during childhood and can be influenced by a healthy school food environment. School breakfast and snack programs can provide nutritionally balanced, free meals to students each school day. This is especially important in remote northern communities where many households are food insecure^{2,13,14}; fresh produce and other nutritious perishable foods are inconsistently available and can be extremely expensive^{15,16}. School snack and breakfast programs have been suggested as viable actions to combat food insecurity in Aboriginal populations¹⁷⁻²².

Aboriginal peoples in Canada refers to three groups: Indian (commonly referred to as First Nations), Métis, and Inuit. Nearly two-thirds of the Aboriginal population in Canada identify themselves as First Nations people and there are more than 600 First Nation communities. An environmental scan of nutrition programs in First Nations schools in Canada found that more than 85% of the 303 schools surveyed reported having a school nutrition program and 75% of those schools offered their program daily¹⁷. Despite the large number of nutrition programs existing in Canadian First



Nations schools, there are few publications in the academic literature that report on school meal programs (breakfast, lunch, and/or snack) in these communities^{23,24}. These programs have contributed substantially to calcium, dietary fiber, vitamin A, vitamin C, and vitamin D in students^{18,19,23,24}.

The current study examined the impact of an existing school snack program on the dietary intakes of grade six to ten First Nation students living in the remote sub-arctic community of Fort Albany, Ontario. The main objective was to examine the dietary intakes of students participating in the snack program compared with those who did not participate, using a validated web-based survey called the Waterloo Web-based Eating Behaviour Questionnaire (WEB-Q). Two data collections were conducted in separate years, 2004 and 2007. Given that fewer than half of students reported participating in the school snack program on the days of the 2004 data collection, the repeat evaluation in 2007 incorporated questions to assess the habitual participation in the program and obtain feedback on perceived program strengths and suggestions for improvement.

Methods

Participants

Participants in this study were students in grades six to ten at Peetabek Academy in Fort Albany, Ontario. Fort Albany is situated on the west coast of James Bay along the Albany River and houses the community of Fort Albany First Nation which is home to approximately 850 Cree people. Fort Albany is remote and isolated as it is accessible only by plane year round. The community is connected with other James Bay coastal communities by boat and barge during the ice-free season and by a snow/ice road after freeze-up. Peetabek Academy serves Fort Albany First Nation students from kindergarten to grade 12. The school snack program has been provided to students in Fort Albany for more than 15 years. At the time of this study, the snack program at Peetabek Academy provided a morning snack to all students and an

afternoon snack to all elementary (kindergarten to grade 8) students each school day. Morning snacks were usually breakfast type foods such as cereal with milk or whole wheat toast with a spread (cheese or jam) and fruit juice, while afternoon snacks usually consisted of cut up fruit and fruit juice or milk to drink. Boiled eggs, yogurt, or homemade muffins were usually offered once a week when there were more volunteers to assist with snack preparation and distribution. Vegetables were offered occasionally when time and availability allowed. Traditional foods, such as bannock and game meats, were sometimes offered during special events.

Data collections

For this study, two separate data collections in 2004 and 2007 were used to assess the impact of the school nutrition program. Because time and availability of computer terminals did not permit single-day data collections, the data were collected in each year over the course of 2 days. The WEB-Q was conducted in Fort Albany in November 2004 with 63 grade six to ten students (Data Collection #1). The two day data collection took place with grade six and seven students completing the WEB-Q on 11 November and grade eight, nine, and ten students completing the WEB-Q on 12 November. In December 2007 data were collected with grade six and seven students on 12 December and grade eight, nine, and ten students on 13 December with 50 students (Data Collection #2). All 24 hour recall dietary data were collected to reflect weekday consumption (ie the impact of the school snack program), as the data were collected from Tuesday to Friday.

Web-based survey

The WEB-Q is a validated web-based survey tool developed at the University of Waterloo to assess food and physical activity behaviors of children and adolescents²⁵⁻³⁹. The survey includes a 24 hour dietary recall which asks students about what types of food and how much of those foods they consumed on the previous day.



The WEB-Q simulates a dietitian interview and includes prompts for missed food items, pictures and comparisons to common objects to aid in portion size estimation, as well as immediate feedback for students to compare their individual food intake to recommendations.

The WEB-Q has been used to collect nutrition and physical activity information from over 15 000 non-Aboriginal students in Canada and over 500 First Nation students in Ontario and Quebec. The WEB-Q was adapted for First Nation students through previous quantitative and qualitative research which included input through a local community advisory committees from a number of First Nations communities in southern Ontario, northern Ontario, and northern Quebec. The survey underwent some adaptation for each community; such as, adding questions related to school breakfast and snack programs (as applicable to each community), questions regarding traditional food intake, factors influencing traditional food intake, and questions to assist local planning. Specific to this study, adaptations relevant to Fort Albany and suggested by the community advisory committee were made to the WEB-Q. The primary adaptation involved the addition of traditional Aboriginal foods to the list of approximately 900 possible food choices in the 24 hour dietary recall.

Following adaptations, validity testing of the WEB-Q was conducted with First Nations students. Dietitian-administered interviews were conducted with twenty-five Fort Albany students during a data collection in 2004 and compared with the web-survey that had first been completed for the same 24 hour recall period. Food models from the Ontario Food Survey assisted with portion estimation during dietitian interviews. The results for Fort Albany ($n=25$) showed that there was good agreement for energy and key nutrient intakes (intraclass correlation coefficients for calories, carbohydrates, protein, iron, vitamin C, and fibre >0.67 , $n=25$, grades six to ten) from the web-based survey versus dietitian administered interviews²⁷.

The WEB-Q asked 'At which times did you eat *anything* yesterday?' Students were to indicate all options that applied

to them: breakfast, middle of the morning snack, lunch, middle of the afternoon snack, after school snack, dinner, early evening snack, later evening snack, school snack/breakfast program. This question was used to capture whether students had participated in the school nutrition program on the previous day. Based on input from the director of the program and questions used by FAVES – an evaluation survey of a school fruit and vegetable snack intervention conducted in London, Ontario⁴⁰, five questions were added to the WEB-Q and asked during the second data collection with grade six to ten students in Fort Albany in December of 2007. The five additional questions on the WEB-Q related to the Fort Albany school nutrition program were as follows:

1. How often do you participate in the school snack/breakfast program? (Response options: Every school day, More than half of the week [3 or more days each week], Less than half of the week [2 or fewer days each week], Rarely or never, Not answered)
2. What do you like most about the school snack program? (Check all that apply: I get a snack at school every day; It helps me to focus in class; It keeps me from feeling hungry at school; Juice; Eggs; Cereal or toast; Cut up fruit)
3. Is there a different vegetable or fruit you would like to get as a snack at school? (Open-ended)
4. If you could change one thing about the snack program, what would it be? (Open-ended)
5. Because of the school snack program... (Agree, disagree, not answered: I am motivated to eat healthier; I make better choices about what I eat; I eat more vegetables; I eat more fruit; I have asked my parents to buy or serve vegetables or fruits I try at school).

Participant recruitment, consent, and data collection

Parental passive consent/information letters were sent home with students one week before each scheduled data collection, as passive consent is culturally appropriate in this



community. In addition, students had to provide active consent on the first page of the WEB-Q, by selecting the checkmark on the screen to participate or the 'X', to decline participation in the study. The lead author or her colleagues supervised students while they completed the WEB-Q and answered any questions the students had about the survey. Each student was assigned a unique login and password which ensured anonymity and confidentiality. The surveys were completed during class time using computers with internet access in the computer room at Peetabeck Academy. This study used a convenience sample of all consenting students who were in attendance on the days of each data collection; the participation rate was 100% because all students in attendance participated.

Data analysis

From the WEB-Q data, food group consumption and nutrient intake (from the 24 hour dietary recall) of students participating in the school snack program on the previous day were compared with students who did not participate for 2004 and 2007, respectively. Descriptive statistics (means, standard deviations, frequencies, percentages) were calculated. For both the food-group and nutrient datasets, multivariate analysis of variance (MANOVA) was used to assess differences between groups (snack program participants and non-participants), and by gender and grade. Owing to the small sample size, grades were categorized into two groups with elementary students in grades six, seven, and eight versus high school students in grades nine and ten. Differences in grade were assessed because an afternoon snack was not offered to high school students (grades 9 and 10) and from past research indicating that older students tend to eat differently from younger students. Individual participant intakes were compared with current Canadian dietary recommendations for food groups and nutrients with an Estimated Average Requirement (EAR) value to determine the percentage of participants that were not meeting recommendations. The EAR has been used in dietary studies to describe the population prevalence of inadequate intakes. Data were analyzed using SPSS statistical software

v18 (www.spss.com). Statistical tests were considered significant with p -values <0.05 .

From the December 2007 data, analyses for the questions: 'How often do you participate in the school snack/breakfast program?', 'What do you like most about the school snack program?' and 'Because of the school snack program...' consists of frequencies and results are presented as descriptive characteristics. Frequencies from these questions were compared by gender. For the open-ended school nutrition program questions ('Is there a different vegetable or fruit you would like to get as a snack at school?' and 'If you could change one thing about the snack program, what would it be?'), responses were grouped according to common themes and ordered according to the most common theme (or response) versus the least common theme (or response).

Ethics approval

Permission to conduct this study was obtained from Fort Albany First Nation (the locally elected government), Mundo Peetabeck Education Authority (the local First Nation administered school board), and the Office of Research Ethics at the University of Waterloo (#14081).

Results

Characteristics of the study population for the two data collections are shown (Table 1). The morning and afternoon snacks that were provided to students on the days prior to the data collection, which are the days reported in the 24 hour dietary recall of the WEB-Q, are listed by grade (Table 2). This is a typical example of the snacks that are offered in the school program each day.

Overall for Data Collection #1, the majority of students did not meet current dietary recommendations for almost half of the food groups and nutrients that were examined (Table 3). More than three-quarters of the students did not meet recommendations for 'Milk and Alternatives', calcium, and vitamin D. With the exception of 'Meat and Alternatives',



there was a trend for a higher percentage of students to meet dietary recommendations if they participated in the snack program. The majority of snack program participants met recommendations for eight of the 12 food group/nutrient variables; whereas, the majority of non-participants only met five recommendations. For the 'Vegetables and Fruit' food group and folate, the percentage of non-participants failing to meet recommendations was more than double the percentage of snack participants (78% vs 35% and 60% vs 30%, respectively).

Similarly, Data Collection #2 showed that the majority of students were not meeting current dietary recommendations (Table 3) and more students tended to meet recommendations if they participated in the school nutrition program.

For Data Collection #1, students participating in the snack program (37%; $n=23$) had significantly higher ($p<0.05$) intakes for six of the 12 variables examined than those who did not participate (63%; $n=40$). For example, participants in the snack program had higher mean intakes of servings from the Vegetables and Fruit category (7.5 vs 3.4 servings) than non-participants. Mean values and differences in food group and nutrient intakes between participants and non-participants are shown (Table 4). Differences in intake also occurred by gender for Meat and Alternatives, calcium, and iron, by gender and grade for 'Other' Foods, vitamin A and dietary fiber, and by grade only for folate and vitamin C.

For Data Collection #2, students participating in the snack program (52%; $n=26$) had significantly higher intakes for five of the 12 variables examined than those who did not participate (48%; $n=24$) and with the exception of calcium, differed from the food groups and nutrients that were significant from the analysis for Data Collection #1. For example, participants in the snack program had higher mean intakes of servings from the Milk and Alternatives food group (3.3 vs 2.2 servings) as well as vitamin A (697 vs 551 RE [retinol equivalents]) and vitamin D (6.9 vs 4.4 μg) than non-participants. Vitamins A and D are nutrients that are added to most of the fluid milk sold in Canada. For Data Collection #2, differences in intake occurred by gender for nearly all the food groups and nutrients with the exception of Vegetables

and Fruit, 'Grain Products', and vitamin C. Differences in food group intake are shown by sex for snack program participants and non-participants in 2007 (Fig1). There were differences by grade for Other foods, vitamin A, calcium, and vitamin D.

For both data collections boys generally had higher intakes from all food groups and nutrients than girls. High school students generally had higher intakes from all food groups and nutrients than elementary students. There were no significant ($p \geq 0.05$) interaction effects between snack participation and gender or snack participation and grade for either of the two data collections.

Despite only half of students participating in the snack program on the day of the second data collection, 78% students reported that they usually participate in the school snack and breakfast program more than half of the week or every day (Fig2).

Students were asked to check 'all that apply' when asked, 'What do you like most about the school snack program?'. However, the majority of students (33 of 50, 66%) only chose one response option. Students indicated that the three things they liked most about the school snack program were the juice (50%), that the program kept them from feeling hungry at school (40%), and that they got a snack at school every day (32%).

Students were asked, 'Is there are different vegetable or fruit you would like to get as a snack at school?' This was an open-ended question, so students could choose whatever vegetables or fruit that they wanted. Many students suggested more than one vegetable and/or fruit. Of the 46 students who responded to this question, the six most common responses were grapes ($n=8$), bananas ($n=6$), apples ($n=6$), juice ($n=6$), kiwifruit ($n=5$), and strawberries ($n=5$). Apples and juice were already regularly served to students from the snack program as they were easier to transport into the community. Bananas were served occasionally, grapes and strawberries rarely and often only for very special events. At this time, kiwifruit had never been served at school.



Table 1: Characteristics of study population according to data collection

Characteristic	Data collection no. & date	
	#1 11-12 November 2004	#2 12-13 December 2007
No. participants	63 [¶]	50
Percentage of eligible participants [†]	86	83
Age (years \pm SD)	13.5 \pm 1.6	13.0 \pm 1.8
Male, <i>n</i> (%)	28 (44.4)	22 (42.9)
Female, <i>n</i> (%)	35 (55.6)	28 (57.1)
Elementary School (Grade 6-8), <i>n</i> (%)	38 (60.3)	37 (74.0)
High School (Grade 9-10), <i>n</i> (%)	25 (39.7)	13 (26.0)
Male snack participants, <i>n</i> (%)	10 (35.7)	15 (68.1)
Female snack participants, <i>n</i> (%)	13 (37.1)	11 (39.3)
Elementary School snack participants, <i>n</i> (%)	15 (39.5)	18 (48.6)
High School snack participants, <i>n</i> (%)	8 (32.0)	8 (61.5)
Total snack participants, <i>n</i> (%)	23 (36.5)	26 (52.0)

[†]Represents the number of participants in the data collection divided by the number of students enrolled in the school in grades 6-10 at the time of the data collection. [¶]Three participants did not report sex and/or age for Data Collection #1, so the working *N* was 63, and their data were excluded from further analyses.

Table 2: Morning and afternoon snacks provided prior to data collection

Grade	Snack [†]		
	Morning		Afternoon
Data collection #1 - 2004			
Date	10 November	11 November	10 & 11 November
Grade 6-8 (<i>n</i> =38)	Cold cereal with milk, juice	Hot oatmeal with milk, juice	Oranges, apples, juice, tea biscuits
Grade 9-10 (<i>n</i> =25)	Cold cereal with milk, juice	Hot oatmeal with milk, juice	Do not receive afternoon snack
Data collection #2 - 2007			
Date	12 December	13 December	12 & 13 December
Grade 6-8 (<i>n</i> =37)	Cold cereal with milk, juice	Whole wheat toast with spreadable cheese, milk	Bananas, milk
Grade 9-10 (<i>n</i> =13)	Cold cereal with milk, juice	Whole wheat toast with spreadable cheese, milk	Do not receive afternoon snack

[†]The cold cereal was either Honeynut Cheerios[™] mixed with regular Cheerios[™] (oat-based processed cereal with added salt and sugar) or Shreddies[™] (wheat-based processed cereal with added salt and sugar). The juice offered with snacks was 100% juice from concentrate: either apple, orange, or grape juice.

When students were asked what they would change about the program, only 64% (*n*=32) of the students submitted a response. The most common response (*n*=16, 50%) was that they would change nothing about the program or that they didn't know what they would change. The next most common response was that students wanted more fruit (*n*=6,

19%). Other program changes suggested were that students could help out more in the kitchen and that they wanted to eat their snack in the cafeteria instead of in the classroom. A few students wanted to also have a lunch program offered at school.



Table 3: Percentage of children not meeting dietary recommendations by snack participation and sex (N = 116)^{41,42}

Food group or nutrient (units)	Dietary recommendation			Children < minimum recommendation – n (%)					
	CFG or EAR recommendation by age group [†]			Data collection #1 – 2004, n=63			Data collection #2 – 2007, n=50		
	9–13 y	14–18 y	CFG or EAR	Snack participants total n=23	Non-participants total n=40	Overall total n=63 [¶]	Snack participants total n=26	Non-participants total n=24	Overall total n=50
Vegetables and Fruit (svgs)	5 (♂&♀)	7 (♂&♀)	CFG	8 (35)	31 (78)	28 (62)	23 (88)	23 (96)	46 (92)
Grain Products (svgs)	4 (♂&♀)	7 (♂) 6 (♀)	CFG	9 (39)	21 (53)	30 (48)	14 (54)	13 (54)	27 (54)
Milk and Alternatives (svgs)	2 (♂) 3 (♀)	3 (♂&♀)	CFG	17 (74)	36 (90)	53 (84)	15 (58)	16 (67)	31 (62)
Meat and Alternatives (svgs)	1 (♂&♀)	3 (♂) 2 (♀)	CFG	9 (39)	11 (28)	20 (32)	9 (35)	9 (38)	18 (36)
Carbohydrate (g/day)	100	100	EAR	1 (4)	5 (13)	6 (10)	2 (8)	4 (17)	6 (12)
Vitamin A (RE/day)	445 (♂) 420 (♀)	630 (♂) 485 (♀)	EAR	9 (39)	18 (45)	27 (43)	12 (46)	14 (58)	26 (52)
Folate (µg/day)	250 (♂&♀)	330 (♂&♀)	EAR	7 (30)	24 (60)	31 (49)	18 (69)	17 (71)	35 (70)
Vitamin C (mg/day)	39 (♂&♀)	63 (♂) 56 (♀)	EAR	3 (13)	13 (33)	16 (25)	14 (54)	14 (58)	28 (56)
Calcium (mg/day)	1100	1100	EAR [§]	14 (61)	35 (88)	49 (78)	14 (54)	19 (79)	33 (66)
Vitamin D (µg/day)	10	10	EAR [§]	18 (78)	35 (88)	53 (84)	21 (81)	21 (88)	42 (84)
Iron (mg/day)	5.9 (♂) 5.7 (♀)	7.9 (♂) 7.7 (♀)	EAR	4 (17)	6 (15)	10 (16)	2 (8)	7 (29)	9 (18)

CFG = Canada Food Guide; EAR = Estimated Average Requirement; y = years old; svgs = servings; RE = Retinol Equivalents. ♂ = Male; ♀ = female.

[†]Recommended number of daily servings for food groups were from Health Canada's *Eating Well with Canada's Food Guide (CFG) for First Nations, Inuit and Métis*[42]. No formal recommendations exist for "Other" foods, so they were excluded; [¶]Three students did not provide sex and/or age for Data collection #1 in 2004 and were not included in the analysis; [§]Based on the EAR values that became available in 2010 but were not in place at the time of data collections[43].

Students indicated that the snack program helped them to eat healthier by motivating them (74%), eating more fruit (86%), and making better dietary choices (68%) (Fig3). However, the majority (50%) did not think that the snack program encouraged them to ask their parents

to purchase vegetables or fruit that they had tried at school. For this question, students could choose all responses that applied to them.



Table 4: Differences in food group and nutrient intakes between snack program participants and non-participants⁴¹

Food group [†] or nutrient (units)	Data collection #1 - 2004			Data collection #2 - 2007		
	Mean ± SD		P value	Mean ± SD		P value
	Participants n=23	Non-participants n=40		Participants n=26	Non-participants n=24	
Vegetables and Fruit (svgs)	7.5 ± 4.2	3.4 ± 2.9	<0.001*	2.4 ± 1.8	2.6 ± 2.3	0.416
Grain Products (svgs)	5.3 ± 2.7	5.1 ± 3.3	0.777	5.6 ± 5.9	4.6 ± 2.9	0.603
Milk and Alternatives (svgs)	2.1 ± 1.9	1.5 ± 1.5	0.142	3.3 ± 2.6	2.2 ± 1.7	0.010*
Meat and Alternatives (svgs)	3.3 ± 3.2	2.8 ± 2.2	0.471	3.1 ± 2.6	2.5 ± 2.4	0.551
“Other” Foods [‡] (svgs)	6.9 ± 4.7	5.5 ± 3.9	0.232	6.0 ± 4.6	7.2 ± 6.5	0.049*
Vitamin A (RE)	741.4 ± 562.4	593.5 ± 434.3	0.248	696.6 ± 521.4	550.9 ± 383.9	0.020*
Folate (µg)	420.2 ± 236.4	270.4 ± 176.6	0.006*	241.0 ± 184.7	223.0 ± 112.8	0.892
Dietary fiber (g)	18.0 ± 12.3	7.8 ± 5.8	<0.001*	8.9 ± 6.5	7.3 ± 5.8	0.112
Vitamin C (mg)	223.2 ± 159.6	94.4 ± 82.7	<0.001*	68.8 ± 77.1	67.7 ± 74.2	0.868
Calcium (mg)	1054.7 ± 692.2	719.6 ± 458.8	0.024*	1185.9 ± 807.9	836.9 ± 626.6	0.009*
Vitamin D (µg)	5.9 ± 5.2	3.7 ± 3.9	0.064	6.9 ± 6.0	4.4 ± 3.8	0.004*
Iron (mg)	16.5 ± 8.7	11.7 ± 4.7	0.005*	12.1 ± 8.1	13.4 ± 6.4	0.089

SD = standard deviation; svgs = servings; RE = Retinol Equivalents. Analysis was adjusted for sex and grade grouping distribution.

[†]Food groups are from Health Canada's *Eating Well with Canada's Food Guide for First Nations, Inuit and Métis*[42]. [‡]“Other” Foods refer to foods and drinks that were not part of the four food groups according to *Eating Well with Canada's Food Guide*.

*P < 0.05.

Discussion

The findings from this study suggest that the school snack program at Peetabeck Academy in Fort Albany is having a positive impact on the dietary intake of grade six to ten students. Although the long-term effects of the school snack program were not examined, the fact that the program has been providing healthy food for students for more than a decade and the findings from the WEB-Q showing improved nutritional benefits to students shows that the program is likely to be very important with respect to increasing food security for children and adolescents in Fort Albany.

Similar to other studies of school nutrition programs in Canadian Aboriginal children, the snack program in Fort Albany helped to improve the dietary intake of fiber^{18,23}, and vitamin C¹⁸ in 2004, calcium^{19,24} in 2004 and 2007, and vitamin A²⁴ and vitamin D^{19,24} in 2007. Gates et al found that the impact of their snack programs in First Nations were only

maintained over the short-term and not sustained at one year follow-up^{18,19}. It is important to note that their projects were pilot intervention programs that had not existed prior to their studies. The sustainability of their programs were hindered by a lack of funding and personnel resources over the long term. In contrast, the snack program in Fort Albany has become institutionalized in the community and the school and has been sustained and gradually improved over the course of many years. In the past few years, the program in Fort Albany has been expanded further to include an extensive and daily offering of breakfast with various breakfast food options for all high school students. The success of the school nutrition program in Fort Albany has been attributed to the dedication of a ‘program champion’ throughout the program’s history²⁰, adequate food preparation and storage facilities, continuous financial resources²⁰, and widespread community support^{43,44}.

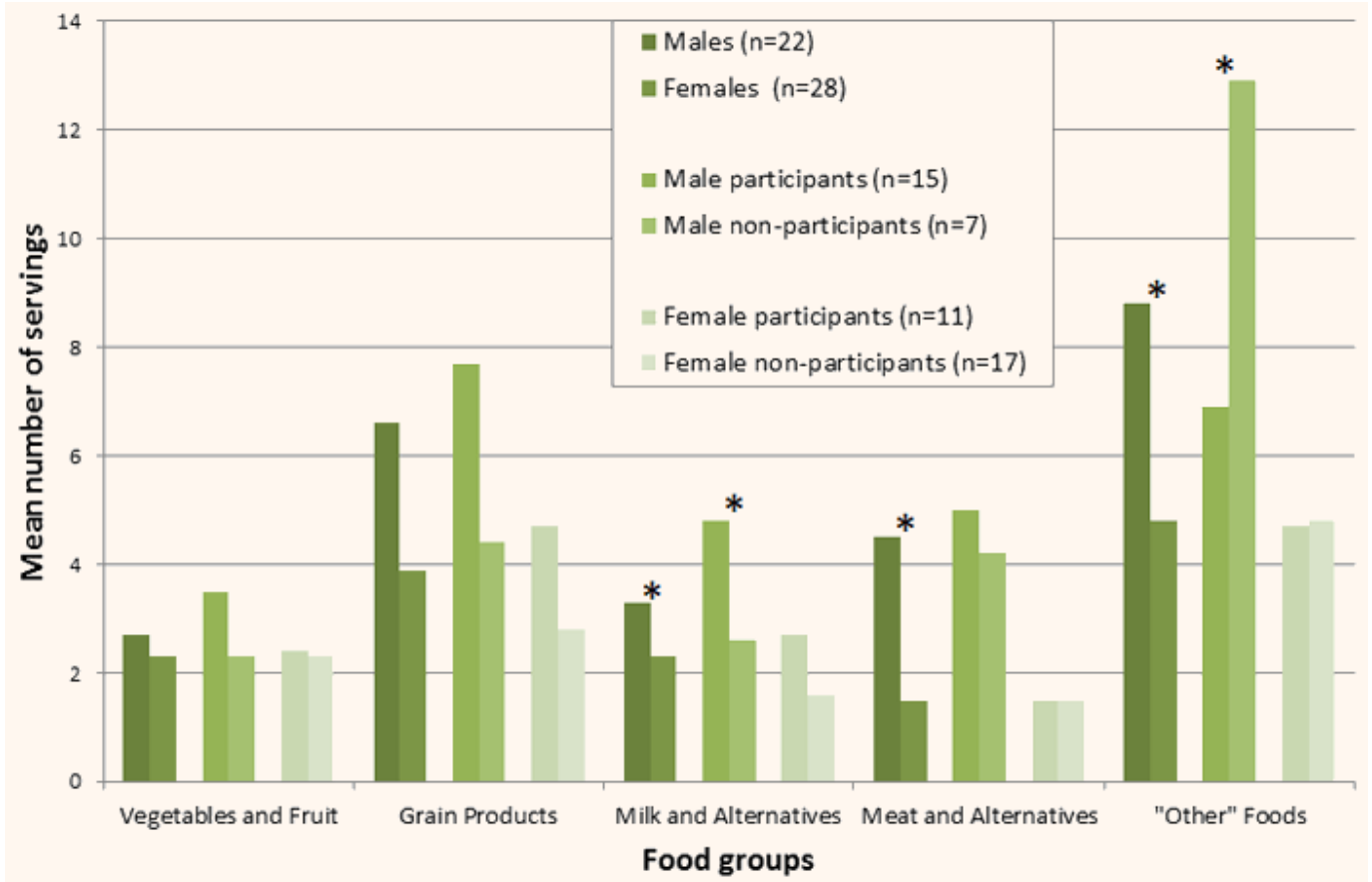


Figure 1: Differences in food group intake by sex between snack program participants and non-participants in 2007 (N=50). *Significant differences between paired columns, $p < 0.05$.

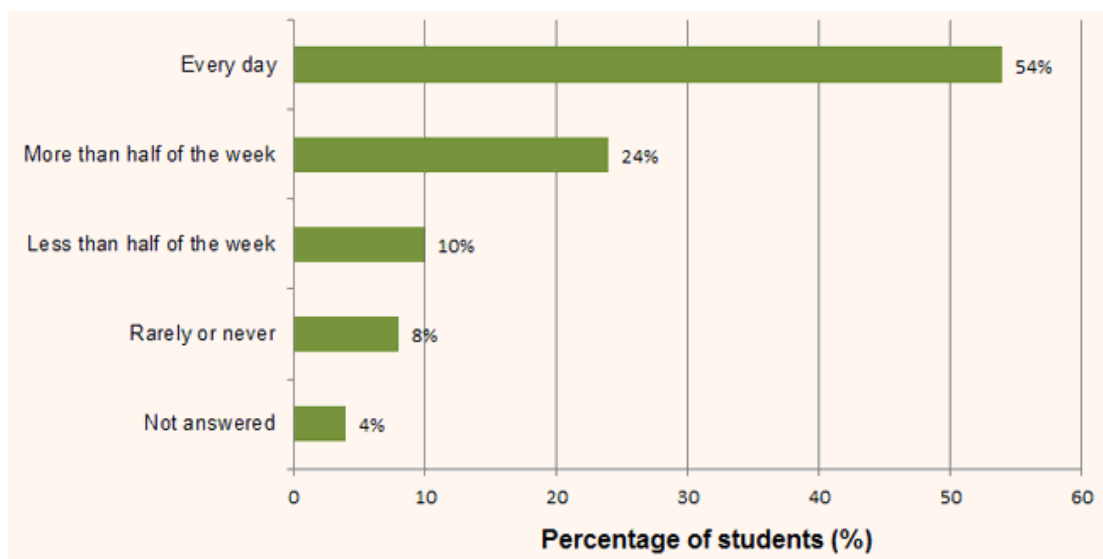


Figure 2: How often students reported participating in the snack program in 2007 (N = 50).

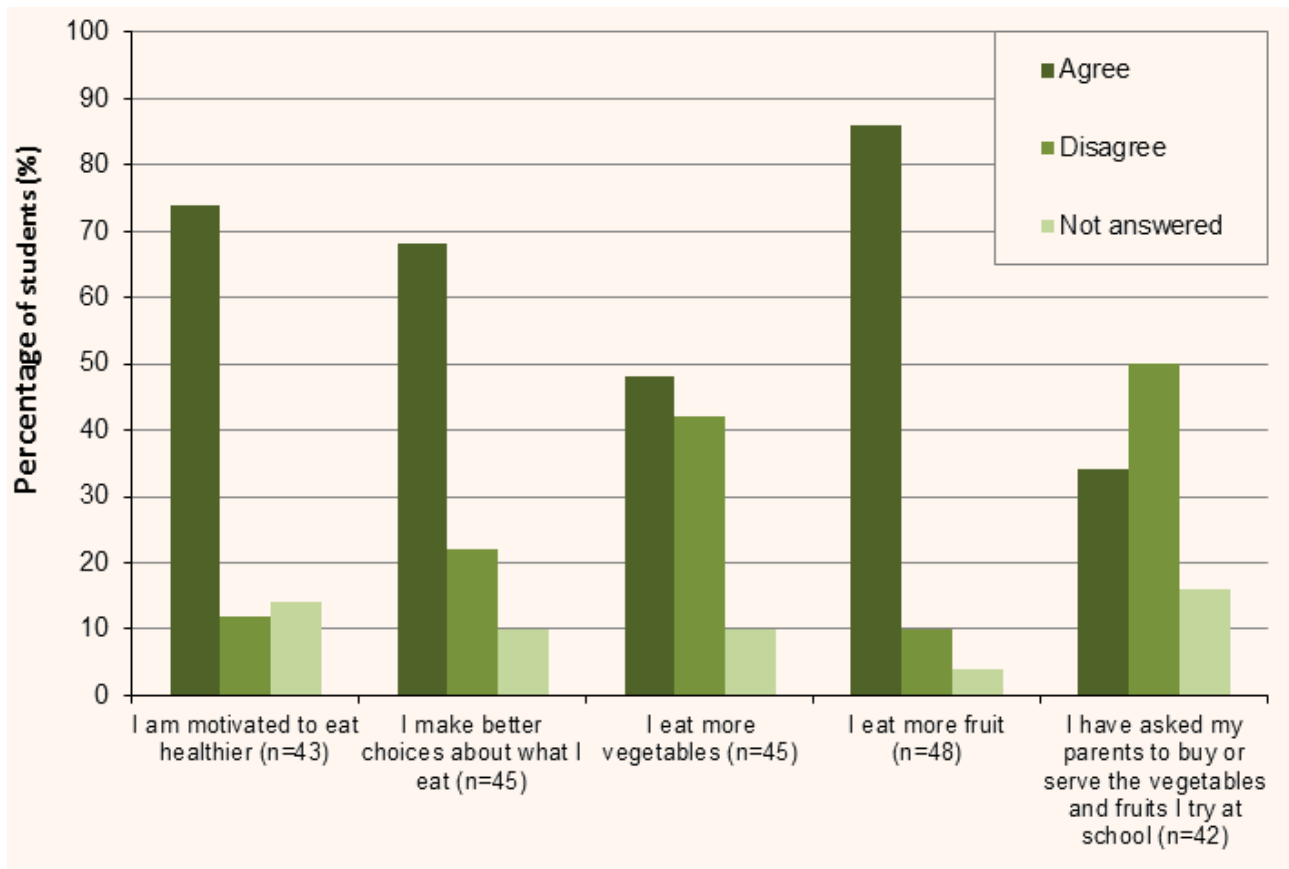


Figure 3: Student responses to 'Because of the school snack program...'

As in other studies of Aboriginal children, Vegetables and Fruit consumption for the majority of students was below guidelines^{3,9,18,45}. It is promising that participants in the 2004 snack program in Fort Albany had significantly higher intakes of Vegetables and Fruit and more than double the percentage of snack participants met Vegetable and Fruit recommendations compared with non-participants. In a population where the majority of children and youth do not meet dietary recommendations for many food groups and nutrients, the snack program appears to make an important contribution to meeting national nutritional guidelines. It is important to note that the EAR values are expected to satisfy the needs of only 50% of the people in that age group based on a review of the scientific literature, whereas the Recommended Dietary Allowance (RDA), a higher value, is the daily dietary intake level of a nutrient considered

sufficient to meet the requirements of nearly all (97–98%) healthy individuals in each life-stage and gender group. The RDA is calculated by adding 2 standard deviations to the EAR values⁴⁶. Therefore, despite improvements in dietary intakes for participants of the snack program, intakes of important nutrients were still very low. It also is important to point out that although oranges and apples were offered during the afternoon snack in 2004, the majority of the 7.7 servings of Vegetables and Fruit for snack program participants came from the consumption of fruit juice. The majority of students also reported that the juice was what they liked most about the snack program. The Canada Food Guide suggests that people have vegetables and fruit more often than juice, as they have more fiber and are more nutrient dense than fruit juice⁴¹. Also recommended by the Canada Food Guide is to eat one dark green and one orange vegetable each day; a



recommendation not met by the Fort Albany snack program. The program does not regularly offer vegetables, as they are extremely expensive and can be more difficult to transport, store, and prepare. Wein et al conducted a study of food preferences for traditional and store-bought foods with Aboriginal and non-Aboriginal school children in northern Alberta and suggested that nutrition programs for Aboriginal communities should use a variety of preferred foods as a means for achieving a more nutritious diet. Most students in the study indicated that they did not think the program required any changes, although there were a few types of fruit that they would like to receive more often⁴⁷. Because the students in Fort Albany were keen to have grapes, kiwifruit and strawberries – three fruits that were rarely or never provided - offered by their snack program, it may be important to attempt to present these fruits more frequently. Acknowledging that these specific fruits are more expensive than other fruit, difficult to transport, and to store, it would be beneficial for the school to conduct a future survey with students of the vegetables and fruit that they like. The results of this survey could contribute valuable information about how the snack program could be improved to combine student food preferences with more of the Canada Food Guide recommendations.

Interestingly, the study by Wein et al found higher mean preference scores by Native children for milk than soft drinks, with apples, chicken and milk receiving the highest preference scores for store-bought food⁴⁷. Despite the preference for drinking milk, many of the mothers participating in their study mentioned being unable to afford milk in large enough quantities to supply their families for more than one or 2 days a week. Milk or a milk alternative (cheese spread) was offered by the program during both morning and afternoon snacks during the 2007 data collection. Findings from the second data collection in this study, with significantly higher Milk and Alternatives, calcium, vitamin A, and vitamin D intakes in snack program participants than non-participants, indicate that the actual content of the snacks provided were having an impact on student consumption. The cost of a 4 L bag of milk in January of 2007 at the grocery store in Fort Albany was \$12.19

compared with \$4.49 at the same time point in southern Ontario (unpubl. data; the southern Ontario price was an average price from 3 grocery stores in one city). Many studies of Canadian Aboriginal children have reported very low intakes from the Milk and Alternatives food group as well as low intakes of related nutrients such as calcium and vitamin D^{3,7,9,19,44,48}. *Milk insecurity*, a phenomenon described by Williams et al⁴⁹ as a lack of access to affordable milk for families, is probably a very common issue for northern First Nations households. The ability to offer milk and milk products to First Nations children and adolescents through a school nutrition program may be an important contributor to healthy dietary intakes in this population.

In this study, only single 24 hour dietary recalls were used and limitations of this method include recall error, inaccurate estimation of portion sizes, underreporting of foods, and the inability to capture a complete picture of usual dietary intake. However, the WEB-Q has incorporated several techniques to minimize the weaknesses of this form of assessment. For each selected food, the student could choose an estimate of the serving size, which was aided by pictures of portion sizes and comparisons to common objects. Prompts were used throughout the dietary recall to capture missed questions and forgotten foods, drinks, and toppings. Visual and hands-on tasks are culturally appropriate and appealing for First Nations students⁵⁰⁻⁵⁸. There was also improved reporting of sensitive information, (eg 'junk' food [food of little nutritional value] intake and body weights) during the WEB-Q validation study, compared with dietitian interviews²⁷. Wein states that dietary recalls are much better suited to the survey needs of Aboriginal communities in comparison to dietary records because they are less labour intensive for the respondent⁵⁹. Although multiple 24 hour recalls can better capture typical dietary intakes, the concern for respondent burden in participating children was taken into account and several studies of nutrition in Aboriginal children have successfully used a single 24 hour recall approach^{3,6,8,23,60-62}.

It is surprising that only 37% of students reported participating in the snack program during the first data collection in 2004. It is possible that some students were



absent from school on the previous day, and therefore would not have participated in the program. For the second data collection in 2007, more than half of grade six to ten students participated in the program. The difference in participation between 2004 and 2007 may be a result of better school attendance in 2007, as well as small improvements made to the snack program itself over time. There was an increase in financial resources applied to the program in 2007 which enabled the program to have a wider variety of foods offered, as well as more program equipment such as bowls and beverage cups. The director of the snack program has been constantly looking for ways to improve the program and to meet the needs and wants of the students. Responses from the additional questions in 2007 supported benefits from the program and offered few suggestions for improvement.

In a study by Gates et al conducted in a nearby First Nation¹⁸, the question 'Because of the school snack program...' was also asked. Results were similar, where 64% of students reported being motivated to eat healthier, 67% reported making better choices about what they ate, and 81% reported eating more fruit, compared with the findings of this study at 74%, 68%, and 86%, respectively¹⁸. A comprehensive school nutrition program, including nutrition education curriculum⁶³, was implemented over a five week period in Fort Albany in the spring of 2010⁶⁴. This program was shown to improve knowledge, exposure to, and preferences for, vegetables and fruit, but did not impact intentions or self-efficacy towards these foods. Despite the positive impression of the program by teachers, parents, and students, it was acknowledged that the affordability, accessibility, and availability of vegetables and fruit remained a barrier to increasing consumption in Fort Albany⁶⁴. While the snack program can help to alleviate some of the barriers to food security for children and adolescents in Fort Albany, improved food security policies and programs and support for local community initiatives remain necessary.

Conclusions

Given the positive impact of the program on the food and nutrient intake of school snack program participants,

qualitative feedback will be used to enhance the program. The results of this study encourage the initiation, support, and continuation of similar healthy school breakfast and snack programs in other remote, northern communities. Clearly, school snack programs can be an important venue to address the nutritional vulnerability of First Nation youth living in remote communities.

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