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RESEARCH ARTICLE

Assessing the Impact of Pilot School Snack Programs on Milk and Alternatives Intake in 2 Remote First Nation Communities in Northern Ontario, Canada

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ABSTRACT

BACKGROUND: Canadian Aboriginal youth have poorer diet quality and higher rates of overweight and obesity than the general population. This research aimed to assess the impact of simple food provision programs on the intakes of milk and alternatives among youth in Kashechewan and Attawapiskat First Nations (FNs), Ontario, Canada.

METHODS: A pilot school snack program was initiated in Kashechewan in May 2009 including coordinator training and grant writing support. A supplementary milk and alternatives program was initiated in Attawapiskat in February 2010. Changes in dietary intake were assessed using Web-based 24-hour dietary recalls in grade 6 to 8 students, pre- and 1-week post-program, with a 1-year follow-up in Kashechewan. Student impressions were collected after 1 week using open-ended questions in the Web survey. Teacher and administrator impressions were collected via focus groups after 1 year in Kashechewan.

RESULTS: After 1 week, calcium intake increased in Kashechewan (805.9 ± 552.0 to 1027.6 ± 603.7 mg, $p = .044$); however, improvements were not sustained at 1 year; milk and alternatives (1.7 ± 1.7 servings to 2.1 ± 1.4 servings, $p = .034$) and vitamin D (2.5 ± 2.6 to 3.5 ± 3.4 µg, $p = .022$) intakes increased in Attawapiskat. Impressions of the programs were positive, though limited resources, staff, facilities, and funding were barriers to sustaining the consistent snack provision of the 1-week pilot phase.

CONCLUSION: These illustrations show the potential of snack programs to address the low intakes of milk and alternatives among youth in remote FNs. Community-level constraints must be addressed for sustained program benefits.

Keywords: First Nations; youth; milk and alternatives.

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The worldwide prevalence of overweight (body mass index [BMI] $\geq$ 25.0) and obesity (BMI $\geq$ 30.0) has reached epidemic proportions in recent years.[1] In Canada, Aboriginal people have 2.5 times greater odds of being obese than non-Aboriginals.[2] Childhood overweight and obesity are mounting problems; in 2004, 21% of off-reserve Aboriginal youth aged 12 to 17 years were overweight, and 20% were obese (compared to 29% and 9% in the general population).[3]

Possible contributors to the problem include physical inactivity, unhealthy diets, genetic susceptibility, and physical and social environments.[4] Aboriginal populations in Canada also experience much poorer health than the general population, including a 5 times greater risk of diabetes.[5] Current diets of Aboriginal children have been reported to be low in iron, folate, calcium, vitamin D, vitamin A, fiber, vegetables, and fruit, while containing excess added sugar and fat.[6-9] In a recent study of the diets of Aboriginal children in northern Quebec, more than 80% consumed fewer than 2 servings from the milk and alternatives food group daily.[7] The low intake of milk and alternatives is of utmost concern in Aboriginal populations, as they have demonstrated increased fracture risk as compared to non-Aboriginal populations.[10-12] Also, epidemiological studies report an inverse relationship between

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dietary calcium consumption and body weight;[13,14] other studies have suggested that this relationship is related to milk intake.[15,16]

As low milk and alternatives intake is a problem amenable to change, it is important to test opportunities for interventions to improve the current situation. The problem should be addressed early, as childhood weight and dietary habits track into adulthood.[17,18] Schools are an ideal setting to support behavioral change; they can be a rich source of positive influences, including snack program coordinators, teachers, and administrators.[19] The US Centers for Disease Control and Prevention (CDC) note that schools can reach almost all children, and provide an environment to practice healthy eating.[19]

A major barrier to dietary behavioral change is food insecurity, which is more common in the Aboriginal population than the general population.[6] Diet quality suffers when the price of market foods becomes a more important determinant of food choice than nutritional value.[20] Food provision programs can benefit youth in remote communities, providing foods that may otherwise not be accessible. The objective of this research was to investigate the change in milk and alternatives, calcium, and vitamin D intakes of First Nation (FN) youth in grades 6 to 8 following the implementation of pilot food provision programs. In Kashechewan FN, a school snack program was initiated; in Attawapiskat FN, milk and alternatives were added to an existing school snack program that had not been serving these previously.

METHODS

Participants and Intervention

This study was conducted in collaboration with St. Andrew's School in Kashechewan and J.R. Nakogee School in Attawapiskat. Participants included a convenience sample of children and youth attending grades 6 to 8. Kashechewan is located on the northern shore of the Albany River, about 10 km inland from James Bay.[21] Attawapiskat is 5 km inland of the western coast of James Bay, on the Attawapiskat River.[22] Both FN communities are isolated (limited accessibility) and remote (distant from surrounding communities and major urban centers), accessible only by air year round. Each community has 1 main grocery store, where fresh, healthy foods are often scarce and very costly. Starting in May 2009 and continuing through the 2009-2010 school year, a pilot snack program was administered to students in pre-K to grade 8 at St. Andrew's School in Kashechewan (~400 students); while a pilot milk provision program was administered to grades 6 to 8 at J.R. Nakogee School in Attawapiskat during the 2009-2010 school year (108 students), supplementing an existing snack program. Support for the pilot programs was provided through research funds; the program in Kashechewan was sustained through a Breakfast for Learning grant. Both schools consist of portables; while plans for building a new school in Attawapiskat are under way, a new school for Kashechewan has yet to be announced.

Instruments

Web-Based Eating Behavior Questionnaire. The Web-Based Eating Behavior Questionnaire (WEB-Q) was used to assess milk and alternatives, calcium, and vitamin D intakes using a 24-hour dietary recall.[23] Participation in the WEB-Q was voluntary; passive consent for participation was obtained by sending an information letter home to parents. Assent from each student was obtained following the first explanatory screen of the questionnaire. The WEB-Q was validated in multiethnic grade 6 to 8 students in Ontario, and Fort Albany FN, Ontario ($N = 25$).[23] It has moderate to good validity in this population and was significantly correlated with dietitian interviews ($ICC = .77$, $r = .87$ for energy).[23] Web-based assessment demonstrates many benefits over traditional data collection techniques in remote communities.[24] The WEB-Q mimics a multiple-pass technique and uses 3-D portion images to produce the most accurate possible reported information.[23,25] An analog scale and standiometer were provided for participants to measure their height and weight, prior to recording them in the WEB-Q. Participants were categorized as normal (includes underweight), overweight, or obese as defined by the BMI (kg/m^2) cutoffs suggested by Cole et al.[26]

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Procedure

Prior to initiation of the programs, students in grades 6 to 8 completed the WEB-Q to establish baseline data. In May 2009, the pilot snack program was initiated in Kashechewan for students in grades pre-K to 8. The program was initiated by the research team, in collaboration with the primary school. At least 1 serving from the vegetables and fruit, and milk and alternatives food groups of Canada's Food Guide was served daily.[27] Milk and alternatives include milk, cheese, yogurt, and alternatives to milk products that provide similar nutritional value in terms of calcium and vitamin D (eg, fortified soy beverage). Those served included a variety of cheese, yogurts, and Ultra High Temperature (UHT) milk (ie, milk that has been processed as to extend shelf life, with the ability to be stored at room temperature). After 1 week, students repeated the WEB-Q to determine short-term impacts; it was predicted that intakes would improve. Control of the program was then handed over to a local volunteer, who was trained and given written guidelines following a traffic light approach to food choice: ''green foods'' were more nutritious and suggested to be served at least 80% of the time while, ''amber foods'' were less nutritious and suggested to be served at most 20% of the time, and ''red foods'' were discouraged.[28-30] This included a sample shopping list of locally available foods. The program was funded by a Breakfast for Learning grant and continued intermittently (due to various logistical and staffing issues), and students once again completed the WEB-Q in June 2010 to assess long-term impacts.

An existing snack program was supplemented with milk and alternatives in Attawapiskat, starting in February 2009. The project advisory committee consisted of the investigators, school principal and vice principal, and a community nurse. School administrators began serving at least 1 serving from the milk and alternatives food group daily following baseline data collection. Administrators were given written guidelines similar to those used in Kashechewan. Short-term impacts were assessed using the WEB-Q in March 2010. For both schools, researchers were kept informed of program integrity through conversations with program coordinators and school administrators via e-mail and telephone.

Administrator, Teacher, and Student Impressions

In Kashechewan, after 1 year of program implementation, administrator impressions of the snack program were gathered via informal discussion with the current school principal. Teacher impressions were gathered via a focus group session using open-ended questions. In both Kashechewan and Attawapiskat, student impressions of the program were gathered via open-ended questions included in the WEB-Q. In all cases, participation was voluntary and collected information was confidential.

Data Analysis

Nutrient analysis was based on Canadian Nutrient File (CNF) data (version 2007) using The Food Processor software (version 8.0; ESHA Research, Salem, OR, 2002).[31] Food group servings were based on the 2007 version of Canada's Food Guide, as described by the CNF. Descriptive statistics showed participants' intakes in relation to dietary standards and general population data. Paired samples were analyzed using the Wilcoxon signed-rank test to compare intakes of dietary variables between pre- and post-program; including short- and long-term program impacts in Kashechewan. All dietary variables were adjusted for energy intake using the energy density method, to ensure that differences in intake were due to alterations in diet composition and not amount of food consumed.[32] Table 1 presents the dietary standards used for comparison, as well as Canadian Community Health Survey data pertaining to milk and alternatives intakes in the general Canadian population.[33,34] Statistical analyses were performed using SPSS software (version 17.0; SPSS Inc., Chicago, IL, 2008), significant at $p \leq .05$. Qualitative data included notes taken during discussions or answers to WEB-Q questions; these were summarized.

RESULTS

Participant Characteristics

Demographic characteristics of all participants at each time point are presented in Table 2. In Kashechewan, 37 students were included in the paired pre- to 1-week post-program, 24 in the paired pre- to 1-year post-program, and 24 in the paired 1-week post- to 1-year post-program analyses. In Attawapiskat, 48 students were included in the pre- to 1-week post-program analysis. This included all students who completed the survey at both time periods of interest; all students in attendance on the day of the survey completed it. There were no significant differences between students participating in the survey and those for whom paired data were available in terms of sex distribution, energy, or dietary variables; except for the 1-year post-program survey in Kashechewan, where those with paired data were significantly younger. In both communities, baseline overweight and obesity rates greatly exceeded those of the general Canadian population.[3] The majority of participants failed to meet the recommendations of CFG for milk and alternatives, and mean intakes fell below those of the general population for all subgroups.[3] Calcium and vitamin D intakes were low, over 80% of participants in both communities had intakes below the Adequate Intake (AI).[33]

Table 1. **Canadian Dietary Standards and Canadian Community Health Survey Data Used for Comparison**

Age and Sex Group	Standard for Comparison			
	Milk and Alternatives (Canada's Food Guide Servings)	Mean Milk and Alternatives (Servings) General Population Intake (CCHS)	Calcium Adequate Intake (mg)	Vitamin D Adequate Intake (μg)
Males 9 to 13 years	3-4*	2.55	1300	5
Females 9 to 13 years	3-4	2.08	1300	5
Males 14 to 18 years	3-4	2.64	1300	5
Females 14 to 18 years	3-4	1.82	1300	5

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

Table 2. **Participant Demographic Characteristics and Nutrient Intakes Compared to Canadian Dietary Standards***

	Kashechewan			Attawapiskat	
	Baseline	1 Week Post-Program	1 Year Post-Program	Baseline	1 Week Post-Program
N	43	43	67	70	64
Median age, years (range)	13 (11-14)	13 (12-15)	14 (12-16)	12 (11-14)	12 (11-14)
Sex (% male)	60.5	58.1	47.8	35.7	35.9
BMI (% overweight, % obese)	42.5, 17.5	31.0, 23.8	22.8, 26.3	31.3, 37.5	33.9, 35.6
Milk and alternatives intake, servings (mean ± SD)	2.2 ± 1.9	2.8 ± 1.9	1.7 ± 1.4	1.7 ± 1.6	2.3 ± 1.6
% below minimum CFG recommendations for milk and alternatives (%)	74.4	55.8	80.6	82.9	78.1

*Based on total sample at each time period.

Changes in Dietary Intakes

Table 3 describes the change in intakes of milk and alternatives, calcium, and vitamin D following program initiation. Calcium intake increased ($p = .044$) in the short-term in Kashechewan. By contrast, milk and alternatives ($p = .034$) and vitamin D ($p = .022$) intakes improved significantly in Attawapiskat. In Kashechewan, there was no significant change from baseline in any of the dietary variables over the long term; a decrease in milk and alternatives intake was seen between 1 week and 1 year post-program ($p = .021$).

Student Impressions of the Snack Programs

In general, students had positive impressions, and felt that they had made constructive lifestyle changes as a result of the snack programs. In Kashechewan, after 1 week ($N = 43$), 62% of students reported being motivated to eat healthier, while 67% said they made better choices about what they eat. Several students noted that they liked the snack program because they were hungry when they arrived at school. Comments included, ''I like having food in the morning because I'm hungry,'' and ''It fills my stomach.'' In general, students viewed the snack program as a good thing and a time to socialize, with comments including, ''It's cool and fun'' and ''[I like] eating with friends.'' When asked about their favorite part of the snack program, several students in Attawapiskat said they liked receiving yogurt and chocolate milk.

Teacher and Principal Impressions of the Snack Program in Kashechewan

Teachers ($N = 17$) were overwhelmingly positive about the programs. Several suggested that many students do not eat breakfast, so the snack program helped them to be more attentive and motivated. Teachers unanimously indicated that the program was beneficial, but that its sporadic operation after the pilot phase (due to logistical and staffing difficulties) made it challenging to plan activities around it. One teacher said, ''It's crucial, the more good food that can be put into the school the better'' while, another noted ''It introduced [the students] to foods they would never have been able to try.'' The school principal was optimistic about the program's future. He emphasized the need for a strong and dedicated leader, and mentioned that the logistics of obtaining food items and high prices as major barriers to the program's success. Although not ideal, under the current circumstances (staffing, time availability, equipment availability, setting), with continued funding, he was confident that the program could be sustained. He emphasized the extreme need for such a program in the community saying: ''The kids are always hungry.''

Program Integrity

Many challenges in program implementation and barriers to healthy eating were identified. Even with the investigator-run pilot program, intakes did not improve as much as would be expected; unfamiliar

Table 3. **Difference in Mean (±SD) Intakes of Selected Nutrients Pre- and Post-Pilot School Snack Program**

Comparison	Food Group or Nutrient	Baseline	1 Week Post-Program	1 Year Post-Program	p-Value*
Kashechewan					
Baseline to 1 week post-program (N = 37)	Milk and alternatives (servings)	2.2 ± 1.9	2.8 ± 2.0	—	.072
	Calcium (mg)	805.9 ± 552.0	1027.6 ± 603.7	—	.044
	Vitamin D (μg)	2.3 ± 2.1	3.5 ± 3.2	—	.193
Baseline to 1 year post-program	Milk and alternatives (servings)	2.4 ± 2.0	—	1.7 ± 1.2	.317
(N = 24)	Calcium (mg)	794.3 ± 545.3	—	675.5 ± 384.8	.932
	Vitamin D (μg)	2.6 ± 2.4	—	1.9 ± 1.6	.67
1 week to 1 year post-program	Milk and alternatives (servings)	—	2.7 ± 1.9	1.6 ± 1.1	.021
(N = 24)	Calcium (mg)	—	937.1 ± 557.8	645.9 ± 379.5	.052
	Vitamin D (μg)	—	2.4 ± 2.9	1.8 ± 1.6	.715
Attawapiskat					
Baseline to 1 week post-program	Milk and alternatives (servings)	1.7 ± 1.7	2.1 ± 1.4	—	.034
(N = 48)	Calcium (mg)	661.9 ± 476.2	751.3 ± 446.0	—	.117
	Vitamin D (μg)	2.5 ± 2.6	3.5 ± 3.4	—	.022

*p-Value for intakes adjusted per 1000 kcal.

food items did not always appeal to the students' tastes. Students tended not to enjoy drinking the UHT milk on its own, especially when it was not served chilled. As food insecurity (including problems with food access, availability, and use) is prevalent, it remains a challenge to supply children with healthy food on a regular basis outside of school due to availability and affordability. Nevertheless, teachers in Kashechewan noted that the snack program had a positive impact on the variety of healthy foods available at the grocery store, saying: ''[The program] encourages the [local store] to stock variety if the kids ask for it (if it gets purchased).'' Once foods were purchased for Kashechewan's snack program, storage was a major problem, as the school consists of portables with very limited space. A lack of fridge space meant that milk and alternatives could not always be served on a regular basis. Transporting snacks from the main portable to individual classrooms was time consuming. Lack of personnel was problematic; much of the burden of each program fell on 1 individual. In Kashechewan, unforeseen circumstances meant that the volunteer coordinator was unavailable for several weeks. Without a replacement, the program needed to be discontinued for some time. Another barrier was limited funding. With funds running short, the variety and quantity of foods offered by the program in Kashechewan needed to be reduced to 1 item per day, meaning milk and alternatives were not always served.

DISCUSSION

The current study explored the current intakes of milk and alternatives and their associated nutrients of FN youth in 2 remote northern Ontario communities, and the changes in the intakes of these dietary variables after the implementation of pilot school snack programs. Intakes of calcium improved in the short term in Kashechewan while intakes of milk and alternatives and vitamin D improved in Attawapiskat. However, in assessing long-term change in Kashechewan, the positive changes in nutrient intakes were not sustained. Even with the improvements seen over the short term in both communities, mean consumption of milk and alternatives remained far below national standards. In most cases, students' intakes continued to fall below those of youth in the general population.[3]

The results presented here reflect the situation reported in studies of milk and alternative intakes in other Canadian Aboriginal populations. A 2009 study of Aboriginal children in northern Quebec found that only 19.1% consumed at least 2 servings of milk and alternatives daily.[7] A 2010 study of Cree youth from the eastern James Bay coast showed that 95% failed to reach the minimum CFG recommendations.[35] Our data indicate a similar situation; at baseline 74.4% of youth in Kashechewan and 82.9% in Attawapiskat failed to reach minimum recommendations. These intakes seem poorer as compared to on-reserve Mi'kmaq youth in Prince Edward Island, Canada, of whom 49% consumed adequate milk and alternatives daily.[9] With milk and alternatives being the predominant source of calcium and vitamin D in the Canadian diet, this low intake is concerning because Aboriginal populations have demonstrated increased fracture risk, and adolescence is an important period for the attainment of peak bone mass.[8-10] Northern latitudes, heavy clothing, and darker skin pigmentation mean that endogenous vitamin D production is inadequate; if this is not made up for in the diet, deficiency can result. Traditional sources of calcium and vitamin D include wild plants, organ meats, fish with bones, bone soup, shellfish, nuts, and beans. These were available in the WEB-Q but calcium and vitamin D intakes remained suboptimal. Whereas it has been noted that

a large proportion of the North American Aboriginal population may be lactose intolerant, this did not appear to be a barrier to milk intake in this study; no children reported feeling sick after drinking milk.[36]

The reported results are not entirely unexpected. School food provision is only 1 factor among many others influencing the full day's food intake among school-aged youth. However, the improvements seen in the short-term demonstrate the potential of such programs and should be seen as a first step toward addressing a greater number of factors affecting dietary behavior. The CDC has suggested that to affect dietary patterns, schools must provide an environment that is conducive to behavioral change, while supporting the healthy choices that students will be expected to make.[19] The current findings suggest that there may be benefit from extending the snack program (supportive school environment) evaluation to assess other elements of a comprehensive school-based intervention, including a nutrition policy, nutrition education, integration of school food service, training for school staff, and family and community involvement.[37] This is supported by a recent review, where interventions that were effective in terms of changing dietary behavior were ones that employed a comprehensive approach.[37] However, the logistics of a comprehensive program need to be considered, and this is a step that could only be undertaken once the necessary resources are established.

Numerous opportunities and barriers to the implementation of school snack programs in remote FN communities were identified. The suboptimal intakes of milk and alternatives and high rates of overweight and obesity clearly identified a need for school-based interventions. Students were introduced to healthy foods that they would not normally have access to because of price or availability. Addressing the nutritional need may have added a secondary benefit regarding learning potential, as observed in a recent systematic review concluding that breakfast eating (and school food provision programs) generally have positive effects on cognitive performance in children.[38] Several teachers in Kashechewan noted that students were more motivated and ready to learn after having eaten their snack.

Barriers included lack of access to the personnel, facilities, and funding resources to operate the program to its full potential. It has been noted that funds available through usual assistance programs in Canada do not keep pace with the high cost of food in the north; this was true in the current study.[39] Although the school in Kashechewan was able to secure external funds through a Breakfast for Learning grant, funds were insufficient to support the high food costs. Also, the expectation that supplementary funds be provided through community partners and fundraising is not realistic in remote communities with few businesses. In an effort to make the program sustainable, we have been working with the communities in securing additional funding from a variety of sources. Furthermore, schools consisting of portables without kitchen facilities stand in the way of food preparation, storage, and delivery. Thus, the lack of improvement in the dietary variables being studied in the long term is understandable taking into account the existing barriers. Nevertheless, the short-term improvements demonstrate the potential of such programs.

The results of this research have immediate application to the communities under study and other FNs. Communities can use the current study as an example for future program implementation, and acknowledgement of the barriers identified here may help in the planning of future programs. Future research into addressing the barriers to sustainable program implementation is needed to inform successful program planning.

Limitations

As FN populations vary in degrees of isolation, remoteness, and traditional lifestyles, all results may not be transferable to all other FNs. The limited sample size may have impacted our ability to detect significant changes in intakes. Although single 24-hour recalls are effective population-based dietary assessment techniques, it is recognized that the single data collection and reliance on recall are limiting.[40] Even with the anonymity of the Web-based approach, underreporting can be a problem, related to a number of potential factors including social desirability, however, the use of the United States Department of Agriculture (USDA) Automated Multiple-Pass Approach (AMPM), mimicked in the WEB-Q, has been found to improve accuracy at a group level.[41,42]

CONCLUSION

The current study demonstrates the potential of school food provision programs to positively impact the extremely low intakes of milk and alternatives and associated nutrients in FN youth. Unfortunately, the ideal circumstances of the pilot program often do not exist, and programs suffer when resources are lacking. These results support the need for continued efforts to improve and sustain current programs; and in the future, to initiate more comprehensive programs or community-based initiatives to help FN youth to adopt healthy eating habits.

IMPLICATIONS FOR SCHOOL HEALTH

The current findings bring insight into developing and initiating snack programs in remote FNs. Prior

to beginning such a program, existing barriers to their implementation should be considered to improve sustainability. Here, barriers included a lack of facilities and storage space, high food prices and a limited budget, environmental constraints, and limited personnel. Whereas intensive, well-organized food provision programs can produce positive results, outcome expectations should be realistic in light of existing barriers. Implementing a food provision program does not change the environment in which the children live, which may not be supportive of healthy eating. Because of this, global changes in diet cannot necessarily be expected. More comprehensive programs require greater inputs of staff, time, and funding. Schools having the resources required to initiate such programs may wish to investigate this as a viable way to improve the nutrient intakes of schoolchildren, especially in remote FN communities where the need is undeniable.

Human Subjects Approval Statement

This research was conducted in collaboration with St. Andrew's School in Kashechewan, Ontario and J.R. Nakogee School in Attawapiskat, Ontario. This research was approved by the University of Waterloo Office of Research Ethics.

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