



ORIGINAL RESEARCH ARTICLE

A mixed methods inquiry into the determinants of traditional food consumption among three Cree communities of Eeyou Istchee from an ecological perspective

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Background. The Aboriginal nations of Canada have higher incidences of chronic diseases, coinciding with profound changes in their environment, lifestyle and diet. Traditional foods can protect against the risks of chronic disease. However, their consumption is in decline, and little is known about the complex mechanisms underlying this trend.

Objective. To identify the factors involved in traditional food consumption by Cree Aboriginal people living in 3 communities in northern Quebec, Canada.

Design. A mixed methods explanatory design, including focus group interviews to interpret the results of logistic regression.

Methods. This study includes a secondary data analysis of a cross-sectional survey of 3 Cree communities (n = 374) and 4 focus group interviews (n = 23). In the first, quantitative phase of the study, data were collected using a food-frequency questionnaire along with a structured questionnaire. Subsequently, the focus group interviews helped explain and build on the results of logistic regressions.

Results. People who consume traditional food 3 days or more weekly were more likely to be 40 years old and over, to walk 30 minutes or more per day, not to have completed their schooling, to live in Mistissini and to be a hunter ($p < 0.05$ for all comparisons). The focus group participants provided explanations for the quantitative analysis results or completed them. For example, although no statistical association was found, focus group participants believed that employment acts as both a facilitator and a barrier to traditional food consumption, rendering the effect undetectable. In addition, focus group participants suggested that traditional food consumption is the result of multiple interconnected influences, including individual, family, community and environmental influences, rather than a single factor.

Conclusion. This study sheds light on a number of factors that are unique to traditional foods, factors that have been understudied to date. Efforts to promote and maintain traditional food consumption could improve the overall health and wellbeing of Cree communities.

Keywords: *traditional foods; first nations; ecological perspective; determinants; mixed methods research*

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Over the last few decades, the Aboriginal nations of Canada have had higher incidences of chronic diseases, coinciding with profound changes in their environment, lifestyle and diet (1). The 9 Cree communities of Eastern James Bay have followed this trend, which

is described in detail elsewhere (2). The Cree diet, which was traditionally based on the consumption of wild animals and fish, now consists mainly of market foods. Several studies have reported that the consumption of traditional foods, such as wild animals, fish, birds and

berries, is in decline (3,4). A diet rich in traditional foods can potentially protect against the risks of chronic disease due to its high levels of protein, quality fats, vitamins and minerals (5,6).

In 2005, Willows noted the lack of understanding of the determinants of food intake among Aboriginal nations (7). The influences on food consumption are multifactorial (7–10), and the few studies that do exist have pointed out certain factors that are strongly associated with traditional food consumption (7,11,12). Therefore, an extensive literature review was undertaken to identify factors previously associated with traditional food consumption: living in a small and isolated community facilitates consumption (6), as does being an older hunter, being physically active and practicing traditional activities (12–14).

Many studies have explored food consumption models, from a wide variety of disciplines and perspectives (8,15–18). The ecological model is particularly interesting because it suggests that traditional food consumption is influenced not only by individual variables but also by social and environmental factors and their interactions, thus involving different levels of influence (19–23). A 4-level ecological model, inspired from previous studies (15,16,21), has been proposed as a conceptual framework to map the multiple factors involved in traditional food consumption. This model considers environmental, cultural and social influences on aboriginal populations (22). Moreover, our choice of an ecological approach is culturally appropriate, being in keeping with the Cree concept of health, *miyupimaatsiium*, as defined by Adelson, which goes beyond the idea of individual health to encompass a healthy and respectful relationship between the community and the natural environment (24).

The aim of this study was first to identify, using quantitative analysis, the factors associated with traditional food consumption, and second, to help explain these results based on the findings of focus group interviews.

Material and methods

To explore the factors associated with traditional food consumption by the Cree, we used what Creswell calls a “sequential explanatory mixed methods design” (Fig. 1) (25,26) to help explain the quantitative analysis results. In the first phase, quantitative findings were obtained from a secondary analysis of 3 cross-sectional studies as part of the Multi-Community Environment and Health Longitudinal Study in Iyiyuu Aschii (n = 374). The overall methodology of this study is described in detail elsewhere (27,28). In the second study phase, we used focus group interviews to help explain the quantitative results.

Quantitative data collection (phase I)

In Mistissini (pop. 3,000), data were collected over a period of 2 months during the summer of 2005. Data were collected in Eastmain (pop. 500) and Wemindji (pop. 500) over a 2-month period in 2007. These 2 communities are smaller and more remote than Mistissini, but all 3 communities are accessible by road.

Data were analysed on a total of 374 participants aged from 18 to 90 years. Participants were selected randomly using stratified population sampling.

To assess traditional food intake, a traditional food-frequency questionnaire covering a 1-year period was developed in partnership with community members, taking into account seasonal variations and availability (29). The interviewers who administered the questionnaire were selected from the community members. They received training on interviewing techniques from the nutritionists’ research team. An additional questionnaire was administered to gather information about the individual participants and their levels of physical activity. The variables used for the quantitative analysis are presented in Table I. The interviews lasted 3 hours and were conducted in the Eeyou language (Cree).

At the completion of each interview, 1 member of the research team reviewed all the questionnaires.

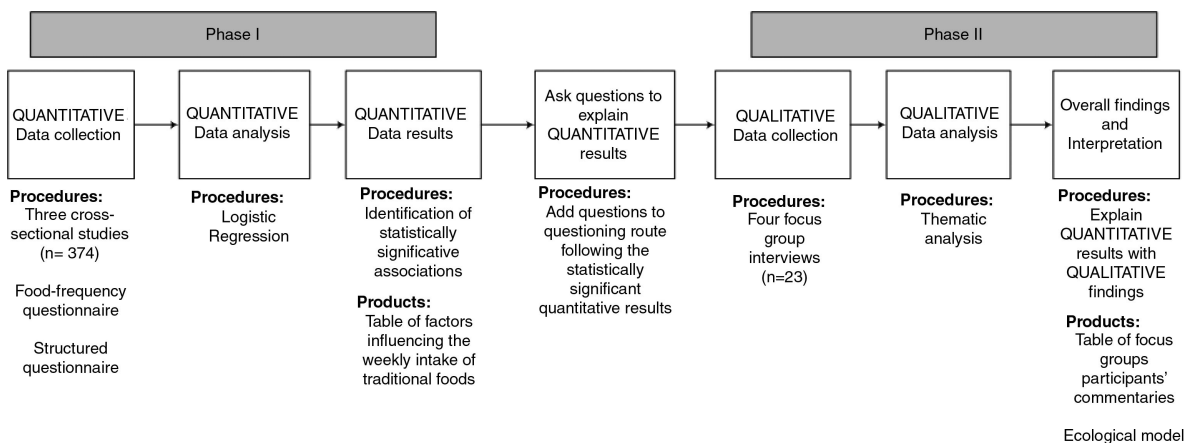


Fig. 1. Process flow diagram of the procedures for this sequential explanatory mixed methods study.

Table 1. Variables used in the quantitative analysis

	Variable	Definition	Source ^a	Questions/items	Categorisation	Reference(s)	I/D ^b
Individual level	Age	Age of participant during interview	Ind	What is your birth date?	Following previous study (18–39 year old, 40–90 year old)	Bonnier-Viger et al. (31), Lambden et al. (32)	I
	Sex	Sex of participant	Ind	What is your gender?	Male, female	–	I
	Body mass index (BMI)	Measured BMI	Ind	Weight and height were taken by a nurse	Following WHO classification (18.5–24.9 (normal), 25–29.9 (overweight) \geq 30 (obese))	WHO (33)	I
	Daily walking	Number of minutes walked by the participant per day	Ind	From IPAQ short format: during the last 7 days, on how many days did you walk for at least 10 minutes at a times? What is the total amount of time you spent walking over the last 7 days?	Following public health recommendations promoting 30-minute walk per day (less than 30 min/day, more than 30 min/day)	Lemieux and Thibault (34)	I
	Education	Highest level of schooling completed by the participant	Ind	What is the highest level of schooling you have completed? Can you tell the last grade or year of school you have completed?	College/University, high school, no formal schooling/elementary school	–	I
	Hunter	Whether or not the participant hunt (regardless of the frequency of hunting activities)	Ind	Do you hunt?	Yes, no	–	I
	Smoking	Whether or not the participant smoke (smoker described regular and occasional smokers)	Ind	Do you smoke?	Smoker, non-smoker	–	I
	Employment status	Whether or not the participant has a job (employed indicated individuals working full-time, part-time and occasionally)	Ind	Which of the following best describes your present working status?	Employed, unemployed	–	I
	Health perception	Own participant perception of health	Ind	In general, would you say your health is ...	Excellent to very good, good, fair to poor	–	I
Interpersonal level	Worries about pollution	Participant concerned about environmental pollution	Ind	Are you worried about the pollution of the environment (land, water or air) in Iiyiyiu Aschii?	Very much, somewhat to fairly, not at all	–	I
	English spoken at home	Whether or not the participant speaks English at home	Ind	What language, or language, do you usually speak at home?	English spoken at home, no English spoken	–	I
	No. of people in the household	Number of people living in the participant house	Ind	How many persons of the following age groups live in your house or apartment at this time?	1 to 4 persons, 5 persons or more	–	I

Table 1 (Continued)

Variable	Definition	Source ^a	Questions/items	Categorisation	Reference(s)	I/D ^b
Community level	Community of residence	–	Census from each community used to recruit participant	Mistissini, Wemindji, Eastmain	–	I
Community level	Frequency of traditional food consumption over a week	TFF	Items from 5 traditional food groups examined (game, birds, fishes, greases and berries), Bannock, other plants food and tea were not gathered by the TFF questionnaire	Dichotomized based on a Cree campaign (less than 3 times/week, more than 3 times/week)	Wasayabin challenge, 2008–2009	D

^aInd = individual questionnaire; TFF = traditional food frequency questionnaire.

^bI = independent variable; D = dependent variable.

Quantitative data analysis (phase I)

All analyses were conducted with SPSS software (Statistical Package for the Social Sciences v. 16.0), and p-values ≤ 0.05 were considered statistically significant. Logistic regression was used to control for confounding variables (30) and to examine the multivariate relationships between traditional food consumption (≤ 3 times per week) and the following predictive variables: community, sex, age, body mass index (BMI), smoking status, self-reported health status, worries about pollution, employment status, education, practice of hunting, daily walking, English spoken at home and number of people living in the household.

Table I summarizes the definitions, sources, and categorization of all dependent and independent variables.

Qualitative data collection (phase II)

In 2009, 4 focus groups consisting of 4–8 people were organized in Mistissini, for a total of 23 individuals. Each group discussion lasted approximately 90 minutes. All focus groups were mixed-gender and were held at the participants' preferred location and time. In order to increase participant similarity and to create a more comfortable environment for the discussions, homogenized sampling was used, whereby the participants were divided into 2 groups aged from 18 to 40 and 2 groups aged from 40 to 90 (35). Participants were selected by nomination (35). Previous participation in the Multi-Community Environment and Health Longitudinal Study was not required.

All discussions and interviews were held in English and/or Cree, and a Cree interpreter was used when necessary.

Following Krueger's recommendations, a questionnaire route was developed and pre-tested (Table II), using short, clear, simple and 1-dimensional open-ended questions (35).

Focus group data analysis (phase II)

Each focus group discussion was recorded and then transcribed by an external contributor and then carefully reviewed by the moderator. Initially, major themes were organized manually and categorized into 4 levels of influence according to the ecological model: individual, interpersonal, community and environment. However, to ensure better data management, QDA Miner 3.2 software (Provalis Research, Montreal) was subsequently used to code and organize the transcribed data into factors. This allowed an iterative coding process that identified inconsistencies, and it facilitated updating and modifying the coding system (35). The coding process assigned sentences and/or paragraphs to a factor. Then, in an iterative process, each factor was revisited and, if necessary, moved to another level or merged or divided into different factors. As a rigor criterion (36) or respondent validation (37), the results were presented to a group of community representatives.

This study was approved by the Cree Board of Health and Social Services of James Bay, the research ethics committee of the University of Montreal, and the Band

Table II. Questionnaire route

This focus group is about exploring the facilitators and obstacles that influence traditional food consumption.

1. Following statistical analysis: (*visual support: simplified results table*)
 - a. What do you think of these factors? Do you agree with our findings? Can you explain how they might have an influence?
 - b. What do you think of the factors that seem not to be linked? Do you agree?
 - c. Can you think of other factors that influence traditional food intake?
2. Is there anything you would like to add?

Councils. All participants provided their informed consent before participating in the study.

Results

Demographic characteristics (phase I)

Table III presents the data collected from the 374 participants enrolled in the Multi-Community Environment and Health Longitudinal Study in Iiyuu Aschii from 2005 to 2007. Significant differences within the 3 communities are seen in education, employment status, perception of health, worries about pollution and traditional food consumption.

Logistic regression (phase I)

Table IV summarizes the associations tested in the full logistic regression model. Positive associations were found between traditional food consumption and the variables age, daily walking, education, hunter and community ($p < 0.05$ for all comparisons).

People who reported consuming traditional foods 3 days or more per week were more likely to be from 40 to 90 years old, to walk 30 minutes or more per day, not to have completed any schooling, to be hunters and to live in Mistissini compared to those who consumed fewer traditional foods ($p < 0.05$ for all comparisons). After adjusting for other variables, no associations were found with sex, BMI, smoking, employment status, health perception, worries about pollution, English spoken at home, or number of people in the household. According to the Hosmer-Lemeshow statistic, this model shows no evidence of lack of fit (Chi-square 3.246, df 8, $p = 0.918$). Nagelkerke R^2 is 0.43.

Further bivariate Chi-square analyses of the associations between independent variables showed collinearity between hunter and sex: 92% of males were hunters and 81.2% of females were non-hunters ($p < 0.001$, data not shown). In addition, age acted as a confounding variable for a few variables. For example, 69.4% of people aged less than 40 attended high school, whereas only 41% of people over 40 had done so ($p < 0.001$, data not shown). In addition, 64.7% of smokers were younger than 40 and 74.8% of non-smokers were over 40 ($p < 0.001$, data not shown). As for employment status, 26.4% of people under 40 were unemployed and 73.6% were employed ($p < 0.001$, data not shown). We also found significantly more frequent game consumption in Mistissini ($p < 0.001$, Table III).

Mistissini also showed more frequent consumption of birds, fish and grease compared to Eastmain ($p < 0.05$, Table III).

Focus group interviews (phase II)

In general, when presented with our quantitative findings, the focus group participants agreed with them. For example, they agreed that age, being a hunter, daily walking and education level influenced traditional food intake. However, they were surprised to learn that residents of Mistissini consumed traditional foods more frequently than residents of Wemindji and Eastmain, because they believed that living in an isolated community and having limited access to market foods would be strong influences on traditional food consumption. Similarly, focus group participants disagreed with the non-association found between traditional food consumption and employment status. They felt that employment acts as both a facilitator and a barrier to traditional food consumption (Table V presents the participants' explanations for our quantitative findings).

In addition, the participants provided supplementary information on the factors influencing traditional food consumption that were not included in the original quantitative questionnaire. Whereas the quantitative analyses focused mainly on individual-level factors, the focus group participants identified a number of social- and environment-level factors. The most frequently mentioned factors were the powerful influence of peers on food consumption as well as factors related to projects with an environmental impact, such as forestry, mining, hydro-electricity, wildlife sustainability, and government laws and regulations. The participants believed that the family has a strong influence over traditional food consumption because families go hunting together, it is through family members that traditional knowledge get passed on and because hunters share their game within family members. In addition, they believed that traditional food consumption was greatly influenced by government laws, such as the law regulating the use of hunting territories and laws governing the distribution of traditional food through public and private channels. Furthermore, any actions that could affect the ecological environment, such as hydroelectric projects, mining and forestry, as well as measures taken to preserve wildlife and

Table III. Characteristics of 3 communities in the multi-community environment and health longitudinal study in Iyiyuu Aschii

			Mistissini (n = 156)	Wemindji (n = 126)	Eastmain (n = 92)	Total (n = 374)	
			2005	2007	2007	–	–
Nearest city with a population >7,000 – distance			88 km	850 km	691 km	–	–
			n (%)	n (%)	n (%)	n (%)	P
Individual level	Age	18–39 (n = 235)	98 (62.8)	81 (64.3)	56 (60.9)	235 (62.8)	0.876
		40–90 (n = 139)	58 (37.2)	45 (35.7)	36 (39.1)	139 (37.2)	
	Sex	Male (n = 150)	59 (37.8)	57 (45.2)	34 (37.0)	150 (40.1)	0.350
		Female (n = 224)	97 (62.2)	69 (54.8)	58 (63.0)	224 (59.9)	
	BMI	18.5–24.99 (n = 27)	11 (7.1)	10 (7.9)	6 (6.5)	27 (7.2)	0.678
		25–29.99 (n = 86)	41 (26.3)	28 (22.2)	17 (18.5)	86 (23.0)	
		30 and + (n = 261)	104 (66.7)	88 (69.8)	69 (75.0)	261 (69.8)	
	Daily walking	Less than 30 minutes (n = 174)	73 (46.8)	55 (43.7)	46 (50.0)	174 (46.5)	0.647
		30 minutes or more (n = 200)	83 (53.2)	71 (56.3)	46 (50.0)	200 (53.5)	
	Education	College/university (n = 79)	32 (20.5)	31 (24.6)	16 (17.4)	79 (21.1)	0.008
		High school (n = 220)	80 (51.3)	76 (60.3)	64 (69.6)	220 (58.8)	
		No formal schooling/elementary school (n = 75)	44 (28.2)	19 (15.1)	12 (13.0)	75 (20.1)	
	Hunter	No (n = 194)	82 (52.6)	57 (45.2)	55 (59.8)	194 (51.9)	0.102
		Yes (n = 180)	74 (47.4)	69 (54.8)	37 (40.2)	180 (48.1)	
	Smoking	Smoker (n = 187)	79 (50.6)	61 (48.4)	47 (51.1)	187 (50)	0.907
		Non-smoker (n = 187)	77 (49.4)	65 (51.6)	45 (48.9)	187 (50)	
	Employment status	Employed (n = 255)	100 (64.1)	80 (63.5)	75 (81.5)	255 (68.2)	0.007
		Unemployed (n = 119)	56 (35.9)	46 (36.5)	17 (18.5)	119 (31.8)	
Health perception	Fair to poor (n = 100)	44 (28.2)	29 (23.0)	27 (29.3)	100 (26.7)	0.021	
	Good (n = 176)	76 (48.7)	69 (54.8)	31 (33.7)	176 (47.1)		
	Very good to excellent (n = 98)	36 (23.1)	28 (22.2)	34 (37.0)	98 (26.2)		
Worries about pollution	Very much (n = 122)	29 (18.6)	65 (51.6)	28 (30.4)	122 (32.6)	< 0.001	
	Somewhat to fairly (n = 166)	84 (53.8)	44 (34.9)	38 (41.3)	166 (44.4)		
	Not at all (n = 86)	43 (27.6)	17 (13.5)	26 (28.3)	86 (23.0)		
Interpersonal	English spoken at home	No English (n = 187)	78 (50.0)	59 (46.8)	50 (54.3)	187 (50.0)	0.548
		English (n = 187)	78 (50.0)	67 (53.2)	42 (45.7)	187 (50.0)	
	No. of people in the household	1–4 persons (n = 159)	105 (67.3)	73 (57.9)	46 (50.0)	224 (59.9)	0.023
5 persons or more (n = 215)		51 (32.7)	53 (42.1)	46 (50.0)	150 (40.1)		

Table III (Continued)

Traditional food frequency	Mean freq/wk (CI)	Mean freq/wk (CI)	Mean freq/wk (CI)	Mean freq/wk (CI)	P
Games	2.26 (1.76–2.77)	1.06 (0.85–1.28)	1.11 (0.61–1.61)	1.57 (1.31–1.84)	<0.001
Birds	1.34 (1.00–1.68)	0.93 (0.78–1.09)	0.85 (0.67–1.02)	1.08 (0.92–1.24)	0.022
Fishes	1.49 (0.99–1.98)	0.85 (0.61–1.10)	0.38 (0.11–0.65)	1.00 (0.77–1.24)	0.001
Berries	0.56 (0.36–0.76)	0.31 (0.13–0.23)	0.31 (0.07–0.57)	0.42 (0.31–0.53)	0.094
Greases	0.46 (0.33–0.59)	0.18 (0.20–0.43)	0.24 (0.15–0.32)	0.31 (0.31–0.25)	<0.001
Total traditional food	6.11 (4.71–7.52)	3.34 (2.77–3.92)	2.88 (1.90–3.87)	4.39 (3.71–5.06)	<0.001

The bold values are the significant values with an alpha of 5%.

plants, were considered of great impact on traditional food consumption.

Figure 2 presents an ecological model of all the factors associated with traditional food consumption that were identified by the focus group. Four levels of influence are included: environment, community, interpersonal and individual. Although this model contains the factors associated with traditional food consumption, the degree of influence for each factor could vary according to individual participants. The boundaries between the levels of influence are highly permeable, as the relationships and interactions among individuals, groups and their environments are complex.

Discussion

This study contributes to the scientific literature by identifying the influence of certain individual-level factors on traditional food consumption and by presenting Cree participants' explanations for the impact of these and other factors on their food consumption. The explanations of the Cree participants are consistent with the ecological model, which suggests that the factors involved in food consumption are related not only to individuals, but also to their interpersonal relationships and their relationships to the community and the broader environment. In addition, the factors Knowledge and Income, which are usually classified as individual factors in most ecological models (22), were classified as interpersonal factors. In fact, the participants talked about traditional knowledge in the sense of collective knowledge, including the fact that this knowledge was passed down within families. The same held true for Income because each time they mentioned the money they needed in order to go hunting, they invariably referred to the costs for the family and the family income that this would entail. If the factors were categorized as individual alone, much of the interpretative richness would be lost. Another example is that we found no statistical association between employment status and traditional food consumption, which contradicts Batal's study (38), but concurs with Wein's study (39). Considering the individual level alone, this non-association could be explained by the suggestions of the focus group participants that although employment-generated income can help cover hunting expenses, employment reduces the time available for hunting. Perhaps income and time cancel each other out such that there is no detectable association between employment and traditional food consumption in the logistic regression. However, considering the overall ecological model, another possible hypothesis emerges: when hunting is practiced within a family, the resources are shared among the family members. Thus, a salaried person pays the expenses of other family members while the non-employed members spend time working around the hunting camp to prepare it for other family members. Individual-level

Table IV. Factors influencing traditional food weekly intake (<3 times– ≥3 times): a logistic regression (n = 374)

		≥3 Times/ week (%)	Crude OR	CI 95%	Adjust ^a OR	CI 95%
Age	18–39 (n = 235)	26.0	1.00		1.00	
	40–90 (n = 139)	65.5	5.41	3.43, 8.53	4.51	2.47, 8.26
Sex	Male (n = 150)	48.7	1.00		1.00	
	Female (n = 224)	35.3	0.58	0.38, 0.88	1.10	0.50, 2.40
BMI	18.5–24.99 (n = 27)	37.0	1.00		1.00	
	25–29.99 (n = 86)	37.2	1.01	0.41, 2.47	0.64	0.22, 1.81
	30 and + (n = 261)	42.1	1.24	0.55, 2.81	1.08	0.42, 2.80
Daily walking	Less than 30 minutes (n = 174)	35.1	1.00		1.00	
	30 minutes or more (n = 200)	45.5	1.55	1.02, 2.35	2.41	1.40, 4.13
Education	College/university (n = 79)	34.3	1.00		1.00	
	High school (n = 220)	30.0	0.83	0.48, 1.43	0.87	0.45, 1.69
	No formal schooling/elementary school (n = 75)	78.7	7.10	3.45, 14.62	5.53	2.20, 13.89
Hunter	No (n = 194)	28.9	1.00		1.00	
	Yes (n = 180)	53.3	2.83	1.84, 4.32	3.86	1.78, 8.39
Smoking	Smoker (n = 187)	30.5	1.00		1.00	
	Non-smoker (n = 187)	50.8	2.36	1.54, 3.60	1.15	0.65, 2.02
Employment status	Employed (n = 255)	34.9	1.00		1.00	
	Unemployed (n = 119)	52.9	2.10	1.35, 3.27	1.17	0.63, 2.17
Health perception	Fair to poor (n = 100)	46.0	1.00		1.00	
	Good (n = 176)	37.5	0.70	0.43, 1.16	0.60	0.31, 1.15
	Very good to excellent (n = 98)	40.8	0.81	0.46, 1.42	0.71	0.34, 1.49
Worries about pollution	Very much (n = 122)	36.0	1.00		1.00	
	Somewhat to fairly (n = 166)	44.0	1.21	0.75, 1.95	1.30	0.70, 2.41
	Not at all (n = 86)	39.3	0.87	0.49, 1.54	0.72	0.33, 1.58
English spoken at home	No English (n = 187)	44.9	1.00		1.00	
	English (n = 187)	36.4	0.70	0.46, 1.06	1.12	0.64, 1.96
No. of people in the household	1–4 persons (n = 159)	43.4	1.00		1.00	
	5 persons or more (n = 215)	38.6	0.82	0.54, 1.24	1.45	0.84, 2.50
Community	Eastmain (n = 92)	26.1	1.00		1.00	
	Wemindji (n = 126)	36.5	1.63	0.90, 2.94	1.58	0.75, 3.32
	Mistissini (n = 156)	52.6	3.14	1.79, 5.50	3.62	1.78, 7.36

^aAll variables included.

The bold values are the significative values with an alpha of 5%.

factors have limited power to explain traditional food consumption practices and influences, which are strongly shaped by family and households. A further example is the factor Hunter. Our results concur with many studies showing that the presence of a hunter, trapper, or fisherman in the family has a positive effect on the frequency and quantity of bush food that is consumed (12,14,39). Within an ecological model, being a hunter has greater meaning, as it indicates social status, cultural values, accessibility to a hunting territory, and possession of a certain set of skills, knowledge and resources. These relationships and characteristics might not be thoroughly captured or understood when considered at the individual level alone.

Mistissini, the largest and least remote of the 3 studied communities, showed the highest traditional food

consumption. This finding contrasts with previous studies that found an association between community size or remoteness and traditional food consumption. For example, in 2006, Chan et al. noted that in larger communities, traditional foods were sometimes less available due to limited access to hunting territories (12). Other studies found that community isolation was associated with more frequent consumption of bush food, and in larger quantities (6,12,14,39,40). Because Wemindji and Eastmain have less access to restaurants and because store-bought foods are more expensive in these communities than in Mistissini (41), this result was surprising. The focus group participants suggested that this result could be explained by the presence of various promotional programs organized by the Mistissini Band Council to promote

Table V. Focus group participants' comments on the quantitative findings

Variables	Participants' explanations	Quotations
Body mass index (BMI)	<p>Participants disagreed with the non-association.</p> <ol style="list-style-type: none"> 1. People with a higher BMI might be eating high-fat traditional foods, such as bear grease, or using high-fat cooking methods. 2. People with normal BMI use healthy cooking methods and eat less junk food. 3. People with higher BMI eat bigger portions. 	<ol style="list-style-type: none"> 1. <i>I guess those people who are obese, they eat more, more greasy food. Bear fat. Siikusakin (bear fat cracklings) that's really delicious.</i> 2. <i>Because we don't know the non-obese and the obese people like are the non-obese people cooking more nutritional foods or adapting to new ways or the obese still practicing what we had in the past, that we don't really know. And the people that are obese, they still going to Kentucky Fried Chicken or the people that are non-obese are they still doing the same.</i> 3. <i>Big people serve themselves big portions. Like when I go over to Murray's lodge, these people that are big, they get a whole portion – almost double of what the smaller person is eating. And yet they would eat all of it.</i>
Education	<p>Participants agreed with the association.</p> <p>People with more education had to study outside the community, where they had less access to traditional foods and as a result their traditional knowledge or habits were altered.</p>	<p><i>They probably live the lifestyle of White people. They have more education so they don't care about the traditional Cree food.</i></p>
Employment status	<p>Participants disagreed with the non-association.</p> <ol style="list-style-type: none"> 1. Having a job provides the means to pay for expenses related to hunting. However, being employed means you have less time to hunt. 2. People with a job tend to stay in the community while the unemployed live in the bush. 	<ol style="list-style-type: none"> 1. <i>Those who are non-employed, where they get their money to get their bush food and those who are employed may have the money but they don't have the time.</i> 2. <i>I don't know if I would agree, because people that are employed tend to stay in their home in the community, Yah. More than the non-employed. Yup. And the non-employed Cree trappers. They live in the bush.</i>
Health perception	<ol style="list-style-type: none"> 1–2. Some participants disagreed with the way the question was phrased, stating that the definition of health can vary from 1 individual to another. 2–3. Some participants agreed with the non-association. 	<ol style="list-style-type: none"> 1. <i>Even people that are healthy can feel unhealthy.</i> 2. <i>Whether you feel healthy or not it depends on what you eat so you might feel healthy because you eat traditional food all the time and some of us might feel different because we mostly eat commercial food.</i> 3. <i>Yeah. I'm not healthy, but I still eat beaver, goose, and moose meat. It's healing for the elders, like when they're sick in the hospital. Usually the doctors encourage them to eat traditional food. So, being healthy doesn't have to go with eating traditional food.</i>
Worries about pollution	<ol style="list-style-type: none"> 1. Some participants disagreed with the non-association. 2. Some participants agreed, saying that they were not worried about contaminants because they did not listen to the awareness campaign. 	<ol style="list-style-type: none"> 1. <i>I don't know anybody that would not worry about it. That's why I'm stuck with this question. I don't know anybody who would not worry about contaminated food. That's inevitable.</i> 2. <i>Myself, I don't usually listen to that, you know. If I get a lake trout, I'll eat it (laughing). I won't pay any attention, you know. I won't follow to have it once a week or once a month the way they recommend we do, you know (laughing).</i>

Table V (Continued)

Variables	Participants' explanations	Quotations
Community	<p>1–2. Participants were surprised because Wemindji and Eastmain are more isolated than Mistissini, so they should be less influenced by non-aboriginal culture and the price of market foods should be higher; representing incentives to traditional food consumption.</p> <p>3. Participants tried to explain the result: Presence of programs promoting traditional food in Mistissini.</p>	<p>1. <i>I am surprised because they're more isolated. And they have less access to restaurant foods. The towns are more far away than us. We were exposed more to the Southern people than them.</i></p> <p>2. <i>They are isolated but their (market) food is more expensive.</i></p> <p>3. <i>I think the other thing too in Mistissini is having those programs there, Murray's lodge and the elder's point there, having those program will help, having people eating traditional food because they can go, you know to Murray's lodge or somewhere.</i></p>

traditional food consumption. In winter and summer, the community offers free traditional food meals to the entire community 4 times a week. Meals are served in a traditional camp setting, where elders teach others how to prepare traditional food and make traditional goods such as snowshoes, moccasins and so on. It would be interesting to measure the influence of such programs in future studies. Because this program inspires this community to consume more traditional foods, it could be exported to other communities as a concrete way to promote traditional food consumption at the community level. Again, this result underscores the significant community influence on traditional food consumption. In addition, upon closer examination of the data on traditional food consumption, we found significantly greater consumption of game in Mistissini (Table III). It is possible that the wildlife population fluctuated, making game more available in 2005 than in 2007. Alternatively, moose may have been more accessible in the southern region where Mistissini is located. Thus, greater access to a variety of traditional foods may increase consumption frequency. Both hypotheses underscore the potentially strong environmental influence on traditional food consumption, as testified by the frequent mention of interpersonal, community and environmental factors by the focus group participants.

In the logistic regression, although no relationship was found between traditional food consumption and education level in previous studies (39,42), our results agree with the findings of Hopping et al. that a person with no formal schooling is much more likely to consume traditional foods (43). Apart from the focus group participants' explanations (Table V), this could be due to their exposure to traditional aboriginal education, whereby knowledge and skills in gathering, preparing and cooking traditional foods are acquired, which has been shown to promote traditional food consumption (12,14,39).

Studies have found that older people consume more traditional foods than younger people (12,14,39). Some of the older Cree were raised in the bush, where they were exposed to traditional foods and learned traditional skills at an early age. Because Crees began to settle in residential communities about 35 years ago, with the signing of the James Bay Agreement, younger people have been less exposed to traditional foods and lifestyles.

Some studies also reported that men consumed more traditional foods than women did (40). Future studies could control for (either sex or sex and hunting status), 2 factors that showed strong collinearity in our analysis.

In our study, physically active people were more likely to consume traditional foods 3 days or more per week, a relationship that few studies have demonstrated. However, because a cross-sectional design was used, we were unable to establish a temporal relationship between traditional food consumption and walking (44), and therefore could not determine whether being physically active

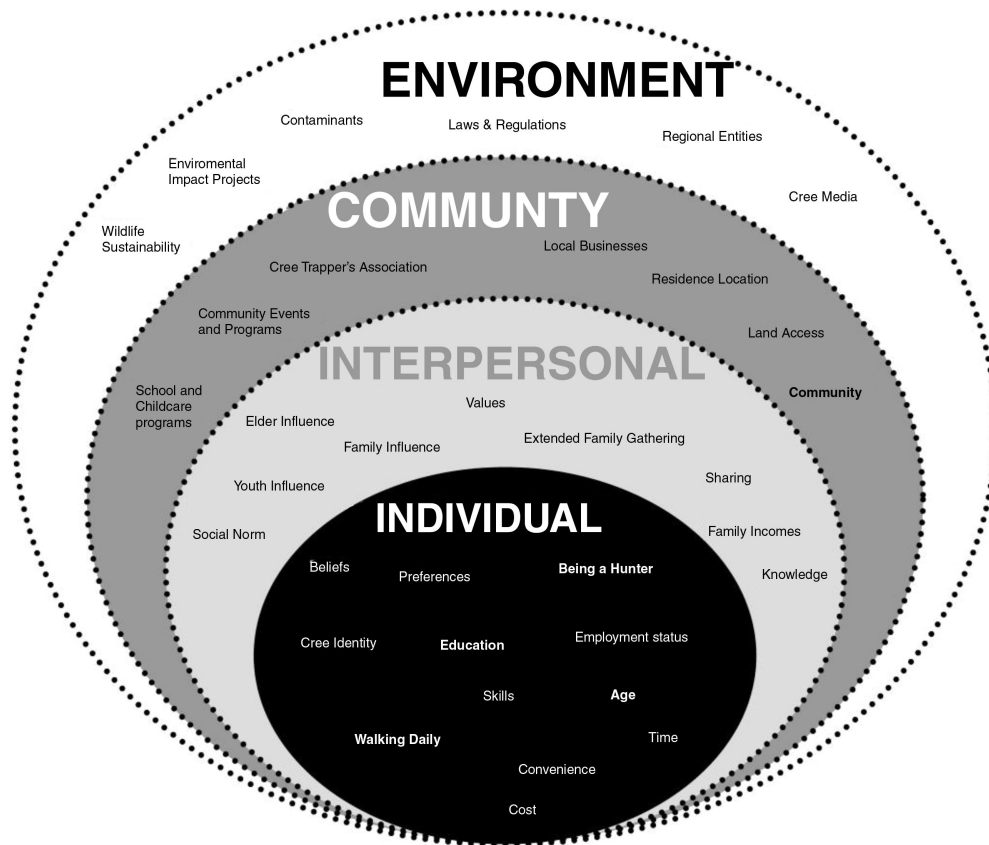


Fig. 2. An ecological model of factors influencing the consumption of traditional food. *Bolded factors are statistically significant in logistic regression.

favours traditional food consumption or whether the desire to consume traditional foods is independently associated with physical activity. Whereas the adoption of a balanced, holistic lifestyle, including physical activity and healthy eating, may positively influence traditional food consumption, the practices of hunting, trapping, collecting and preparing traditional foods require plenty of walking.

Although other studies have similarly failed to find a relationship between BMI and traditional food consumption, a relationship between normal BMI and high consumption of traditional foods would be expected. The focus group participants suggested that people with a higher BMI might tend to eat traditional high-fat foods such as bear grease, eat bigger portions, or use high-fat cooking methods. This highlights the importance of food type and cooking methods over the frequency of traditional food consumption. Additionally, the frequency of traditional food consumption might be an insufficiently sensitive factor to reveal an association.

Limitations

This study includes certain limitations, mainly concerning some of the independent variables. First, we predicted that traditional food consumption would be associated

with a feeling of better health and wellbeing, because traditional foods are an integral part of *miyupimaatisiium* (wellbeing) (24). However, no such association was found, probably due to differing meanings of health between the Crees and the researchers. In future studies, questions on the feelings of health and wellbeing should be culturally adapted, and the meanings should be more thoroughly explored. Second, although we expected to find a relationship between worries about pollution and traditional foods, we did not find one. For over 30 years now, public awareness campaigns have been in place to warn against contaminants found in fish and animal organs. This lack of association was perhaps due to the fact the traditional food categories include all types of wild animals. Future studies could explore this association using only wild animals affected by contaminants.

Similarly, because data were taken from a cross-sectional study, the associations found cannot be used to infer a causal relationship (44). Errors may also have occurred during the collection of quantitative data. It is possible that the lengthy duration of the interviews resulted in a measurement error, leading to the attenuation of the odds ratio. However, the pertinent study questions were asked at the beginning of the interview.

A limitation associated with the use of food-frequency questionnaires is that they depend on the accuracy of the participants' recall and self-reports. Not only must participants recall their eating habits over a 12-month period, but they must also provide the usual amounts eaten and the usual frequencies of eating each food.

Unfortunately, the focus groups were organized in Mistissini only. It would have been useful to include the opinions of Eastmain and Wemindji residents as well. However, we took several steps in our methodology to ensure the validity of our focus group results. We pilot-tested the question grid and we listened to the participants and asked them to clarify areas of ambiguity. We also created an environment where they could share their thoughts freely. The qualitative data and their analysis refined and explained the statistical results by exploring the participants' views in greater depth. The collection of both quantitative and qualitative data enabled combining the strengths of the 2 research methods (25).

Conclusion

The aim of this study was to conduct an initial exploration of factors influencing traditional food consumption using an ecological model, and further investigation along this line is needed. Whereas the quantitative analyses focused largely on individual-level factors, the qualitative analysis revealed that many collective factors were predominant, in the participants' view, which highlights the importance of acting on family, community and environmental factors to increase traditional food consumption. Nevertheless, further studies using an ecological model are needed to investigate these influences. We believe that our findings can be used to design traditional food promotion strategies to enable the Cree of northern Quebec and other nations to improve their overall wellness.

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