Dietary Intake in a Population Undergoing a Rapid Transition in Diet and Lifestyle: The Inuvialuit in the Northwest Territories of Arctic Canada

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ABSTRACT

Objectives: To: 1) characterize diet in Inuvialuit; 2) determine the foods and nutrients to be targeted for a nutritional intervention program; and 3) develop a Quantitative Food Frequency Questionnaire (QFFQ) to evaluate the program and monitor nutrition transition for Inuvialuit in the Northwest Territories (NWT), Canada.

Methods: Twenty-four-hour dietary recalls were collected among 101 Inuvialuit aged 19 years and over in two communities in the NWT. All foods reported in the recall were tabulated for inclusion in the QFFQ.

Results: Forty-eight men and 53 women (mean age 49 and 45 yrs, respectively) completed the recalls. Mean energy intake was 2,352 kcal and 1,739 kcal for men and women, respectively. Mean daily intakes of many nutrients including dietary fibre, calcium, and vitamins A, C and E, and total folate were much lower than recommended. The most frequently reported foods were non-nutrient-dense store-bought foods. Most traditional foods (TF) were reported one time by one person. The top two contributors to energy intake, 'sugar added to tea and coffee' and 'sweetened juices and drinks', were targeted by the intervention program. A 145-item QFFQ was developed including 41 TF and 8 categories of consumption frequency.

Conclusions: This study has provided dietary intake data previously unavailable for Inuvialuit and highlighted nutrients and foods to be targeted for the intervention program. The QFFQ is up-to-date, culturally appropriate, and currently being used to evaluate the intervention program, Healthy Foods North, which aims to reduce dietary- and lifestyle-related risk factors for chronic disease in Inuvialuit.

Key words: Nutrition transition; food and nutrient intake; Quantitative Food Frequency Questionnaire (QFFQ); Inuvialuit; nutritional intervention; Northwest Territories (NWT)

La traduction du résumé se trouve à la fin de l'article.

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Inuvialuit in Canada's Western Arctic have been living by hunting and gathering for approximately 1,000 years.[1] Two activities define traditional Inuvialuit identity: harvesting of traditional foods (TF) and its redistribution or sharing.[2,3] Like most Indigenous peoples in North America,[4-6] Inuvialuit face extreme pressure to acculturate to Western values, including transitioning to a Western diet.[7,8] Traditional foods, defined as those harvested from the local environment, include animals obtained directly from the land or sea, which contributed largely to dietary intake and were vital to nutrition, health, and food security. However, drastic climate changes pose environmental stress on those animals (e.g., polar bear, seal and caribou) that are TF sources.[9,10]

Foods that replace TF are mainly processed, high in sugar and fat, and much less nutrient-dense. This shift in diet has resulted in a decreased intake of many micronutrients[11-14] and is associated with increasing rates of obesity, diabetes, and other chronic disease in Indigenous peoples in the Arctic.[15,16] Prevalence of diabetes in Indigenous North Americans is 3-5 times that of the general population in Canada.[17] The prevalence of risk factors of diabetes, such as overweight and obesity, is higher among the Canadian Aboriginal population compared to the general population.[18,19] Consequently, there is an urgent need to develop a nutritional intervention program to improve dietary intake for chronic disease prevention.

Despite the known effectiveness of risk reduction interventions for obesity, diabetes and other chronic diseases,[20] few nutritional intervention programs for Inuvialuit have been successful. Furthermore, there is little up-to-date data on Inuvialuit diet, particularly the diet during transition to a Western diet.

The aims of this study were to: 1) characterize diet in Inuvialuit; 2) highlight foods and nutrients for a community-based multi-institutional nutritional and lifestyle intervention program; and 3) develop a Quantitative Food Frequency Questionnaire (QFFQ) to evaluate the program and monitor nutrition transition in Inuvialuit.

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METHODS

Setting

The Northwest Territories (NWT) has an area of 1,140,835 square kilometres and had a population of 41,055 with 4,165 Inuvialuit (vs. 50,480 Inuvialuit in Canada) as of the 2006 census.[21] Two communities in the NWT were chosen to represent a range of Inuvialuit communities. One is a large administrative centre with good access to food and employment; the other is isolated with only ice road access in the winter and two grocery stores and relatively more traditional activities. Community A had approximately 3,500 members in 2006 (employment rate: 71%), almost 63% Aboriginal.[21] Community B had approximately 900 members in 2006 (employment rate: 39%), approximately 84% Aboriginal.[21]

24-hour dietary recall collection

Subjects aged 19 years and over who reported as Inuvialuit and had lived in the community for at least six months were eligible. Pregnant and breast-feeding women were excluded because they have different requirements for the intake of foods compared to other participants. (The intervention program examined the dietary intake pre- and post-intervention; for pregnant and breast-feeding women, their requirements and consumption would have varied pre- and post-intervention but the dietary change would be unrelated to the program.) Both communities cover a very small area and the houses are all relatively close together. Fieldworkers were asked to use housing maps to randomly select houses from each corner of the community and from the community centre to ensure inclusion of both those with the closest access to the stores and those who resided further away. To obtain the maximum diversity in diet within the community, only one person per household was selected as it is likely that people within a household would eat similar foods. An attempt was made to stratify the sample based on age and gender to ensure that the respondents represent all those who reside in the communities. Men and women were selected from each age decade and only those who reported to be the main food preparer/shopper were included.

Two local interviewers trained for five days by the Principal Investigator (S.S.) collected all the 24-hour recalls using a standard manual of procedures (MOP). A single 24-hour recall was collected on each respondent after obtaining written informed consent. The interviewers systematically sought and recorded information about foods and drinks consumed during the preceding 24-hour period. The time of consumption and the type of foods or drinks consumed (e.g., meat type or brand name) was recorded, as well as the source and any additions (e.g., lard on dried meat and butter on bread). A range of models (including 3-D food models, familiar household units, and standard store packets) was selected with the help of local staff to represent different portion sizes of foods usually consumed. An additional list of questions was included to prompt for easily forgotten foods (e.g., dried meats, fats, and snacks).

All interviews in Community A were conducted in English. In Community B, almost all interviews were conducted by a bilingual interviewer in the local language (Inuvialuktun) and recorded in English.

The interviewers collected 24-hour recalls on different weekdays and weekends between September and December in 2006. The respondents were given a CAD $25 gift certificate as an incentive. The recalls were reviewed for completeness before the interviewer left the home. A nutrition researcher checked and coded each recall and no recall was excluded due to incompleteness.

Data analyses

All foods recorded on the recalls were coded, entered, and analyzed using Nutribase Clinical Nutrition Manager v. 5.18, which has a computerized research quality dietary database and analysis program that provides data for 121 nutrients using the Canadian Food Composition Tables (FCT) and additionally contains Arctic foods.[22] For some Arctic foods unavailable in the FCT, recipes were estimated based on the information provided by the local respondents and input into Nutribase to update the FCT. To determine the major food sources of energy and selected nutrients and to highlight foods for a nutritional intervention program, we combined the contribution of similar foods, such as different pops and chips. SAS statistical software (v. 9.1) was used for descriptive statistical analysis and manipulation of the data. [23]

Development of the QFFQ

Food or drink items reported in the 24-hour recalls were tabulated and any item consumed more than once was included in the draft QFFQ, with the exception of foods very low in energy and nutrients, such as condiments and spices. Food and drink items that will be promoted (e.g., low-fat spreads, low-sugar drinks, baked chips, fruits, and vegetables) were added to the draft QFFQ in order to track changes in consumption pre- and post-intervention. A MOP was developed for the administration of the draft QFFQ and all interviewers were local Inuvialuit and trained and certified by S.S. The draft QFFQ was pilot tested in 18 randomly selected subjects using a housing map in each community to determine if foods had been forgotten because of seasonality. Blank lines were added to the draft QFFQ for participants to add any other foods consumed during the last 12 months. A range of food models was also listed on the QFFQ to assist participants in describing their usual amounts consumed.

The dietary data were used to develop an integrated, multilevel, multi-institutional intervention strategy called Healthy Foods North (HFN), which aims to reduce dietary- and lifestyle-related risk factors for chronic disease in Inuvialuit.

Diet-based components of the intervention program, HFN, were to improve dietary intake by increasing food knowledge, self-efficacy, and attitudes about healthier behaviours as well as improving the availability of healthy food choices at the community level. Foods that are to be targeted for the intervention program were based on results from the 24-hour recall analyses, in-depth interviews conducted with community members, community workshops, and input from interested parties (e.g., Department of Health and Social Services, Government of the NWT), a process we have used in other nutritional intervention programs with indigenous North Americans.[24,25] Institutional Review Board approval was obtained from the Committee on Human Studies at the University of Hawaii and the Office of Human Research Ethics at the University of North Carolina at Chapel Hill. This study was also approved by the Aurora Research Institute in the NWT.

RESULTS

Forty-eight men and 53 women aged between 19-88 yrs completed single 24-hour recalls. Twenty men and 25 women (mean (± SD) age: 47 (± 17.4) yrs and 48 (± 17.5) yrs, respectively) were from Communi-

Table 1. Mean (± SD) and Median Daily Energy and Nutrient Intake in Adult Inuvialuit in the NWT

	Men (n=46)			Women (n=52)		
	Mean ± SD	**Median**	**DRI***	**Mean ± SD**	**Median**	**DRI***
Age (yrs)	49 ± 16	49	–	46 ± 18	46	–
Energy (kcal)	2352 ± 933	2183	2200†	1739 ± 847	1633	1800†
Energy (kj)	9840 ± 3904	9134	9204†	7278 ± 3543	6843	7533†
% of energy from fat	32 ± 9	34	20-35‡	31 ± 11	30	20-35‡
% of energy from carbohydrate	50 ± 11	51	45-65‡	51 ± 13	52	45-65‡
% of energy from protein	17 ± 6	16	10-35‡	18 ± 9	16	10-35‡
Fat (g)	85 ± 41	79	–	63 ± 43	55	–
Saturated fat (g)	29 ± 18	25	–	20 ± 14	15	–
Protein (g)	99 ± 48	92	–	83 ± 72	62	–
Carbohydrate (g)	287 ± 119	280	–	210 ± 91	192	–
Sugars (g)	150 ± 84	120	<25% of energy	108 ± 63	98	<25% of energy
Dietary fibre (g)	11 ± 7	9	38§	8 ± 5	6	25§
Monounsaturated Fat (g)	24 ± 16	20	–	17 ± 17	12	–
Polyunsaturated Fat (g)	11 ± 8	10	–	7 ± 7	6	–
Omega-3 fatty acid (g)	1.2 ± 2.1	0.4	–	0.6 ± 1.5	0.2	–
Omega-6 fatty acid (g)	4.7 ± 4.8	3.5	–	2.5 ± 2.5	1.5	–
Cholesterol (mg)	358 ± 286	243	As low as possible¶	271 ± 273	160	As low as possible¶
Vitamin A (µg-RE‖)	164 ± 182	89	900**	112 ± 129	63	700**
Vitamin A (IU)	1745 ± 2347	995	–	2074 ± 2968	930	–
Vitamin B-6 (mg)	1.4 ± 0.9	1.1	1.3**	1.0 ± 0.9	0.8	1.3**
Vitamin B-12 (µg)	32 ± 43	19	2.4**	16 ± 21	8.3	2.4**
Thiamin (mg)	1.5 ± 0.9	1.3	1.2**	1.0 ± 0.7	0.8	1.1**
Riboflavin (mg)	2.6 ± 1.5	2.3	1.3**	2.0 ± 1.2	1.5	1.1**
Niacin (mg)	23 ± 13	20	16**	16 ± 13	12	14**
Vitamin C (mg)	83 ± 92	49	90**	63 ± 84	26	75**
Vitamin D (IU)	256 ± 433	92	200§††	75 ± 153	31	200§††
Vitamin E (mg) ‡‡	1.9 ± 1.8	1.6	15**	1.2 ± 1.4	0.8	15**
Total Folate (µg)	177 ± 101	149	400**	130 ± 80	127	400**
Calcium (mg)	475 ± 382	355	1000§	499 ± 855	268	1000§
Iron (mg)	17 ± 18	12	8**	13 ± 13	9	18**
Zinc (mg)	12 ± 10	9	11**	9 ± 10	5	8**

* The recommended Dietary Reference Intakes (DRI) are presented in this table using Adequate Intake (AI) and Recommended Dietary Allowance (RDA) for men and women aged between 31-50 yrs. The DRI selected for estimated amounts of energy intake needed to maintain energy balance were for men and women aged between 31-50 years at the level of very low physical activity-sedentary level because: 1) Based on our other preliminary data collected using the international physical activity questionnaire, Inuvialuit population has a sedentary lifestyle; 2) The mean and median age of our sampled men and women was within the age group 31-50 yrs. These age ranges are set by the Institute of Medicine on which the dietary recommendations by age are based.[34]
† Estimated amounts of energy intake needed to maintain energy balance for men and women aged between 31-50 yrs at the level of very low physical activity-sedentary level.[34]
‡ Acceptable macronutrient distribution ranges (AMDR).[34]
§ Adequate Intake (AI).[34]
‖ Retinol equivalent.
¶ As low as possible while consuming a nutritionally adequate diet.[34]
** Recommended dietary allowance (RDA).[34]
†† Adequate intake. As cholecalciferol. In the absence of adequate exposure to sunlight.[34]
‡‡ As alpha tocopherol (mg).[34]

Table 2. The Ten Major Food Sources of Energy and Selected Macronutrients in Adult Inuvialuit in the NWT

Foods	**% Contribution to Energy**	**Foods**	**% Contribution to Total Fat**	**Foods**	**% Contribution to Protein**	**Foods**	**% Contribution to Carbohydrate**
Sugar*	6.2	Butter/margarine	10.4	Caribou, roasted	8.3	Sugar*	13.2
Sweetened juices/drinks	5.5	Chips	5.9	Caribou soup/stew	7.7	Sweetened juices/drinks	12.2
Pops, regular	4.5	Muktuk/whale blubber	5.9	Pork, chop/rib	6.3	Bread, white	6.6
Bread, white	4.4	Sausages/lunchmeats	5.1	Caribou, raw/dried	5.3	Pops, regular	6.6
Chips	3.8	Chicken eggs	4.7	White fish, raw/dried	5.2	Chips	3.5
Pizza	3.5	Pizza	4.1	Pizza	3.7	Caribou soup/stew	3.2
Butter/margarine	3.3	Coffee creamer	4.0	Beef, rib/steak	3.4	Pizza	3.0
Caribou soup/stew	3.3	Pork, chop/rib	3.9	Whitefish, baked/broiled	3.2	Pastries, any kind	2.9
Coffee creamer	2.9	Pastries, any kind	3.9	Chicken eggs	3.2	Bread, wheat	2.8
Pastries, any kind	2.7	Ground beef dishes	1.8	Muktuk/whale blubber	2.7	Bannock, fried	2.6
Total	**40.1**	**Total**	**49.7**	**Total**	**49.0**	**Total**	**56.6**

* sugar added to tea or coffee.

ty A, and 28 men and 28 women (mean (± SD) age: 50 (± 16.3) yrs and 43 (± 17.5) yrs, respectively) from Community B (data not shown). The response rate was approximately 85%. Three outliers were excluded due to extreme energy intake greater than 5,000 kcal or less than 500 kcal, the same criteria as applied in previous studies.[26-28]

Dietary intake

Table 1 presents the mean and median nutrient intakes. Mean (± SD) daily energy intake for Inuvialuit men and women was 2,352 (± 933) kcal and 1,739 (± 847) kcal, respectively. Low mean daily intakes of dietary fibre, vitamins A, C, E, total folate, and calcium were observed in both men and women compared to the recommendation. Inuvialuit women had a lower mean daily intake of vitamin D and iron compared to men. Compared to the age-group recommendations for vitamin D, 83-100% of all age and sex groups did not meet the vitamin D recommendations (except 51-70 yr old men, 63% of whom did not meet the recommendations) (data not shown).

Tables 2 and 3 present the 10 major food sources of energy, total fat, protein, carbohydrate, sugar, dietary fibre, calcium and iron. The top 10 contributors to total energy intake were mostly non-nutrient-dense with 'sugar added to tea and coffee' ranking first. 'Butter and margarine' was the highest contributor to total fat intake. 'Raw and dried white fish' was the top single contributor to

Table 3. The Ten Major Food Sources of Selected Nutrients in Adult Inuvialuit in the NWT

Foods	% Contribution to Sugar	Foods	% Contribution to Fibre	Foods	% Contribution to Calcium	Foods	% Contribution to Iron
Sugar*	25.5	Bread, wheat	9.1	Whitefish, dried/raw	18.9	Caribou, roasted	10.5
Sweetened juices/drinks	21.8	Chips	8.1	Milk, 2%	6.9	Caribou soup/stew	9.0
Pops, regular	18.8	Bread, white	6.6	Pizza	6.4	Seal meat	7.2
Candy, any kind	3.3	Pizza	5.0	Bread, white	5.1	Caribou, raw/dried	6.3
Pastries, any kind	2.2	Breakfast cereals	4.5	Cheese, processed	4.9	Bread, white	5.2
Beer, regular	1.6	Pastries, any kind	3.7	Coffee	4.5	Breakfast cereals	3.7
Cake	1.5	Caribou soup/stew	3.4	Chocolate milk	4.4	Pizza	3.3
Chocolate milk	1.5	Beef soup/stew	3.3	Chicken eggs	2.7	Bread, wheat	3.2
Bread, white	1.3	Potato/french fries/hash brown	3.1	Caribou soup/stew	2.2	Bannock, fried	2.9
Ice cream	1.2	Bannock, fried	2.8	Whole milk, evaporated	2.2	Chicken eggs	2.8
Total	**78.7**	**Total**	**49.6**	**Total**	**58.2**	**Total**	**54.1**

* Sugar added to tea or coffee.

calcium intake. The consumption of sweetened juices/drinks combined with regular pop was reported by 95% of the participants. Fruits and vegetables were reported less than one time per day. Salmon, seal, trout, geese, Arctic char, and moose were reported only one time by one person (data not presented). Approximately 14% and 16% of energy and total fat intake, respectively, was contributed by TF (Figure 1). However, TF contributed substantially to protein (42%), iron (45.4%), zinc (50.6%), and vitamin A (21.7%) intakes.

The QFFQ for Inuvialuit

Five foods (cereal bars, white fish chowder, clam chowder, Side Kicks noodles, and grapes) were reported and added to the final QFFQ. Five seasonal foods (duck, ptarmigan, geese, swan, and cranes) were listed on the final QFFQ after focus group discussions with local field staff. The final QFFQ has 145 food and drink items including 41 TF (Appendix 1). The validation study of the QFFQ is currently underway. One sample page of the final QFFQ is presented in Appendix 2.

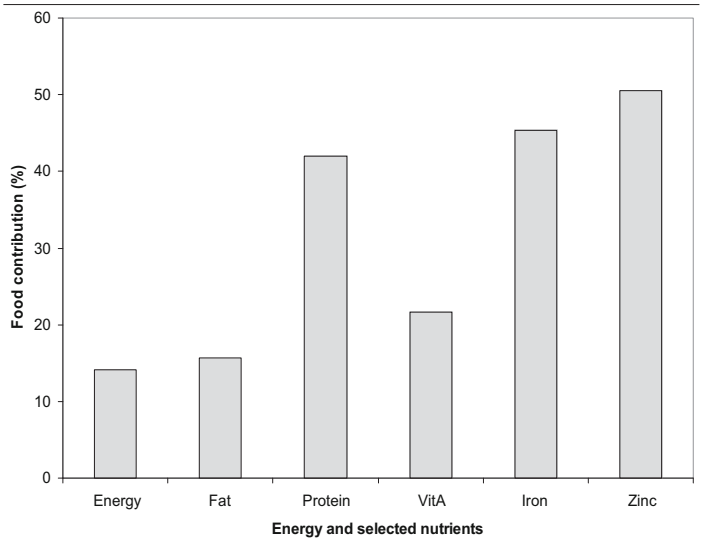
DISCUSSION

Our findings support growing concern about the nutrition transition currently underway in Arctic populations. Compared to Inuit women in Repulse Bay (a population similar to that in our study), Inuvialuit women in our sample had similar mean daily energy intake (1,739 kcal vs. 1,696 kcal).[13] Our Inuvialuit women had a lower mean intake of fat and protein but greater carbohydrate (mostly from sugar).[13] Both our study and the Repulse Bay study reported very low intakes of folate, calcium, zinc, and iron.

The lower mean daily intake of vitamin D and iron in women compared to men in our study is likely due to a lower consumption of TF. TF are rich sources of vitamin D and a main contributor to vitamin D intake.[29] Kuhnlein et al. (2007) reported a single portion of local animal or fish foods could result in a significant increase of vitamin D intake among Arctic Canadian Indigenous population.[29]

Compared to Inuit women in Nunavik, TF consumed by our sample made a much lower contribution to energy intake (14% vs. 40%).[30] Although TF contributed to the intake of some key nutrients, the most frequently reported foods were store-bought foods. The high popularity and high volume consumption of these foods explains why they are significant sources of many nutrients. Similar to our findings, most frequently reported foods by Inuit in Nunavut and the NWT in a survey (1998-1999) were also non-nutrient-dense store-bought foods, such as sugar (74% participants), coffee (63%), tea (53%), and white bread (50%).[8]

Figure 1. Percent contribution of traditional foods to energy and selected nutrients in adult Inuvialuit in the NWT



Because of the low intakes of many micronutrients, the program will promote more nutrient-dense foods, such as unsweetened fruit juice, high-fibre low-sugar cereals, low-fat baked chips, and homemade pizza, and provide instructions in healthier cooking methods.

To assess the changes in dietary intake pre- and post-intervention and to evaluate the effectiveness of HFN, an accurate, up-to-date, and culturally-specific dietary assessment instrument is essential. QFFQ is a comprehensive assessment instrument essential for measuring usual dietary intake. It has advantages over other dietary assessment methods such as short-term recalls and diet records.[31] Three components are involved in the development of a QFFQ: constructing a food list; determining the food portion sizes and categories of consumption frequency; ordering and grouping the foods.[32] Obtaining an appropriate food list for a unique population is the most crucial step in the process of developing a QFFQ. Our QFFQ was developed with local Inuvialuit staff who provided input on the selection of food models and the ordering of the food list. Food grouping in the development of the QFFQ should fit within respondents' 'conceptual framework'.[33] Our instrument followed the logical order that was clear to the local population and easy for them to follow. For example, non-dairy products, such as sweeteners and coffee creamers were grouped under the category 'dairy' to make it easier for respondents to recall the consumption as well as for interviewers to probe these food items. During our formative work, the local community advised on the ordering of the foods

Appendix 1. Food and drink items listed on the QFFQ

Category	Food items
Breads, Cereals (9)	Bannock, fried, incl. Eskimo donut; Bannock, baked; White bread, incl. toast, rolls, buns and in sandwiches; Whole wheat bread incl. toast, buns and in sandwiches; Pancakes; Sweet cereals incl. Frosted Flakes™, Honey Nut Cheerios™; Cereals (low sugar) incl. Rice Krispies™, Cheerios™, Corn Flakes™; Cereals (high fibre) incl. Mini Wheats™, Harvest Crunch™, Bran Flakes™; Cereal, Cream of Wheat™, oats, porridge
Meats and Poultry (41)	Caribou, boiled, baked or roasted; Caribou, frozen (raw); Caribou, dried meat; Caribou, fried incl. steak (but not burgers); Caribou burger; Caribou stir-fried with vegetables; Caribou offal incl. liver, heart and kidney; Muskox, boiled, baked or roasted; Muskox, dried meat; Muskox, fried incl. steak (excluding burger); Muskox, burger; Muskox stir-fried with vegetables; Moose, boiled, baked or roasted; Moose, dried meat; Moose, fried incl. steak (excluding burgers); Moose burger; Moose, stir-fried with vegetables; Beef burgers patty (not incl. bun – ask patty only); Ground beef or beef ravioli or Hamburger Helper™; Meat pie incl. Shepherd's pie; Beef steak fried without vegetables; Beef steak stir-fried with vegetables; Beef jerky; Pork chops, boiled, baked, roasted or fried; Polar bear, raw, boiled or roasted; Seal meat, boiled; Rabbit or musk rat; Bacon; Ham; Sausage, hot dogs or wieners; Lunch meat incl. Klik™ and corned beef; Chicken nuggets; Chicken burger; Chicken, baked, boiled, or roasted; Chicken wings; Chicken drumstick incl. KFC™ baked or breaded or fried; Turkey, baked or roasted; Wild birds incl. duck, ptarmigan, geese, swan and crane; Caribou fat, hard; Eskimo ice cream with caribou fat; Muktuk, raw incl. fermented
Soups (8)	Any soup with beef or hamburger; Caribou soup; Chicken soup, any kind; Fish or other chowder incl. clam chowder; Any vegetable soup – tomato, mushroom, celery; Caribou stew; Blood soup
Fish and fish dishes (13)	Char, frozen (raw); Char, baked or fried; Char, dried; Char stir-fried with vegetables; White fish boiled or baked or grilled incl. herring, trout; Smoked fish (not char); Fish patty any kind; Fish any kind, dried (not char); Fish any kind, fried (not char); Fish any kind, frozen (not char); Fish, eggs any kind; Fish any kind canned (sardines, salmon); Whale fat or oil incl. fermented
Dairy (13)	Milk, whole (Total for each day on days milk drunk); Milk, 2% (Total for each day on days milk drunk); Milk, 1% or non fat (Total for each day on days milk drunk); Milk, Carnation™ (canned) regular (Total for each day on days milk drunk); Milk, Carnation™ (canned), low fat (2%) (Total for each day on days milk drunk); Yogurt, any kind; Hard cheese or processed cheese (1 slice=1 Q); Eggs, any kind; Chocolate milk or Hot chocolate; Regular Coffee-mate™ or coffee creamer flavoured, powder or liquid; Lite or fat-free Coffee-mate™ or coffee creamer, powder or liquid; Sugar in tea/coffee/on cereal/fruit etc. (total spoons per day); Artificial sweetener incl. Equal™, Twin™, Splenda™ and Sweet 'n Low™
Fruits (11)	Orange, fresh; Apple, fresh; Banana, fresh; Pear, fresh; Strawberries or other berries, fresh; Grape; Any canned fruit, e.g., pineapple, mandarin, fruit cocktail in syrup; Any canned fruit, e.g., pineapple, mandarin, fruit cocktail in natural juice; Fruit, frozen (incl. blueberries or mixed fruits); Fruit salad fresh; Fruit, dried, any kind
Vegetables (11)	Potato, mashed incl. instant; Potato baked, boiled or roasted; Hash browns, fried potato, or French fries; Carrot, raw or cooked incl. baby carrot; Frozen vegetables, any kind, incl. mixed vegetables; Cauliflower or broccoli; Vegetables, canned, incl. corn or peas; Coleslaw or potato salad; Vegetable salad, any kind; Salad dressing, regular; Salad dressing, low fat or light
Starches (4)	Pizza, or Pizza Bites™; Pizza, homemade (new recipe); Spaghetti or noodle (not incl. meat), or macaroni and cheese; Rice, any kind
Desserts and snacks (15)	Ice cream any kind; Cake, any kind, incl. cupcake and English toffee cake; Pie, fruit any kind; Sweet donuts, Cinnamon bun, Danish roll or other pastries; Chips, regular, incl. potato chips, nacho chips, party mix, Cheesies™, Sun Chips™, Doritos™, popcorn, tortilla chips; Chips baked, incl. baked tortilla chips; Popcorn, regular; Popcorn, lower fat; Crackers, Premium™, Ritz™, Wheat Thins™ or sesame snacks, Pilot™ biscuits; Cookies, any kind, incl. shortbread; Candy, any kind incl. jelly beans, mints, chewing gum; Chocolate or chocolate bar; Nuts, any kind; Jell-O™ or jelly incl. strawberry mousse; Cereal bars
Other foods (6)	Regular butter, margarine, or lard on bread/crackers/vegetables; Low fat spreads and low fat butter/margarines; Mayo; Stuffing; Peanut butter; Gravy, any
Beverages (11)	Sweetened drink, any kind (with added sugar) incl. made from concentrate or frozen or powdered, incl. Kool-aid™, punch, Tang™; Unsweetened drink (sugar free, e.g., Crystal Lite™, low sugar varieties), incl. made from concentrate or frozen or powdered; Juice, sweetened, any kind of fruit juice; Juice, unsweetened, any kind of fruit juice; How often do you have drink or juice with added vitamin C; How often do you have juice with added calcium and vitamin D; Pop, regular, any kind, incl. energy drinks; Pop, diet, any kind, incl. diet energy drinks; Tea, any hot tea; Coffee; Water
Alcohol (3)	Hard Liquor incl. tequila, rum, whiskey, or gin; Beer, any kind incl. coolers; Wine red or white

based on local culture and eating habits. There are a large variety of beverages consumed by this population. Some beverages are fortified and, therefore, have different nutrient values. To construct a valid food composition database for the analysis of the QFFQ, we need to know which specific kind of beverage is frequently consumed and how many respondents reported consuming this specific kind of beverage. Therefore, we asked how often the respondents had beverages that are fortified with additional nutrients such as calcium and vitamin D.

There are limitations in our study. We characterized the diet in Inuvialuit using a single 24-hour recall survey in one season, however, the pilot QFFQ study and our formative work included foods consumed throughout the year. The QFFQ was developed based on recalls collected in two Inuvialuit communities and the sample may not be representative of all Inuvialuit in Canada. However, our sampling frame was stratified by gender and age group to ensure we included respondents who consumed a range of foods and were from a variety of economic circumstances.

We did not collect data on plants other than berries, although some other plants could have been considered traditional. No plants or algae were reported in the recalls.

To conclude, this study has highlighted foods for a nutritional intervention program to improve dietary intake in Inuvialuit. Nutrient-dense TF, fruits and vegetables will be promoted and healthy alternatives to high-fat, high-sugar, processed foods and drinks will be encouraged. The QFFQ is culturally appropriate, up-to-date, and is currently being used to evaluate the nutritional intervention program and monitor nutrition transition in Inuvialuit.

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Appendix 2. A sample page of the QFFQ

How often during the last 30 days did you USUALLY eat the following foods?	How much do you usually eat at one time?	Never	1/ last 30 days	2-3 x/ last 30 days	1/wk	2-3 x/wk	4-6 x/wk	Once a day	2 or more x/day
Meats (not incl. soups or stews) Remember to praise respondents! Meat is the amount eaten WITHOUT THE BONE. Mention all Caribou first.									
Caribou, boiled, baked or roasted	___ ZZ*	1	2	3	4	5	6	7	8
Caribou, frozen (raw)	___ ZZ	1	2	3	4	5	6	7	8
Caribou, dried meat	___ YY	1	2	3	4	5	6	7	8
Caribou, fried incl. steak (but not burgers)	___ ZZ	1	2	3	4	5	6	7	8
Caribou, burger	___ M	1	2	3	4	5	6	7	8
Caribou, stir-fried with vegetables	___ "O"	1	2	3	4	5	6	7	8
Caribou, offal incl. liver, heart and kidney	___ P	1	2	3	4	5	6	7	8
Muskox, boiled, baked or roasted	___ ZZ	1	2	3	4	5	6	7	8
Muskox, dried meat	___ YY	1	2	3	4	5	6	7	8
Muskox, fried incl. steak (excluding burger)	___ ZZ	1	2	3	4	5	6	7	8
Muskox, burger	___ M	1	2	3	4	5	6	7	8
Muskox, stir-fried with vegetables	___ "O"	1	2	3	4	5	6	7	8
Moose, boiled, baked or roasted	___ ZZ	1	2	3	4	5	6	7	8
Moose, dried meat	___ YY	1	2	3	4	5	6	7	8
Moose, fried incl. steak (excluding burgers)	___ ZZ	1	2	3	4	5	6	7	8
Moose, burger	___ M	1	2	3	4	5	6	7	8
Moose, stir-fried with vegetables	___ "O"	1	2	3	4	5	6	7	8
Beef burgers patty (not incl. bun – ask patty only)	___ M	1	2	3	4	5	6	7	8
Ground beef or beef ravioli or Hamburger Helper™	___ "O"	1	2	3	4	5	6	7	8
Meat pie incl. Shepherd's pie	___ BB	1	2	3	4	5	6	7	8
Beef steak, fried without vegetables	___ ZZ	1	2	3	4	5	6	7	8
Beef steak, stir-fried with vegetables	___ "O"	1	2	3	4	5	6	7	8
Beef jerky	___ YY	1	2	3	4	5	6	7	8
Pork chops, boiled, baked, roasted or fried	___ U	1	2	3	4	5	6	7	8
Polar bear, raw, boiled or roasted	___ ZZ	1	2	3	4	5	6	7	8
Seal meat, boiled	___ E	1	2	3	4	5	6	7	8
Rabbit or musk rat	___ ZZ	1	2	3	4	5	6	7	8
Bacon	___YY	1	2	3	4	5	6	7	8
Ham	___L	1	2	3	4	5	6	7	8
Sausage, hot dogs or wieners	___J	1	2	3	4	5	6	7	8
Lunch meat incl. Klik™ and corned beef	___ LL	1	2	3	4	5	6	7	8
Chicken nuggets	___Z	1	2	3	4	5	6	7	8
Chicken burger	___M	1	2	3	4	5	6	7	8
Chicken, baked, boiled, or roasted	___U	1	2	3	4	5	6	7	8
Chicken wings	___ #	1	2	3	4	5	6	7	8
Chicken drumstick incl. KFC™ baked, breaded or fried	___ #	1	2	3	4	5	6	7	8
Turkey, baked or roasted	___ NWT M	1	2	3	4	5	6	7	8
Wild birds incl. duck, ptarmigan, geese, swan and crane	___ U	1	2	3	4	5	6	7	8
Caribou fat, hard	___ Q	1	2	3	4	5	6	7	8
Eskimo ice cream with caribou fat	___ Q	1	2	3	4	5	6	7	8
Muktuk, raw incl. fermented	___ Q	1	2	3	4	5	6	7	8

* The letters in this column represent different food models

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RÉSUMÉ

Objectifs : 1) Caractériser le régime inuvialuit; 2) déterminer les aliments et les nutriments à cibler par un programme d'intervention nutritionnelle; et 3) élaborer un questionnaire quantitatif sur la fréquence de consommation des produits alimentaires (QQFC) pour évaluer le programme et faire le suivi de la situation nutritionnelle des Inuvialuits des Territoires du Nord-Ouest (T. N.-O.), au Canada.

Méthode : Des feuilles de rappel des aliments ingérés pendant les 24 dernières heures ont été remplies par 101 Inuvialuits de 19 ans et plus vivant dans deux communautés des T. N.-O. Nous avons compilé tous les aliments indiqués sur les feuilles pour les inclure dans le QQFC.

Résultats : Quarante-huit hommes et 53 femmes (âgés en moyenne de 49 et de 45 ans, respectivement) ont rempli une feuille de rappel. L'apport énergétique moyen était de 2 352 kcal pour les hommes et de 1 739 kcal pour les femmes. Les apports quotidiens moyens de nombreux nutriments (dont les fibres alimentaires, le calcium et les vitamines A, C et E et le folate total) étaient très inférieurs aux apports recommandés. Les aliments les plus souvent cités étaient pauvres en nutriments et achetés au magasin. La plupart des aliments traditionnels ont été cités une fois par une personne. Le programme d'intervention a ciblé les deux aliments qui contribuaient le plus à l'apport énergétique, soit « le sucre ajouté au thé et au café » et « les jus et boissons édulcorés ». Nous avons créé un QQFC de 145 questions incorporant 41 aliments traditionnels et 8 catégories de fréquence de consommation.

Conclusion : Cette étude fournit des données sur les apports alimentaires des Inuvialuits qui n'étaient pas disponibles auparavant, et elle indique les nutriments et aliments à cibler par le programme d'intervention. Le QQFC est un outil à jour, adapté à la culture inuvialuite, et on l'utilise actuellement pour évaluer le programme d'intervention Healthy Foods North (qui vise à réduire les facteurs de risque de maladies chroniques liés au régime et au mode de vie des Inuvialuits).

Mots clés : situation nutritionnelle; apports alimentaires et nutritionnels; questionnaire quantitatif sur la fréquence de consommation des produits alimentaires (QQFC); Inuvialuits; intervention nutritionnelle; Territoires du Nord-Ouest (T. N.-O.)

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