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RESEARCH PAPER

Assessment of dietary adequacy in a remote Inuvialuit population

E. Erber,* B. N. Hopping,* L. Beck,† T. Sheehy,‡ E. De Roose§ & S. Sharma**

*Nutrition Research Institute, University of North Carolina at Chapel Hill, Kannapolis, NC, USA
†Northwest Territories and Nunavut Public Health Association, Yellowknife, NWT, Canada
‡School of Food and Nutritional Sciences, University College Cork, Cork, Ireland
§Department of Health and Social Services, Government of the Northwest Territories, Yellowknife, NWT, Canada
**Department of Medicine, University of Alberta, Edmonton, AB, Canada

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Correspondence
S. Sharma, University of Alberta, Department of Medicine, 1-126 Li Ka Shing Centre for Health Research Innovation
Edmonton, AB T6G 2E1, Canada.
Tel.: +1 780 248 1393
Fax: +1 780 248 1611
E-mail: sangitag@ualberta.ca

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Abstract

Background: Traditional foods are rich sources of essential nutrients, but Inuvialuit in the Northwest Territories (NWT), Canada, have been undergoing a nutrition transition, characterised by an increased consumption of non-nutrient-dense foods. The present study aimed to characterise energy, nutrient and food intakes amongst adult Inuvialuit.

Methods: The study collected up to three 24-h dietary recalls on nonconsecutive days for each participant in spring/summer of 2008 in one remote community in the NWT. Recall data were analysed for energy and nutrient intake, dietary adequacy, most commonly reported foods, and food contributors to energy and nutrients.

Results: Participants included 14 men and 50 women (response rate 79%). Median daily energy intake was 9.4 (interquartile range = 5.7) MJ for men and 8.3 (3.6) MJ for women. The majority of adult Inuvialuit did not meet the recommendation for vitamins A [median intake = 344.7 (246.3) μg-RAE in men, 248.9 (213.8) μg-RAE in women], B_6 [0.9 (0.8) mg in men, 1.0 (0.5) mg in women] and E [2.4 (2.1) mg in men, 1.8 (1.0) mg in women], dietary fibre [7.7 (5.7) g in men, 8.7 (4.4) g in women], calcium [779.6 (842.0) mg in men, 610.4 (431.5) mg in women] and total folate [222.6 (57.7) μg in men, 264.6 (127.5) μg in women]. Vitamin D intake was below the recommendation for most women [median intake = 100.0 (119.2) IU]. Traditional foods contributed substantially to protein and iron intake. Juices were the main contributors to energy, carbohydrate and calcium.

Conclusions: The present study revealed an inadequate consumption of essential nutrients in an Inuvialuit population. If these nutrient deficiencies continue, this population will face an increased burden of chronic diseases and malnutrition.

Introduction

Aboriginal populations in Canada are undergoing a rapid socio-cultural change, including transition to a nontraditional diet and a more sedentary lifestyle (Collings, 2000). Historically, Inuvialuit in the Northwest Territories (NWT), Canada, met their dietary requirements through a diet high in nutrient-rich traditional foods from fishing and hunting (Kuhnlein & Receveur, 2007). In recent years, however, this diet has been increasingly substituted with non-nutrient-dense, shop-bought foods, especially amongst younger generations, as a result of a variety of factors, including environmental changes, a lack and high cost of hunting equipment, changing tastes and a loss of

skills associated with hunting and gathering (Blanchet *et al.*, 2000; Curtis *et al.*, 2005). Changes in diet and lifestyle have been linked to a synchronous increase in obesity, as well as other risk factors for chronic diseases. Cancer and heart disease are now the leading causes of death amongst Arctic populations (Lanier & Alberts, 1996; Bjerregaard *et al.*, 2004; NWT Health and Social Services, 2005; Kelly *et al.*, 2008). Aboriginal populations in Canada are experiencing especially high rates of cancers of the oesophagus, nasopharynx, salivary glands, kidney, liver and gallbladder and have the highest mortality of lung cancer in the world (Young & Frank, 1983; Young & Choi, 1985; Lanier & Alberts, 1996; Circumpolar Inuit Cancer Review Working Group *et al.*, 2008). Diabetes affects 6% of Aboriginal people in Canada compared with only 2% in the general population. This disease and its complications are more prevalent amongst Aboriginals than any other ethnic group, and the rates are still increasing (MacMillan *et al.*, 1996; Public Health Agency of Canada, 2003). High rates of obesity and central adiposity may contribute to the disproportionate prevalence of diabetes amongst Canadian Aboriginals (Mokdad Ali *et al.*, 2003; Lazar, 2005).

Poor diet is a known modifiable factor in the prevention and treatment of obesity and other chronic diseases (World Health Organization and Food and Agriculture Organization, 2003; Alberti *et al.*, 2007). If the nutrition transition in the Canadian Arctic continues at this rapid speed, younger generations will become increasingly unfamiliar with the traditional diet. Future generations will, on the one hand, have an excess consumption of energy-dense, nutrient-poor foods, and, on the other hand, be at an extreme risk of undernutrition of essential nutrients, which will ultimately lead to even higher rates of chronic diseases and increased cost of health care. Understanding the current diet in these populations is crucial before appropriately targeted obesity and chronic disease prevention programmes can be implemented. However, dietary data on Inuvialuit in the NWT are limited, especially in remote communities (Collings, 2000). The present study aimed to determine energy and nutrient intakes and corresponding top food contributors, dietary adequacy and the most commonly reported foods amongst adult Inuvialuit.

Materials and methods

Recruitment and data collection

Sampling, recruitment and data collection amongst adult Inuvialuit in the Beaufort Delta Region in the NWT have been described elsewhere (Sharma, 2010). In brief, housing maps were used to randomly select participants from each corner of the community and the community centre to ensure sampling from areas with varied proximity to food shops. The study targeted the main food shopper or the person primarily responsible for food preparation because this person decides which food items are consumed in the household. People <19 years and pregnant breastfeeding women were excluded as a result of their changing dietary requirements. Up to three quantitative 24-h dietary recalls per person were collected on nonconsecutive days (including at least one weekend day) in spring/summer of 2008. A field worker was trained by the Principal Investigator in the administration of the instrument before entering the field.

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, as well as the Beaufort Delta Health and Social Services Authority Ethics Review Committee. The Aurora Research Institute in the NWT licensed the study.

Statistical analysis

All food items, recipes and drinks reported in the 24-h recalls were entered into NUTRIBASE CLINICAL NUTRITION MANAGER, version 7.17 (CyberSoft, Inc., Phoenix, AZ, USA) using Canadian food composition tables to determine daily energy and nutrient intakes. Recipes for traditional dishes were collected in the field (17 recipes for nine dishes). The mean energy and nutrient intake from the 1–3 days of recalls was calculated for each participant first, followed by calculation of the mean intake for the entire study sample. Participants with only one 24-h recall were included in the analysis because their exclusion did not considerably change the mean nutrient intake adjusted for within-person variation, which was calculated using the participants with multiple recalls. No subjects were excluded as no participant reported an extreme mean energy intake of <2.1 MJ or >20.9 MJ.

Daily energy and nutrient intakes in adult Inuvialuit were compared with the appropriate Dietary Reference Intakes (DRIs), Adequate Intakes (AIs) and Recommended Dietary Allowances, for men and women aged ≥19 years (Institute of Medicine, 2005). Dietary adequacy was calculated using the Estimated Average Requirements (EARs) and was determined using the specific EARs for the age groups 19–30, 31–50, 51–70 and >70 years. However, because of the small sample size, the dietary adequacy results for men were collapsed into one group, whilst, for women, they were presented for the collapsed age groups of 19–50 and >50 years. Where an EAR was unavailable, as for dietary fibre, vitamin D and calcium, the AI was used.

Table 1 Daily energy and nutrient intake amongst Inuvialuit adults in the Northwest Territories, Canada [mean (standard deviation, SD) and median (interquartile range, IQR)]

	Men (n = 14)			Women (n = 50)		
	Mean (SD)	Median (IQR)	Dietary reference intake*	Mean (SD)	Median (IQR)	Dietary reference intake*
Energy (MJ)	10.1 (4.4)	9.4 (5.7)	9.2[†]	8.7 (2.9)	8.3 (3.6)	7.5[†]
% of energy from fat	32.7 (10.5)	29.4 (14.3)	20–35[‡]	29.4 (6.6)	28.7 (9.7)	20–35[‡]
% of energy from carbohydrates	46.3 (10.7)	49.3 (15.6)	45–65[‡]	54.1 (8.7)	53.9 (13.9)	45–65[‡]
% of energy from protein	15.3 (5.0)	13.3 (5.3)	10–35[‡]	15.2 (4.3)	15.3 (6.3)	10–35[‡]
Total fat (g)	88.6 (44.5)	80.4 (49.0)	–	66.7 (23.6)	66.2 (26.4)	–
Saturated fat (g)	28.4 (16.4)	24.7 (17.5)	<10% of energy*	22.8 (8.4)	23.0 (9.4)	<10% of energy*
Protein (g)	88.9 (37.5)	80.5 (49.0)	–	78.8 (36.3)	71.5 (34.5)	–
Carbohydrate (g)	272.7 (135.9)	233.8 (183.6)	–	277.7 (108.5)	253.9 (158.4)	–
Total sugars (g)	151.7 (93.1)	151.6 (133.7)	<25% of energy*	148.4 (76.2)	133.7 (84.1)	<25% of energy*
Dietary fibre (g)	7.8 (4.2)	7.7 (5.7)	38[§]	9.5 (4.8)	8.7 (4.4)	25[§]
Monounsaturated fat (g)	30.0 (16.4)	27.5 (10.0)	–	22.2 (9.3)	21.8 (10.4)	–
Polyunsaturated fat (g)	12.6 (6.6)	11.3 (9.2)	–	9.1 (4.1)	9.2 (5.5)	–
Omega-3 fatty acid (g)	1.9 (1.8)	1.4 (1.3)	–	0.8 (0.5)	0.7 (0.5)	–
Omega-6 fatty acid (g)	8.1 (4.0)	7.7 (6.0)	–	5.5 (2.6)	5.1 (4.1)	–
Cholesterol (mg)	391.6 (196.7)	416.0 (378.1)	As low as possible	302.5 (159.8)	246.9 (213.6)	As low as possible
Vitamin A (μg-RAE**)	383.1 (220.9)	344.7 (246.3)	900[¶]	314.0 (232.8)	248.9 (218.3)	700[¶]
Thiamin (mg)	1.3 (0.5)	1.0 (0.8)	1.2[¶]	1.4 (0.6)	1.2 (0.5)	1.1[¶]
Riboflavin (mg)	2.5 (1.0)	2.3 (1.7)	1.3[¶]	2.2 (0.8)	2.1 (1.1)	1.1[¶]
Niacin (mg)	18.4 (8.9)	16.5 (13.6)	16[¶]	18.4 (7.6)	17.2 (8.3)	14[¶]
Vitamin B_6 (mg)	1.1 (0.6)	0.9 (0.8)	1.3[¶]	1.1 (0.5)	1.0 (0.5)	1.3[¶]
Vitamin B_{12} (μg)	8.8 (12.5)	4.6 (7.8)	2.4[¶]	5.9 (6.3)	4.3 (3.3)	2.4[¶]
Vitamin C (mg)	147.5 (120.6)	154.2 (225.9)	90[¶]	114.6 (115.3)	77.9 (120.4)	75[¶]
Vitamin D (IU)[††]	306.0 (283.0)	271.0 (268.6)	200[§]	121.3 (106.2)	100.0 (119.2)	200[§]
Vitamin E (mg)[‡‡]	2.6 (1.5)	2.4 (2.1)	15[¶]	2.0 (1.2)	1.8 (1.0)	15[¶]
Total folate (μg-DFE[§§])	252.2 (101.3)	222.6 (57.7)	400[¶]	272.8 (114.8)	264.6 (127.5)	400[¶]
Calcium (mg)	790.8 (454.6)	779.6 (842.0)	1000[§]	656.0 (326.3)	610.4 (431.5)	1000[§]
Iron (mg)	14.0 (4.9)	13.5 (6.3)	8[¶]	14.1 (6.4)	12.7 (6.8)	18[¶]
Zinc (mg)	10.4 (4.5)	8.5 (5.2)	11[¶]	12.6 (23.3)	9.1 (6.3)	8[¶]

*The Dietary Reference Intakes are presented using Adequate Intake, Recommended Dietary Allowance, Acceptable Macronutrient Distribution Ranges and recommendations on sugar and saturated fat intake for men and women aged 19–50 years (Joint WHO/FAO Expert Consultation, 2003; Institute of Medicine of the National Academies, 2005).

[†]Estimated energy required to maintain energy balance for men and women 31–50 years at the very low physical activity-sedentary level; 1 MJ = 238.8 kcal.

[‡]Acceptable Macronutrient Distribution Ranges.

[§]Adequate Intake.

[¶]Recommended Dietary Allowance.

**RAE, retinol activity equivalents.

[††]As cholecalciferol in the absence of adequate exposure to sunlight.

[‡‡]As α-tocopherol.

[§§]DFE, dietary folate equivalent.

The percentage contribution of reported foods to energy and the macronutrients, as well as dietary fibre, calcium and iron, and other nutrients of concern in current Arctic research (Sharma *et al.*, 2009), was determined using NUTRIBASE CLINICAL NUTRITION MANAGER. The percentages of similar food items (e.g. all dishes containing caribou, different flavours of carbonated drinks or different brands of sweetened drinks) were combined.

Dietary adequacy and descriptive statistics were calculated using SAS statistical software, version 9.1 (SAS Institute, Inc., Cary, NC, USA).

Results

Fourteen men [mean (SD) age: 46 (13) years] and 50 women [mean (SD) age: 45 (13) years] completed at least one 24-h recall, two participants finished two 24-h recalls and two participants completed only one 24-h recall. The response rate was 79%.

Nutrient intake

Median daily energy intake was 9.4 (interquartile range = 5.7) MJ for men and 8.3 (3.6) MJ for women (Table 1). The median percentage of energy from fat [29.4% (14.3%) in men and 28.7% (9.7%) in women] and protein [13.3% (5.3%) in men and 15.3% (6.3%) in women] was similar in male and female Inuvialuit adults. Women had a higher percentage of energy from carbohydrate [53.9% (13.9%) compared with 49.3% (15.6%) in men].

Compared with the DRI, low median daily intake of vitamin A [344.7 (246.3) μg in men and 248.9 (218.3) μg in women], vitamin B_6 [0.9 (0.8) mg in men and 1.0 (0.5) mg in women], vitamin E [2.4 (2.1) mg in men and 1.8 (1.0) mg in women] and total folate [222.6 (57.7) μg in men and 264.6 (127.5) μg in women] was observed amongst 61–100% of Inuvialuit men and women (Tables 1 and 2). Even though more than 50% of Inuvialuit adults met the DRI for vitamin C and zinc, there was still a large proportion of participants consuming these nutrients below the recommendations (approximately 45% of men and women for vitamin C and 57% of men for zinc). Most Inuvialuit adults met the DRI for iron.

Median daily consumption of dietary fibre, which was 7.7 (5.7) g in men and 8.7 (4.4) g in women, was below the AI in 100% of men, 100% of women aged ≤50 years and 89% of women >50 years. The median intake of calcium was 779.6 (842.0) mg in men and 610.4 (431.5) mg in women, and 71% of males, 90% of females ≤50 years and 95% of females >50 years did not meet the AI. Amongst men, 43% did not meet the vitamin D requirement, whilst 84% and 100% of women aged ≤50 years and >50 years, respectively, were below the AI.

Table 2 Dietary adequacy amongst adult Inuvialuit in the Northwest Territories, Canada (% below the Dietary Reference Intakes by age group)*

	Men† (*n* = 14)	Women (*n* = 50)	
	≥19 years (*n* = 14)	19–50 years (*n* = 31)	>50 years (*n* = 19)
Dietary fibre (g)‡	100	100	89
Calcium (mg)‡	71	90	95
Total folate (μg-DFE§)¶	86	68	79
Vitamin A (μg-RAE**)¶	93	90	84
Vitamin B_6 (mg)¶	64	61	74
Vitamin C (mg)¶	43	42	47
Vitamin D (IU)‡,††	43	84	100
Vitamin E (mg)‡‡	100	100	100
Iron (mg)¶	7	16	0
Zinc (mg)¶	57	32	21

*Institute of Medicine of the National Academies, 2005; Joint WHO/FAO Expert Consultation, 2003.
†Men were not presented by age group because only three participants were older than 50 years.
‡Adequate Intake used for comparison.
§DFE, dietary folate equivalents.
¶Estimated Average Requirement used for comparison.
**RAE, retinol activity equivalents.
††As cholecalciferol in the absence of adequate exposure to sunlight.
‡‡As α-tocopherol.

Frequency of consumption of traditional versus shop-bought foods

Non-nutrient-dense, shop-bought food items were reported more frequently by participants than traditional foods (data not shown). The most frequently consumed food groups (reported by 100% of participants) were tea and coffee, which was reported 620 times in all 24-h recalls combined, and sugar and syrup, which was reported 589 times. These foods were followed in frequency by butter and margarine, bread, juices and drinks, vegetables, carbonated drinks, starchy foods, potatoes and beef and pork. The most common traditional food groups were caribou/muskox (land mammal)/moose, fish and traditional meat soups and stews, which were only consumed by 52%, 35% and 33% of participants respectively (data not shown). Consumption of wild birds, muktuk (whale skin and fat) and Arctic char (local wild fish) were reported by 30%, 14% and 3%, respectively.

Food sources of energy and selected nutrients

Juice drinks (including sweetened and unsweetened juices and non-alcoholic, non-carbonated drinks) contributed

Table 3 The ten major food sources of energy and selected nutrients amongst adult Inuvialuit in the Northwest Territories, Canada (% contribution)

Foods	Energy	Foods	Total fat	Foods	Protein	Foods	Carbohydrates
Juice	9.2	Butter/margarine/oil/lard	10.7	Caribou/large game¶	14.2	Juice	17.6
Sugar/syrup/honey	8.3	Beef	9.1	Beef	10.8	Sugar/syrup/honey	16.4
Carbonated drinks	6.8	Crisps/popcorn	6.9	Nontraditional seafood‡	10.6	Carbonated drinks	13.6
Bread	6.4	Sweets/desserts**	6.9	Wild birds¶	7.8	Bread	8.3
Sweets/desserts**	5.6	Sausage/lunchmeat	6.8	Pork	6.3	Sweets/desserts**	6.4
Beef	5.0	Eggs	5.5	Chicken	5.1	Rice/pasta	4.3
Rice/pasta	4.3	Nontraditional soup†	4.7	Bread	5.0	Potato	4.3
Crisps/popcorn	4.2	Wild birds¶	4.6	Rice/pasta	4.9	Crisps/popcorn	3.7
Caribou/large game¶	4.1	Bread	4.4	Eggs	4.7	Bannock	3.4
Alcohol	3.7	Rice/pasta	4.0	Sausage/lunchmeat	3.6	Nontraditional soup†	3.2
Total	53.3	Total	63.6	Total	72.9	Total	81.2

¶Denotes traditional food item.
**Including sweets, biscuits, cake and pastries.
†All soups and stews excluding those made with caribou or Arctic char.

Foods	Total sugar	Foods	Dietary fibre	Foods	Calcium	Foods	Iron
Sugar/syrup/honey	28.6	Bread	14.4	Juice	15.7	Caribou/large game¶	16.7
Juice	28.0	Potato	13.0	Bannock	13.7	Wild birds¶	10.9
Carbonated drinks	22.3	Chips/popcorn	10.0	Fluid milk*	11.0	Bread	10.8
Sweets/desserts**	7.0	Fruit	8.6	Cheese	8.5	Cereal	9.0
Fruit	3.0	Vegetables§	7.4	Bread	8.4	Beef	6.9
Fluid milk*	1.9	Rice/pasta	7.0	Evaporated milk	4.9	Rice/pasta	5.5
Yoghurt	1.5	Cereal	6.0	Sweets/desserts**	4.1	Bannock	5.3
Bread	1.1	Caribou/large game¶	5.0	Rice/pasta	3.8	Nontraditional soup†	4.7
Cereal	1.2	Nontraditional soup†	4.8	Yoghurt	3.4	Eggs	3.4
Rice/pasta	0.8	Sweets/desserts	4.7	Coffee	2.8	Nontraditional seafood‡	3.1
Total	95.4	Total	80.9	Total	76.3	Total	76.2

*Fluid milk excluding evaporated and condensed.
¶Denotes traditional food item.
‡All fish excluding Arctic char.
§All vegetables excluding potatoes.
**Including sweets, biscuits, cake and pastries. All soups and stews excluding those made with caribou or Arctic char.

most to total energy intake (9%) (Table 3). The top ten major food source contributors provided more than half of the total energy. Butter, margarine, oil and lard combined were the highest contributors to total fat (11%). Traditional dishes, such as caribou or other large game and wild birds, were amongst the main sources of protein (22%). The main contributors to carbohydrate intake were drinks, which contributed 18% to the total carbohydrate intake, followed by sugar, syrup and honey, which contributed 16% to the total. Combined with carbonated drinks, these three groups contributed a total of 48% to total carbohydrate intake and 79% to total sugar consumption. The top ten contributors of total sugar were mainly non-nutrient-dense food items. The largest source of dietary fibre was bread (14%), whilst the main sources of calcium were juice and bannock (fried bread), contributing 29% combined; the top ten contributors combined pro-

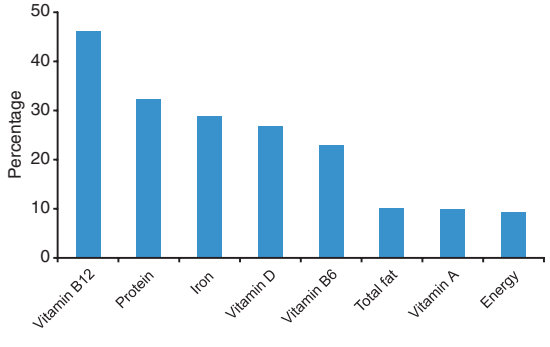

Figure 1 Percentage contribution of traditional foods to daily intake of energy and selected nutrients amongst Inuvialuit adults in the Northwest Territories, Canada. Traditional foods are defined as those obtained through subsistence practices, such as hunting and fishing.

vided 76% of calcium intake. Greater than 76% of total iron intake was derived from a mixture of traditional foods, such as caribou or other large game and wild birds, as well as shop-bought foods (e.g. bread, cereal, eggs). Forty-six percent of vitamin B_{12} was contributed by traditional food items (Fig. 1). Traditional foods also contributed 32% to protein, 29% to iron, 27% to vitamin D, 23% to vitamin B_6, 10% to total fat, 10% to vitamin A and 9% to energy intake.

Discussion

Important aspects of the current diet of Inuvialuit adults are outlined in the present study. Dietary data on Inuvialuit adults are limited, and the present study is therefore an important contribution to the current literature on diet and health amongst this population. The study population reported intakes that were less than the recommended levels for a considerable number of nutrients (e.g. dietary fibre, vitamin A, vitamin B_6, vitamin E, total folate and calcium in both men and women, as well as vitamin D in women). No traditional food items were amongst the ten most frequently consumed foods. Although traditional dishes contributed substantially to protein and iron, only a few traditional items were observed amongst the top ten contributors to energy, total fat and dietary fibre, whilst no traditional food item was amongst the top sources of carbohydrate, sugar or calcium. Conversely, juices were the main contributors to energy, carbohydrate, total sugar and calcium.

Because the literature on Inuvialuit in the NWT is limited, the results reported in the present study will be compared with previous studies amongst similar Aboriginal populations undergoing a nutrition transition, such as Inuit in Nunavut or Native Americans. The transition in diet and lifestyle has led to a decrease in dietary quality and an increase in dietary inadequacies and chronic disease amongst Aboriginal Arctic populations (Thouez *et al.*, 1989; Receveur *et al.*, 1997; Whiting & Mackenzie, 1998). Inadequate intakes of vitamin A and calcium, as observed in the present study, were also reported amongst Inuit women in Nunavik (Blanchet *et al.*, 2000). Previous studies have shown that traditional foods are the major sources of protein, phosphorus, iron, zinc, copper, magnesium, potassium, vitamin A, monounsaturated fats and polyunsaturated fats, whilst convenience foods provide mostly energy, carbohydrate, saturated fat and fibre (Kuhnlein *et al.*, 1996; Receveur *et al.*, 1997; Blanchet *et al.*, 2000). The present study also provides substantial evidence that traditional food items are an important source of vitamin B_6, vitamin B_{12}, protein, iron and vitamin D amongst Inuvialuit, and that efforts need to be made to revitalise the cultural practices of acquisition and hunting of these important foods at the same time as ensuring long-term maintenance of traditional food supplies. A large proportion of non-nutrient dense, shop-bought foods, including coffee, carbonated drinks and bread, were reported amongst Inuvialuit in the present study. These food items were also the core foods found in a study characterising the diets of Native American women (Taylor *et al.*, 2005). This might indicate that Inuvialuit have high expenses on energy-dense, nutrient-poor foods, rather than on their healthy, nutrient-dense alternatives, such as traditional foods. A traditional diet has been shown to reduce diabetes risk, possibly as a result of its generally high levels of omega-3 fatty acids, complex carbohydrates and other nutrients (Lardinois, 1987; Feskens *et al.*, 1991). The present study also highlights the importance of replacing the high contributors of total fat, energy and total sugar, such as butter, margarine, oil and lard, as well as juices and carbonated drinks with healthier alternatives (e.g. cooking spray to reduce added fat when cooking, or 100% fruit juices), and of improving availability and accessibility of nutrient-dense food items amongst Inuvialuit.

The present study is not without limitations. The 24-h recalls were collected between the spring and summer of 2008 and, consequently, did not account for seasonal variability, specifically during the winter months. Furthermore, the present study targeted the main food shopper or the main food preparer in each household, most of whom were women. Therefore, men were under-represented in this sample of Inuvialuit adults; however, the results obtained for male Inuvialuit were still presented for completeness.

This analysis was conducted to supplement a previous study by the same group, which was intended to describe the development of a culturally appropriate food frequency questionnaire using only one 24-h dietary recall per participant (Sharma *et al.*, 2009). The present study is amongst the first to provide essential information on current dietary habits assessed over several days amongst Inuvialuit adults in a remote community and, in particular, to identify the inadequate consumption of several key nutrients (vitamin A, vitamin B_6, vitamin E, dietary fibre, calcium and total folate amongst men and women, as well as vitamin D amongst women), which may help to explain increased rates of chronic disease amongst Inuvialuit populations. The high consumption of non-nutrient-dense foods, such as tea, coffee, sugar, syrup, butter and margarine, as well as the high contribution of non-nutrient-dense foods to energy, total fat, carbohydrates, total sugar and calcium, reveal the need to substitute these food items with nutrient-rich food sources to overcome nutrient deficiencies.

Conflict of interests, source of funding and authorship

The authors declare they have no conflicts of interest. The project was supported by American Diabetes Association Clinical Research award 1-08-CR-57, the Government of the Northwest Territories Department of Health and Social Services, Health Canada, the Public Health Agency of Canada and the Northwest Territories and Nunavut Public Health Association. SS developed the conception and design of the study. EDR oversaw all field activities. EE and BNH contributed to data analysis, and LB was responsible for data collection. All authors were responsible for data interpretation. EE drafted the manuscript, and all authors critically reviewed its content and have approved the final version submitted for publication.

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