Changing dietary patterns in the Canadian Arctic: Frequency of consumption of foods and beverages by Inuit in three Nunavut communities

Tony Sheehy, Fariba Kolahdooz, Cindy Roache, and Sangita Sharma

Abstract

Background. *Inuit in Arctic regions are experiencing a rapid diet and lifestyle transition. There are limited data on food consumption patterns among this unique population, raising concerns about assessing the risk for the development of diet-related chronic diseases.*

Objective. *To assess the current frequency of consumption of foods and beverages among Inuit in Nunavut, Arctic Canada.*

Methods. *A cross-sectional dietary study was conducted among randomly selected Inuit adults from three communities in Nunavut using a validated quantitative food frequency questionnaire. The participants were 175 women and 36 men with median (IQR) ages of 41.0 (32.5–48.5) and 40.1 (30.0–50.0) years, respectively. The mean and median frequencies of consumption over a 30-day period were computed for 147 individual food items and grouped as foods or beverages.*

Results. *The 30 most frequently consumed foods were identified. Non-nutrient-dense foods (i.e., high-fat and high-sugar foods) were the most frequently consumed food group (median intake, 3.4 times/day), followed by grains (2.0 times/day) and traditional meats (1.7 times/day). The frequency of consumption of fruits (0.7 times/day) and vegetables (0.4 times/day) was low. The median values for the three most frequently consumed food items were sugar or honey (once/day), butter (0.71 times/day), and Coffee-mate (0.71 times/day). Apart from water, coffee, and tea, the most frequently consumed beverages were sweetened juices (0.71 times/day) and regular pop (soft drinks) (0.36 times/day).This study showed that non-nutrient-dense foods are consumed most frequently in these Inuit communities.*

Conclusions. *The results have implications for dietary quality and provide useful information on current dietary practices to guide nutritional intervention programs.*

Key words: Food and beverage consumption, food frequency, Inuit, Nunavut

Introduction

Inuit are indigenous peoples who reside in the Arctic regions of the United States, Canada, Russia, and Greenland. Similar to other indigenous populations around the world, Inuit are experiencing a rapid transition in diet and lifestyle characterized by increased consumption of manufactured non-nutrient-dense foods (NNDFs) [1]. This rapid dietary shift presents a significant public health concern for Inuit, as it may be linked to increasing prevalence rates of diet-related chronic diseases, such as type 2 diabetes, heart and circulatory disorders, and cancers [2–6]. These diseases affect the life expectancy and quality of life of individuals living in these communities [7] and may have important implications for the costs associated with providing health services and treatment for such remote jurisdictions. Nunavut is the easternmost of three territories in Arctic Canada and consists of 25 remote communities dispersed over an approximate area of 2 million square kilometers [8]. In 2007, the age-standardized rate of cancer incidence (per 100,000 people) was 395 in Nunavut [9]. Obesity rates have also increased significantly in Nunavut; according to current statistics, the age-standardized rates of overweight and obesity in Nunavut were 36% and 28%, respectively [10].

Nutritional and lifestyle intervention programs are

Tony Sheehy is affiliated with University College Cork, Cork, Republic of Ireland; Fariba Kolahdooz, Cindy Roache, and Sangita Sharma are affiliated with Aboriginal and Global Health Research Group, Faculty of Medicine & Dentistry, Department of Medicine, University of Alberta, Edmonton, Alberta, Canada.

Please direct queries to the corresponding author: Sangita Sharma, Centennial Professor, Endowed Chair in Aboriginal Health, Professor in Aboriginal and Global Health Research, Aboriginal and Global Health Research Group, Faculty of Medicine & Dentistry, Department of Medicine, University of Alberta, Unit 5-10 University Terrace, 8303 112 St. Edmonton, AB T6G 2T4, Canada; e-mail: gita.sharma@ualberta.ca.

needed to improve dietary quality and reduce risk factors for obesity and other chronic diseases among Inuit populations. In a previous study, it was shown that intakes of dietary fiber, vitamins A, D, and E, and calcium were inadequate among this population group [11]. However, more data on food consumption patterns in this unique population are needed to guide interventions that can improve dietary quality. To address dietary inadequacies and promote healthy eating and lifestyles in this population, a culturally appropriate, community-based nutrition and lifestyle intervention program called Healthy Foods North (HFN) was designed and implemented in several communities in the Northwest Territories and Nunavut [12–14]. Further investigations of food consumption patterns could provide additional insights into the foods and beverages that are currently being consumed most frequently by Inuit, which would help to inform and sharpen the focus of nutritional intervention programs aimed to reduce the rates of chronic disease and obesity [15]. Frequency of food consumption should be considered a priority area of research to prevent and reduce diet-related chronic diseases [2, 16–18].

Previously, a culturally appropriate, quantitative food frequency questionnaire (QFFQ) was developed and validated specifically for Inuit in Nunavut [14]. The aims of this study were to assess the frequency of food and beverage consumption by an Inuit population in three remote communities in Nunavut using a validated QFFQ developed specifically for the target population. We aimed to identify foods and beverages that are frequently or infrequently consumed and to collect data on consumption of traditional and store-bought meats. Baseline data on frequency of food consumption are useful to monitor changes in frequency over time and may be used for future food and health policy and planning decision-making.

Methods

Study design

This was a cross-sectional study that used a culturally appropriate, validated quantitative food frequency questionnaire (QFFQ) [19] to collect dietary intake data in three remote communities in Nunavut, Canada. Data on demographic features and socioeconomic status of the participants were also collected. A survey was also conducted to obtain anthropometric information on height and weight in order to calculate body mass index (BMI).

Setting

Nunavut (Inuktitut for "our land") is one of three territories in northern Canada. It is located above the tree line, with few plant-based foods [20]. The territory has 25 communities with populations ranging from 150 to 6,000 and has the youngest population in Canada, with a median age of 23.1 years; 53% of the population is 24 years of age or less [21]. Approximately 85% of the population of Nunavut is Inuit [20]. The majority of foods are obtained from hunting, fishing or from local food stores in each community. The stores' food supplies are provided by air freight year round or by barge or sealift during a small window of time in the summer months when the sea ice melts and weather conditions allow delivery [22].

The three communities selected for this study represent a variety of socioeconomic status levels, geographic locations (degree of remoteness), and acculturation levels. The characteristics of each community have been reported elsewhere [15]. In brief, the populations ranged from approximately 800 to 1,500, with Inuit representing 79% to 93% of the community population (**table 1**). The median household income in each community varied between CAD $46,000 (US$46,920) and CAD $72,000 (US$73,440), with the employment rate varying between 40% and 64% [15].

Sampling

Households were randomly selected in the three communities with the use of government housing maps. Subjects were chosen to participate in the study if they were self-identified Inuit adults aged 19 years or older, had lived in the community for at least 6 months, and were the main food preparers and shoppers for the household. The total numbers of participants were 175 women and 36 men, with median (IQR) ages of 41.0 (32.5–48.5) and 40.1 (30.0–50.0) years, respectively. The response rate was between 69% and 93%, depending on the community sampled. Pregnant and breastfeeding women were excluded because of their different nutritional requirements, changes in dietary habits, and energy expenditure.

Data collection

Data collection occurred between July 2007 and July 2008. The main food preparer and shopper from each randomly selected household was invited to be interviewed. If a participant agreed to do the interview at that time, it was conducted immediately. If the participant preferred to wait, the interview was scheduled for a later time. Participants were contacted up to seven times; if they were still unavailable, the interviewers moved on to the next household on the list. Participants were informed of the objectives of the study and were asked to sign a consent form prior to the start of the interview. An interviewer fluent in the local language or an interpreter was used for participants whose primary language was not English. Upon completion of

TABLE 1. Demographics of three Inuit communities in Nunavut and characteristics of the study participants

Variable	Community A	Community B	Community C
Community demographics			
Population (no.)[a]	> 1,000	< 1,000	≤ 1,000
Inuit population (%)	79	91	93
Median age (yr)	26	20	20
Median family income for all households (CAD)[b]	72,000	46,000	58,000
Employment rate (%)	64	40	44
No. of grocery stores	2	2	2
Participant characteristics			
No. of respondents	71	74	66
Response rate (%)	74	69	93
Sex (%)			
Male	30	9	12
Female	70	91	88
Mean ± SD age (yr)	42 ± 13	40 ± 17	40 ± 10
Mean ± SD BMI (kg/m^2)	29.4 ± 7.4	29.4 ± 8.1	30.8 ± 7.7
BMI (%)			
Normal (≤ 24.99 kg/m^2)	28.2	33.9	22.9
Overweight (25.0–29.9 kg/m^2)	26.9	23.1	34.3
Obese (≥ 30 kg/m^2)	44.9	43.1	42.9

Source: Statistics Canada [10], Sharma [12].
a. Values are rounded to protect the communities' identities.
b. CAD$1 = US$1.02 as of 7 September 2011.

each interview, the participants were given a CAD$25 (US$25.5) gift certificate for a local store to thank them for their time.

Ethical approval

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. The Nunavut Research Institute licensed the study.

Food consumption and the QFFQ

The QFFQ, which was developed specifically for Inuit in Nunavut to measure the consumption of all foods and beverages in the previous 30 days, has been described elsewhere [13, 14]. In brief, the QFFQ contained 150 items and had eight frequency categories that ranged from "never" to "two times a day or more." The QFFQ was validated against three 24-hour recalls and showed good agreement [23]. The highest correlation between the tools for macro- and micronutrients were 0.71 (carbohydrates) and 0.66 (vitamin C), respectively. Eighty-three percent of macronutrient intake estimations and 77% of micronutrient intake estimations from the QFFQ and recalls were placed in the same or adjacent quartiles [23]. The collection of QFFQ data was also described elsewhere [12, 24]. Briefly, data collectors were trained by the principal investigator for 5 days on how to interview and record responses. The respondents were asked about foods they consumed and how frequently they had consumed them in the past 30 days. All data were examined by the project coordinator, and if any set of data was incomplete, the interviewer re-contacted the respondent for the missing information.

Data analysis

The mean, standard deviation, and median of frequency of consumption (reported as times/day), were determined for individual foods and beverages. The frequency categories on the QFFQ were converted to times/day. For example, "never" was converted to 0 times/day, "once/month" to 0.03 times/day, "once/week" to 0.14 times/day, and "two or more times/day" to 2 times/day. All statistical analyses were performed with SAS statistical software.

Results

The demographics and characteristics of the participants are presented in **table 1**. Ninety-six, 107, and 71 participants were chosen to participate in the study in communities A, B, and C, respectively, and the response rates achieved were 74%, 69%, and 93%. The data presented are for 175 women and 36 men, with median (IQR) ages of 41.0 (32.5–48.5) and 40.1 (30–50)

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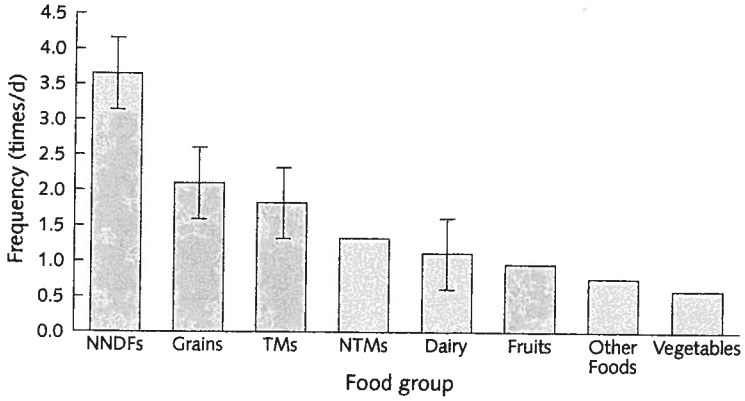

FIG. 1. Mean (SD) frequency of consumption of food groups by Inuit adults in Nunavut. NNDFs, non-nutrient-dense foods; NTMs, non-traditional meats; TMs, traditional meats

years, respectively. The mean (SD) BMI for participants from communities A, B, and C was 29.4 (7.4), 29.4 (8.1), and 30.8 (7.7) kg/m^2, respectively. Approximately one-third of the participants were within the normal range for BMI.

Figure 1 shows the mean (SD) frequency of consumption of foods by participants across all three communities, grouped according to the food categories listed in the QFFQ. The individual food items that made up each category are shown in the **appendix**. The most frequently consumed food group was NNDFs (3.4 times per day), followed by grains and traditional meats (2.0 and 1.7 times/day, respectively). Nontraditional meats, dairy products, fruits, and vegetables were less frequently consumed; for these food groups, the median frequencies of consumption were 1.1, 1.1, 0.7, and 0.4 times/day, respectively. There was no significant difference in frequency of consumption of food groups between participants 45 years of age or older compared with those under 45 years of age (data not shown).

The mean (SD), median, and IQR for frequency of consumption of the 30 most frequently consumed food items by participants from the three communities are shown in **table 2**. Based on medians, the three most frequently consumed foods were sugar or honey (once/day), butter (0.71 times/day), and Coffee-mate (0.71 times/day). White bread and rice were the most frequently consumed grain foods (both at 0.36 times/day). Whole wheat bread was consumed less frequently than white bread (0.03 vs. 0.36 times/day). There was a high frequency of consumption of biscuits (all types), and potato chips (both 0.14 times/day). However, among fruits and vegetables, only frozen vegetables, bananas, oranges, and apples ranked among the top 30 foods in frequency of consumption (median frequency, 0.08 times/day or less). The most frequently consumed traditional meat was caribou (boiled, baked, or roasted) (0.14 times/day), followed by raw caribou (0.08 times/day), caribou soup or stew (0.08 times/day), and caribou, dried (0.03 times/day). Arctic char, raw, was the most frequently consumed traditional fish (0.08 times/day).

Table 3 shows the mean (SD) and median (IQR) frequency of consumption of beverages by participants from the three communities. Water, tea, and coffee were the most frequently consumed beverages (median intake, once/day), followed by high-sugar, high-calorie beverages (sweetened juice, regular pop [soft drinks], and unsweetened juice). Sugar-free juices and diet pop were consumed very infrequently.

Conclusions

This study adds to the growing body of knowledge on the changing patterns of food consumption that are taking place among Inuit in the Canadian high Arctic [25–27] by presenting data on frequency of consumption of foods and beverages for an Inuit population in three remote, isolated communities in Nunavut in the Canadian Arctic. The data revealed a prevailing food consumption practice that is consistent with previous findings in similar populations [11, 12, 28–30] whereby NNDFs were most frequently consumed. This finding is a cause for concern, as a high frequency of consumption of energy-dense, nutrient-poor foods is associated with increased risks of obesity, metabolic syndrome, and other chronic diseases [31, 32].

Despite the wide range of traditional meats consumed by Inuit that appear on this QFFQ (including caribou, polar bear, seal, muktuk [whale skin and blubber], muskox, Arctic char, trout, goose, and ptarmigan), it was notable that only caribou and Arctic char ranked among the 30 most frequently consumed food items (**table 2**), probably due to seasonality. Traditional meats are nutrient-dense foods that contribute significantly to the intake of essential nutrients, such as protein,

TABLE 2. Frequency of consumption (times/day) of the 30 most consumed foods by Inuit adults in three communities in Nunavut

Food	Frequency of consumption (times/day)			
	Mean	SD	Median	Q1–Q3
Sugar or honey[a]	0.66	0.54	1.00	0.00–1.00
Butter, all brands[a]	0.74	0.50	0.71	0.36–1.00
Coffee–mate, regular[a]	0.55	0.50	0.71	0.00–1.00
White bread[b,c]	0.53	0.46	0.36	0.14–0.71
Rice, any[b]	0.32	0.30	0.36	0.08–0.36
Biscuits, all types[a]	0.29	0.32	0.14	0.03–0.36
Potato chips[a]	0.25	0.29	0.14	0.03–0.36
Chicken or duck eggs[d]	0.24	0.28	0.14	0.03–0.36
Caribou, boiled, baked, or roasted[e]	0.23	0.25	0.14	0.03–0.36
Hard cheese[d]	0.23	0.32	0.14	0.03–0.36
2% skimmed milk[d]	0.27	0.35	0.08	0.00–0.38
Bannock, fried[b]	0.23	0.31	0.08	0.03–0.36
Frozen vegetables, including mixed[f]	0.19	0.26	0.08	0.00–0.36
Banana[g]	0.18	0.20	0.08	0.03–0.36
Caribou, raw[e]	0.17	0.22	0.08	0.00–0.36
Caribou, soup or stew[e]	0.16	0.18	0.08	0.03–0.36
Hash brown potato[h]	0.16	0.22	0.08	0.00–0.36
Char, raw[e]	0.16	0.22	0.08	0.00–0.36
Orange[g]	0.15	0.18	0.08	0.00–0.14
Apple[g]	0.15	0.19	0.08	0.00–0.14
Char, dried[e]	0.15	0.22	0.08	0.00–0.14
Noodles[b]	0.13	0.19	0.08	0.00–0.14
Whole wheat bread[b]	0.22	0.33	0.03	0.00–0.36
Jam, all kinds[a]	0.15	0.24	0.03	0.00–0.14
Caribou, dried[e]	0.14	0.22	0.03	0.00–0.14
Cream crackers[a]	0.13	0.20	0.03	0.00–0.14
Bacon, fried[i]	0.13	0.21	0.03	0.00–0.14
Low-sugar cereals[b,j]	0.14	0.23	0.00	0.00–0.14
Sweet cereals[b,k]	0.12	0.22	0.00	0.00–0.14
Milk, or Carnation cream, half fat[d]	0.11	0.28	0.00	0.00–0.00

a. Non-nutrient-dense foods (NNDFs).
b. Grains.
c. Including toast, sandwiches, rolls and bagels.
d. Dairy (+ eggs).
e. Traditional meats.
f. Vegetables.
g. Fruits.
h. Other foods.
i. Nontraditional meats.
j. Including corn flakes, rice krispies and cheerios.
k. Including frosted flakes or honey nut cheerios.

iron, and vitamins B_{12}, A, and D [11, 33]. Such foods are vital to dietary quality and health for Inuit populations. Traditional food consumption has been shown to be associated with improved glucose tolerance, insulin secretion, and insulin receptor sensitivity, which may reduce the risk of diabetes [5, 34–36]. Traditional foods consumed by Arctic populations have also been shown to be associated with reductions in other risk factors for obesity, diabetes, and cardiovascular disease [29, 37]. In addition, traditional food consumption is associated with a lower risk of food insecurity, emphasizing the importance of access to local foods [26]. Thus, the promotion of traditional food consumption among Inuit is necessary not only as a fundamental cultural value for food-sharing networks and social bonds among Inuit peoples, but also to improve dietary quality, reduce the risk of chronic disease, and reduce the prevalence of food insecurity among Inuit households [11, 24, 26].

This study has focused on the frequency of foods consumed among Inuit in Nunavut, Arctic Canada. Assessing the frequency of consumption of foods specifically for this study population is important, not

TABLE 3. Frequency of consumption (times/day) of beverages by Inuit adults in three communities in Nunavut

Beverage	Frequency of consumption (times/day)			
	Mean	SD	Median	Q25–Q75
Water	0.88	0.53	1.00	0.36–1.00
Coffee	0.75	0.49	1.00	0.36–1.00
Tea, any hot tea	0.70	0.57	1.00	0.08–1.00
Sweetened juice, with added sugar	0.63	0.56	0.71	0.08–1.00
Regular pop (soft drink)	0.41	0.39	0.36	0.08–0.71
Unsweetened juice	0.19	0.34	0.00	0.00–0.36
Sugar-free juice	0.07	0.24	0.00	0.00–0.00
Diet pop (soft drink)	0.05	0.16	0.00	0.00–0.00

only for documenting changing consumption patterns but also for accurate assessment of dietary intake and quality. Although a variety of risk factors for obesity and nutrition-related chronic disease exist among Inuit, dietary intake does play a significant role [38, 39]. Rapidly increasing rates of obesity in these populations could be at least partly related to high intakes of less nutritious but less expensive food items such as high-sugar and high-calorie foods. This highlights the urgent need for nutritional intervention programs as strategies for preventing chronic disease. Promotion of greater consumption of traditional foods and less frequent consumption of energy-dense, nutrient-poor foods may help reduce the increasing burden of chronic disease in these communities and mitigate the negative health impacts of household food insecurity [26].

A major strength of this study is the fact that the QFFQ used for assessing the frequency of daily consumption was developed specifically for this Inuit population; thus, it contained the complete list of foods commonly consumed in this group. However, the study also has some limitations. The average age of the participants was about 42 years, and the majority were female, 81% between the ages of 19 and 30, with some 90% of the population being under 60 years of age. These factors limit the generalizability of the results to the entire community. In addition, the study did not account for seasonal variability during the fall and winter months, as the 24-hour recalls were collected during the spring and summer months. There may also be recall bias among participants when reporting foods and beverages consumed in the last 30 days at the time of being questioned. Finally, it should be acknowledged that data collected in these three communities in Nunavut (whose populations ranged from 800 to 1,500) might not be generalizable to all Inuit populations and to those communities with fewer than 800 or more than 1,500 residents, which were not included in this study.

Conflicts of interest

The authors declare they have no conflicts of interest.

Authors' contributions

Sangita Sharma developed the design of the study; Tony Sheehy reviewed the literature, contributed to data analysis, and drafted the manuscript; Fariba Kolahdooz contributed to data analysis and reviewing and editing of the manuscript; Cindy Roache oversaw all field activities. All authors were responsible for data interpretation, critically reviewed the manuscript, and approved the final version for submission for publication.

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Appendix

Food items that contributed to each food group on a culturally appropriate, validated, quantitative food-frequency questionnaire (QFFQ) used for measuring food consumption by Inuit adults in Nunavut

Food or food group	Items on QFFQ
Fruits	Dried fruits, including raisins; apple; orange; banana; mango; grapes; strawberries; kiwi; berries; peaches and nectarines; any fruit, canned in syrup; fruit salad, fresh; frozen fruit
Vegetables	Corn on the cob; corn; carrot eaten alone; canned tomatoes; frozen vegetables, including mixed; canned vegetables, any; fresh vegetables; salad
Grains	Bannock, fried; bannock, baked; white bread; whole wheat bread; pancakes, waffles, all kinds; homemade porridge; Quaker oats or porridge in package; sweet cereals; low-sugar cereals; noodles; macaroni and cheese or Kraft dinner; rice, any
Nontraditional meats	Beef steak; beef, hamburger; meat pie; sloppy joe; pork or beef rib; pork chops; pork roast; chicken wings; chicken legs, fried, including KFC; chicken legs, boiled, baked, or roasted; chicken breast, fried, including KFC; chicken breast, boiled, baked, or roasted; chicken nugget or popcorn chicken; salami, bologna; Klik or other canned meat; beef jerky; spaghetti, with ground beef or ravioli; pepperoni; ham; hot dog, wieners, or sausages; bacon, fried; beef stew, homemade or canned; stir fry beef
Traditional meats	Polar bear, boiled; seal, liver; seal, cooked; seal, fermented, hard; seal flipper; seal, raw, not including liver; muktuk; muskox, fat; muskox, boiled; muskox, fried; bone marrow; any heart, any kidney; any liver, not including seal; caribou, boiled, baked, or roasted; caribou, raw; caribou, dried; caribou, aged; caribou, fried, not including stir fry; caribou, hard, fat; caribou, soup or stew; caribou, stir fry; any stomach, any intestine; char, raw; trout, raw; char, smoked; char, boiled; trout, boiled or baked; char, dried; trout, dried; white fish, raw; white fish, dried; fish, battered and/or fried; fish, baked; small fish head; medium fish head; large fish head; shrimp; baby clams; goose, baked; ptarmigan; char or clam chowder
Dairy (+ eggs)	1% skimmed milk; 2% skimmed milk, whole milk; milk, or Carnation cream, half fat; chicken, duck eggs; goose eggs; swan eggs; hard cheese; cream cheese; yogurt; milk shake; soy milk
Non-nutrient-dense-foods (NNDFs)	Butter; jam; ice cream; any cake, or muffin; pie, blueberry, apple, cherry; cheesecake; chocolate bar; potato chips or french fries; biscuits, any kind; cream crackers; Ritz crackers; cookies; hard candy; popcorn; granola bars; Coffee-mate, regular; artificial sweetener; sugar, honey; salad dressing; pizza
Beverages	Regular pop (soft drinks); diet pop (soft drinks); tea (any hot tea); coffee; sweetened juice (with added sugar); sugar-free juice (no added sugar but may contain artificial sweetener); unsweetened juice (no added sugar or artificial sweetener); water
Other foods	Soup, mushroom; vegetable soup; hash brown potato; potato salad; potato, baked or boiled; mashed potato, including instant; peanut butter; cashews; gravy; tomato vegetable juice