Nutritional Epidemiology

Dietary Intakes Vary with Age among Eskimo Adults of Northwest Alaska in the GOCADAN Study, 2000–2003[1–3]

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ABSTRACT Dietary factors influence the development of cardiovascular disease (CVD). The diet of Alaskan Eskimos differs from that of other populations. We surveyed Eskimo adults in Northwest Alaska to document their usual dietary intakes, differences based on gender and age, and sources of selected nutrients, and to generate appropriate dietary advice to reduce CVD. Interviewers surveyed 850 men and women 17–92 y old, using a quantitative food-frequency instrument. We observed many significant (χ^2 analysis $P < 0.05$) differences in nutrient intakes among 3 age-groups. Energy intake from carbohydrate was negatively related to participant age-group ($P \le 0.01$). Energy intake from all fats ($P < 0.001$) and polyunsaturated fat ($P \le 0.01$) was positively related to age-group among both men and women in contrast to other studies in which age differences were either not observed or decreased with age. Native foods were major sources of monounsaturated and polyunsaturated fats, including 56% of (n-3) fatty acids primarily from seal oil and salmon. However, Native foods contributed significantly less to the diets of young adults than to those of elders, especially among women. Store-bought foods were the main sources of energy, carbohydrate, fat, saturated fat, and fiber for all adults. Based on their nutrient density and potential to inhibit CVD, continued consumption of traditional foods is recommended. Variations in intake by age may portend changing eating patterns that will influence CVD as participants age. These data will contribute to understanding dietary risk factors for cardiovascular disease in this population. J. Nutr. 135: 856–862, 2005.

KEY WORDS: • *Alaskan diet* • *cardiovascular disease* • *n-3 fatty acids*

Genetics of Coronary Artery Disease in Alaska Natives (GOCADAN)[5] is a study of the contribution of genetics and environment to cardiovascular disease (CVD) in several villages on Norton Sound. The study is a working partnership with the Norton Sound Health Corporation (NHSC), the tribally owned, nonprofit corporation that provides medical care to people living in the Bering Straits region; MedStar Research Institute (MRI), Cornell Medical Center, and the Southwest Foundation for Biomedical Research (SFBR). This study is one of the largest dietary surveys of Alaskan Eskimos reported to date.

Many diet factors play a role in the development of CVD (1). Dietary intakes of Alaska Natives (AN) differ from those of non-Natives (2). In the 1980s, AN consumed more energy, protein, fat, carbohydrate, iron, vitamin A, and vitamin C but less calcium and 6 times more fish than others in the U.S. population (2). A previous smaller investigation revealed associations between diets of Alaskan Eskimos and blood lipids (3). Much of the variation in the LDL cholesterol/HDL cholesterol ratio was explained by negative coefficients for α-tocopherol, fresh bird, evaporated milk, and cheese and positive coefficients for BMI, syrup, and pizza. Differing energy intakes from macronutrients were described in several studies among Natives of Alaska (2,3), Canada (4,5), and residents of the contiguous 48 states (6,7). CVD risk factors related to diet in Eskimos include the following: lipoproteins (8), obesity (9,10),

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[3] Supplemental Tables 1–3 are available with the online posting of this paper at www.nutrition.org.

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[5] Abbreviations used: AI, adequate intake; AN, Alaska Native; CVD, cardiovascular disease; DRI, dietary reference intakes; GOCADAN, Genetics of Coronary Artery Disease in Alaska Natives; IHD, ischemic heart disease; MUFA, monounsaturated fatty acids.

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diabetes and hypertension (11–13), and glucose intolerance (14). Infrequent salmon and seal oil intake (15) and nonindigenous food consumption (16) among Alaskan Eskimos have been associated with glucose intolerance.

Until 1994–1998, mortality rates for ischemic heart disease (IHD) among AN were lower than those of U.S. whites (17), but unlike the declining rate for U.S. whites, AN rates are relatively constant. Yet IHD rates among Alaskan Eskimos in the Bering Straits Region have been higher than among all other AN regions (18). There are gaps in our knowledge about current CVD rates and dietary intakes in this region. The high prevalence of risk factors (19) and the presence of a traditional lifestyle call for increased descriptive epidemiologic studies of the incidence and prevalence of CVD outcomes and their relation to traditional lifestyle (17).

This study is a step toward identifying current diet-related CVD risk factors among Alaskan Eskimos. We describe here intakes of macronutrients that may affect CVD rates, as well as nutrients whose intake in the AN diet was shown to be atypical, with emphasis on (n-3) fatty acids.

Our objectives were to describe the nutrient intakes of Alaskan Eskimo adults in Northwest Alaska by age and gender to better understand potential dietary contributions to CVD outcomes that also vary with gender; to assess variability by age group to quantify potential dietary changes that could influence CVD outcomes; to identify sources of key nutrients contrasting these results with those of other populations; and to provide dietary recommendations based on existing national recommendations and current intakes to reduce the risk of CVD in the region. Future reports by the GOCADAN team will evaluate the influence of genetics, diet, and other factors on the development of CVD among Alaskan Eskimos. These results may also be used by health care providers.

SUBJECTS AND METHODS

Field methods. The GOCADAN study population includes 7 villages in the Norton Sound region, a largely roadless area of 60,000 km^2 on the northwest coast of Alaska. The regional population of 9000 is predominately Inupiat Eskimo with some Siberian Yupik and Central Yup'ik Eskimos. The villages are >90% native and Nome (pop. 3000), the largest community in the region, is 54% native.

Initially, the investigators explained the study to each village council. With the council's consent, investigators visited every household in the village along with a locally hired resident, who translated if necessary, explaining the study. Individuals ≥ 18 y old were invited to participate. In Nome, the screening staff contacted by personal visit and telephone relatives identified in the village visits who had migrated to Nome and members of a large Inupiaq group who had migrated to Nome during the mid-1900s.

Participants signed the institution's written informed consent form. The study was approved by the Science Advisory Board of the Norton Sound Health Corporation and the Institutional Review Boards of all institutions participating in the study.

The FFQ, which measured consumption in the previous year, was based on an FFQ previously developed for use in the region (20). Results from the original FFQ were validated with 24-h recalls (20) in 1 village ($r = 0.52$, $P < 0.001$ for SFA, 0.39 $P = 0.002$ polyunsaturated fats, 0.37 $P = 0.004$ monounsaturated fats, 0.31 $P = 0.015$ total fats, 0.22 $P = 0.091$ protein and 0.19 $P = 0.143$ carbohydrate). The original FFQ was modified to include foods from the villages being surveyed and more details about specific fats and food preparation. The diet interviews were not conducted during any specific time of the year as in the previous study (21). A total of 97 local and store-bought foods were included. Although this may be a smaller number of foods than are present in other FFQs, it includes the key foods available in small village stores and the major traditional foods. Although no further validation was conducted, the changes help to improve the relevance of the FFQ and minimize respondent burden.

The 20- to 30-min diet interview was conducted at the survey site in each community as part of the 2-h clinical interview, unlike the previous diet interviews that were conducted in homes. The interviewers used 3-dimensional food models in determining amount, frequency, and seasonality of each food eaten. Quality assurance procedures were in place for data collection, data entry, and analysis.

Data analysis. The overall study recruited 1214 people, representing a participation rate of ~72%. Of the first 900 diet interviews completed from November 2000 through September 2003, 850 (370 men, 480 women) were included in this analysis (94%). Individuals who failed to complete the FFQ based on interviewer comments were excluded from further analysis, as were individuals with unlikely energy intakes (<2092 or >33,472 kJ/d). The mean daily intake of portions of each food consumed per person during a year was calculated using Access 2000 and Excel 2000. When portion size was omitted, we assumed "one" standard portion was consumed; for omissions of season (7 records), we assumed consumption to be "all year," except for bird and bird eggs, which we assumed to be eaten during the 10-wk spring season based on reports of other participants.

Nutrient calculations were created with Nutrition Data System for Research (NDS-R), Database Version 4.06_34© 2003 Regents of the University of Minnesota (22). Because this database was used in several Alaskan studies, it contains nutrient information on an expanded number of Alaskan foods. When necessary, we selected specific foods to represent the nutritive content of generic foods on the FFQ [e.g., Chips Ahoy! Chunky Cookies (Kraft Foods) used for "cookies"; rainbow trout for "other fresh or frozen fish"; and beef stew for "stew with mostly meat"]. Nutrient information was not available for 5 Alaskan foods and similar foods were substituted (e.g., whale blubber substituted for "whale oil," duck eggs for "wild bird eggs"). Standard recipes were used for mixed dishes such as stew, soup, and agutuk. Agutuk or Eskimo ice cream is a mixture of berries, sugar and fat. Although other ingredients are often used, such as seal oil or reindeer fat, we used a fruit agutuk recipe that included crowberries and Crisco (J. M. Smucker).

To identify key sources of selected nutrients, the percentage contributed by each food was generated for each person, the group mean determined, and the foods ranked. We determined the proportion of selected nutrients contributed by Native foods by age group within gender. Native foods included wild meats, fish, sea mammals, their fats, wild greens, berries, and agutuk; non-Native foods comprised those purchased at the store. For total (n-3) fatty acids (18:3, 18:4, 20:5, 22:5, and 22:6), key sources were ranked and compared by age group within gender.

Statistical methods. We calculated both the percentage of energy contributed by macronutrients and nutrient density (nutrient/kJ × 1000) for other nutrients. Intakes of nutritional supplements, alcohol, and added salt were not analyzed. Within each gender, the sample was divided into age groups segmenting the population into ~3 generations. Distributions of energy for each gender and age group were analyzed for normality and equality of variance using the Kolmogorov-Smirnov Test and the Levine Statistic, respectively. None of the selected nutrients met both assumptions ($P > 0.05$). After log-transformation, only percentage of energy from *trans* fatty acids met the criteria for using parametric tests. Therefore, the Kruskal-Wallis test for nonparametric distribution was used. Nutrient intakes were analyzed by gender (not shown) and by age-group within gender for statistical differences ($P < 0.05$). Differences between age-group pairs were tested for significance using the Mann-Whitney U test.

RESULTS

Median energy intakes were high relative to those in the general U.S. population (23) (**Tables 1, 2**).[6] Higher energy intakes influence the absolute intake of other nutrients, yet intakes of calcium and fiber were still low compared with recommendations. Median intakes of calcium were less than the Adequate Intake (AI) established by the dietary reference intakes (DRI; 1000 mg/d 19–50 y old, 1,200 mg/d 51–70 y old)

[6] Additional nutrient intakes are included in Supplemental Tables 1 and 2.

TABLE 1

Percentiles of mean daily nutrient intake of Alaskan Eskimo men by age group in Northwest Alaska, 2000–2003[1,2]

	25th Percentile			Median			75th Percentile		
Age range, *y*	17–39	40–60	61–92	17–39	40–60	61–92	17–39	40–60	61–92
Energy, *kJ*	8883	9593	8621	13178	12921	11773	17865	19686	15239
Energy, %									
Protein	12	13	13	15	15	14	17	18	16
Carbohydrate	45	40	40	50[a]	47[b]	49[ab]	56	53	55
Fat	31	33	32	35[b]	38[a]	38[a]	40	45	45
Saturated fat	10	11	10	12[b]	13[a]	13[ab]	14	15	16
Monounsaturated fat	12	12	12	14[a]	14[b]	14[ab]	15	17	17
Polyunsaturated fat	5.2	5.6	5.6	6.4[b]	6.6[b]	7.4[a]	7.7	8.5	8.9
(n-3) Fatty Acids	0.7	0.9	0.9	0.9[b]	1.1[a]	1.4[a]	1.2	1.7	1.8
trans Fatty acids	1.3	1.5	1.5	1.7[b]	2.0[a]	2.2[a]	2.3	2.5	3.1
Nutrient density, *unit/MJ*									
Cholesterol, *mg*	29	34	32	39	41	40	51	51	50
Total dietary fiber, *g*	1.0	1.0	0.9	1.2	1.4	1.2	1.6	1.7	1.9
Total sugars, *g*	12	10	12	16[a]	13[b]	14[ab]	21	18	18
Vitamin B-12, *μg*	0.5	0.6	0.6	0.7[a]	0.8[b]	0.8[ab]	1.0	1.2	1.2
Absolute Intakes, *unit/d*									
(n-3) Fatty acids, *g*	2.0	2.6	2.2	3.0[b]	4.3[a]	4.0[a]	4.6	6.8	6.8
trans Fatty acids, *g*	3.8	4.4	3.8	5.8	6.5	6.6	9.0	10.4	9.9
Cholesterol, *mg*	313	369	358	493	551	471	753	878	735
Dietary fiber, *g*	11	12	10	16	18	14	23	26	21
Vitamin B-12, *μg*	6.3	7.0	6.2	9.1	11.0	9.1	14.3	16.4	14.0
Calcium, *mg*	639	661	622	970	1096	1040	1443	1574	1598
Iron, *mg*	16	17	15	23	24	19	34	37	32

1 Medians in a row with superscripts without a common letter differ, $P < 0.05$.

2 Group 1 (17–39 y) $n = 180$; Group 2 (40–60 y) $n = 144$; Group 3 (61–92 y) $n = 46$.

(24) among all age-gender groups except middle-aged men. Median total fiber intake was also less than the AI recommended for all age-gender groups (men, 38 g/d for 19–50 y, 31 g/d > 50 y; women, 25 g/d 19–50 y, 21 g/d > 50 y) (23). There were relatively few significant differences in absolute nutrient intakes among age groups within gender.

There were more age differences after adjusting for energy. Young adults consumed significantly more energy from carbohydrate than middle-aged adults, and less of their energy from total fats, polyunsaturated fats, (n-3) fatty acids, and *trans*-fats. Similarly, when intakes of young adults were compared with elders, they consumed less fat, polyunsaturated fat, (n-3) fatty acids, and *trans*-fats.

When significant differences among age groups were observed, young adults reported lower intakes than older adults for all nutrients, with the exceptions of energy from carbohydrate and sugar. Yet energy intake was significantly greater among young women compared with middle-aged women. Energy intake among men did not differ between age groups. Thus, the nutrient density of the diet of young adults was lower than that of older adults.

The leading sources of energy, saturated fat, carbohydrate, and sugars were store-bought foods (**Table 3**).[7] Although Native foods contribute 15% of the energy consumed, they contribute disproportionately more protein, fat, monounsaturated fat, polyunsaturated fat, (n-3) fatty acids, vitamin B-12, and iron (**Table 4**). Again there were generational differences in the proportion of nutrients consumed from Native foods (Table 4). Even though younger adults consumed smaller proportions of Native foods (men < 13%, women 10% of energy), young adults still obtained 16–64% of these same nutrients from Native foods.

We examined the food sources of (n-3) fatty acids by age group with similar results; young adults reported that smaller proportions of their (n-3) fatty acids came from Native foods and greater proportions of (n-3) fatty acids from non-Native foods than older adults (**Table 5**). Seal oil and salmon were the major sources of (n-3) fatty acids for all age-gender groups, especially among older men and women.

Among all participants, 64% reported that they ate fried foods more than once a week, most commonly fried in Crisco (39%) or Wesson Oil (Conagra Grocery Products) (27%). Salt was used by 90% of the respondents in cooking and by 88% at the table.

Overall, 29% of the participants met the AHA dietary recommendations (1) for cholesterol (<300 mg/d), 17% for fat (≤30% of total energy), 20% for saturated fat (<10% of energy), and 30% for fiber (≥20 g/d) (25). More women than men met the recommendations for cholesterol (36 vs. 19%), energy from fat (22 vs. 17%), and saturated fat (21 vs. 18%). The only trends with increasing age group in meeting the recommendations were among women, for cholesterol (37, 36, and 30%), saturated fat (22, 24, and 11%), and fiber (25, 26, and 30%).

DISCUSSION

In this investigation of Alaskan Eskimos we found that the proportion of fat consumed was greater and carbohydrate was less with increasing age in both genders. This likely reflects the greater consumption of traditional foods by the elders and more nontraditional foods by the young people. The trend for fat consumption fits the available data for plasma concentrations of (n-3) fatty acids that also increase with age (13).

Several Alaskan studies reported age differences in macronutrient intake. In 1994, investigators in the same region used a 24-h recall and found that energy from carbohydrate de-

7 Sources of additional nutrients are included as Supplemental Table 3.

TABLE 2

Percentiles of mean daily nutrient intake of Alaskan Eskimo women by age group in Northwest Alaska, 2000–2003[1,2]

	25th Percentile			Median			75th Percentile		
Age range, *y*	17–39	40–60	61–92	17–39	40–60	61–92	17–39	40–60	61–92
Energy, *kJ*	8439	6919	7196	11228[a]	9830[b]	9966[ab]	15437	15049	14134
Energy, %									
Protein	11	12	12	14[b]	15[a]	14[ab]	16	17	16
Carbohydrate	44	41	39	50[a]	48[b]	46[b]	56	53	52
Fat	31	32	35	37[c]	39[b]	40[a]	41	43	47
Saturated fat	10	10	12	12[b]	12[b]	13[a]	15	15	16
Monounsaturated fat	12	12	13	14[b]	15[a]	15[a]	16	17	18
Polyunsaturated fat	5.4	5.9	6.1	6.6[b]	7.3[a]	7.7[a]	8.3	9.0	9.1
(n-3) Fatty acids	0.7	0.9	1.0	1.0[b]	1.3[a]	1.4[a]	1.4	1.9	2.1
trans Fatty acids	1.4	1.4	1.5	1.8[b]	1.9[a]	2.1[a]	2.3	2.8	2.8
Nutrient density, *unit/MJ*									
Cholesterol, *mg*	26	30	32	35[b]	37[a]	39[a]	44	47	52
Total dietary fiber, *g*	1.0	1.0	1.1	1.2[b]	1.4[a]	1.4[a]	1.6	1.9	2.0
Total sugars, *g*	13	10	11	17[a]	14[b]	13[b]	21	18	16
Vitamin B-12, *μg*	0.5	0.5	0.6	0.7	0.8	0.8	1.0	1.1	1.1
Absolute intakes, *unit/d*									
(n-3) Fatty acids, *g*	1.7	2.0	2.3	2.8[b]	3.5[ab]	3.4[a]	5.1	5.8	6.5
trans Fatty acids, *g*	3.5	3.1	3.3	5.4	5.2	5.6	8.5	9.2	8.2
Cholesterol, *mg*	259	236	262	369	373	400	555	562	585
Total dietary fiber, *g*	10	10	11	14	14	15	20	20	22
Vitamin B-12, *μg*	4.7	4.7	5.1	7.7	7.7	7.1	11	13	12
Calcium, *mg*	567	430	561	911[a]	693[b]	894[ab]	1357	1188	1435
Iron, *mg*	14	13	14	19	18	18	27	26	25

1 Medians in a row with superscripts without a common letter differ, $P < 0.05$.
2 Group 1 (17–39 y) $n = 214$; Group 2 (40–60 y) $n = 196$; Group 3 (61–92 y) $n = 70$.

TABLE 3

Selected nutrients contributed by key foods consumed by Alaskan Eskimo adults in Northwest Alaska, 2000–2003[1]

Energy	%	Total fat	%	Carbohydrate	%	Protein	%
Soda	5.9	Butter	6.4	Soda	11.4	Chicken	9.4
Rice	3.9	Beef	5.2	Rice	7.1	Caribou[2]	6.3
Pilot bread[3]	3.9	Chicken	4.4	Tang[4]	6.6	Beef	6.1
Pancake	3.7	Crisco[5]	4.3	Pilot bread	6.0	Salmon[2]	4.7
Tang	3.5	Evaporated milk	4.2	Sugar	6.0	Evaporated milk	4.4
Evaporated milk	3.2	Berry agutuk[2]	3.9	Kool-aid[4]	5.4	Chicken eggs	4.2
SFA	%	MUFA	%	PUFA	%	(n-3) Fatty acids	%
Butter	11.0	Beef	6.0	Mayonnaise	8.0	Seal oil[2]	20.0
Evaporated milk	6.9	Seal oil[2]	5.1	Vegetable oil	7.4	Salmon[2]	7.8
Beef	6.1	Butter	5.0	Berry agutuk[2]	6.1	Mayonnaise	6.4
Cheese	5.6	Crisco	5.0	Crisco	5.8	Muktuk[2]	4.7
Creamer	4.0	Chicken	4.5	Chicken	5.4	Smoked king salmon[2]	4.2
Chicken	3.6	Berry agutuk[2]	4.1	Chips	5.2	Other fresh fish[2]	3.9
trans Fatty acids	%	Total sugars	%	Dietary fiber	%	Iron	%
Crisco	11.7	Soda	20.4	Pilot bread	8.0	Tang	8.4
Berry agutuk[2]	10.0	Tang	11.1	Hot cereal	5.2	Cold cereal	7.4
Margarine, stick	8.8	Sugar	10.8	Dark bread	5.1	Pilot bread	6.6
Pancake	8.6	Kool-aid	9.1	White bread	4.8	Caribou[2]	6.1
Butter	8.0	Evaporated milk	4.1	Blueberries[2]	4.6	Rice	5.0
French fried potatoes	6.2	Cake	3.0	Apples	4.5	White bread	4.8

1 Only the six leading sources are shown.
2 Native food.
3 Interbake Foods, Richmond, VA.
4 Kraft Foods, Rye Brook, NY.
5 J.M. Smucker, Orville, OH.

TABLE 4

Median percentage of energy and selected nutrients from native foods consumed by Alaskan Eskimos by age group in Northwest Alaska, 2000–2003[1]

	Men			Women		
Age range, *y*	17–39	40–60	61–92	17–39	40–60	61–92
			%			
Nutrient						
Energy	12.5^{b}	14.1^{a}	16.0^{ab}	10.3^{b}	15.0^{a}	13.8^{a}
Protein	29.1	32.3	34.0	23.0^{b}	29.8^{a}	29.7^{a}
Carbohydrate	2.7^{b}	3.7^{a}	4.6^{a}	2.8^{b}	4.4^{a}	4.4^{a}
Fat	17.4	20.0	21.4	15.5^{b}	20.9^{a}	19.1^{a}
Saturated fat	12.0^{b}	13.4^{ab}	14.8^{a}	10.6^{b}	14.1^{a}	12.5^{ab}
Monounsaturated fat	20.9^{b}	24.6^{a}	23.6^{ab}	18.0^{b}	24.6^{a}	23.3^{a}
Polyunsaturated fat	19.5^{b}	22.5^{a}	21.7^{ab}	16.8^{b}	22.8^{a}	23.0^{a}
(n-3) Fatty acids	55.9^{b}	60.4^{a}	64.0^{a}	52.7^{b}	63.3^{a}	64.5^{a}
trans Fatty acids	8.9	11.2	6.8	8.7	9.4	10.9
Vitamin B-12	63.7	70.9	71.1	54.8^{b}	68.7^{a}	69.8^{a}
Iron	21.9	22.3	24.2	16.4^{b}	23.9^{a}	23.6^{a}

[1] Medians in a row for a gender with superscripts without a common letter differ, $P < 0.05$.

clined with age, and that energy from polyunsaturated fats decreased with age for women but not for men (personal communication, P. Risica, Brown University). In 1992, among Alaskan Eskimos of the region, intakes of energy from fat and saturated fat increased with age for men but not for women (3). In 1987–1988 (2), AN in varying regions consumed less energy from carbohydrate with increased age (men 43 vs. 38%, women 46 vs. 41%). Men consumed more energy from fat with age (37 vs. 41%), but in women these did not differ (37 vs. 38%) (Nobmann, unpublished data).

TABLE 5

Selected sources of (n-3) fatty acids ranked by intake and compared by age group within gender for Alaskan Eskimos in Northwest Alaska, 2000–2003[1]

Men	17–39 y	40–60 y	61–92 y
		%	
Seal oil[2]	13.1^{b}	20.0^{a}	23.3^{a}
Salmon[2]	8.4	9.1	11.7
Mayonnaise	6.8^{a}	6.1^{ab}	4.5^{b}
Muktuk[2]	5.8	4.7	4.6
Chips	5.1^{a}	1.4^{b}	0.4^{c}
Smoked king salmon[2]	4.9	4.1	3.6
Other fresh fish[2]	3.6^{b}	5.2^{a}	4.0^{ab}
Chicken	3.3^{a}	1.7^{b}	1.3^{b}
Butter	3.3	3.6	3.1
Rendered seal blubber[2]	2.6^{b}	3.9^{a}	4.2^{a}
White fish[2]	2.0	2.6	1.7
Pancakes	1.9	2.5	2.9
Evaporated milk	1.4^{b}	1.7^{ab}	3.4^{a}
Women			
Seal oil[2]	19^{b}	24.6^{a}	25.1^{a}
Mayonnaise	7.3^{a}	6.4^{a}	4.5^{b}
Salmon[2]	6.4	7.2	7.2
Smoked king salmon[2]	5.3^{a}	3.5^{b}	2.3^{b}
Chips	5.2^{a}	1.7^{b}	0.6^{c}
Muktuk[2]	4.3	4.1	5.3
Other fresh fish[2]	2.8^{b}	3.5^{a}	5.9^{a}
Butter	2.7^{b}	3.6^{ab}	4.6^{a}
Chicken	2.6^{a}	2.2^{b}	1.5^{c}
Canola oil	2.4	1.9	1.1
Rendered seal blubber[2]	2.3^{b}	5.1^{a}	5.0^{a}
Evaporated milk	1.3^{b}	1.2^{b}	3.1^{a}
Crisco[3]	2.1	3.4	2.7

[1] Values are means. Means in a row with superscripts without a common letter differ, $P < 0.05$.
[2] Native food.
[3] J.M. Smucker, Orville, OH.

The differences in both fat and carbohydrate consumption among age groups are unusual compared with other populations. Among Baffin Island Inuit of Canada, there were no marked differences by age in energy derived from macronutrients in their heavily traditional diet (4). In the United States in general, no age-related trend was apparent among American Indian adults who participated in the Strong Heart Dietary Survey (45–74 y) in 4 states (6), or among NHANES III participants who were primarily Caucasian (7).

AN foods make a considerable contribution to the diet. Similar to our findings of foods consumed, in Western Alaska, Yupik Eskimos ≥ 60 y old ate significantly more seal oil than Eskimos ≤ 30 y old (16). Among Canadian Indigenous Peoples, older adults consumed greater amounts of traditional foods compared with younger adults (4,26) or compared with young children and teenagers (4). These nutrient-dense foods are also valued for their important role in defining and maintaining Eskimo culture and for their economic value in communities where purchased foods are extremely expensive. Of concern is the lower consumption of Native foods among young adults and the greater amounts of carbohydrates, of which 40–60% are sugars. Whether Alaskan Eskimos retain their eating practices from early adulthood through their later years or whether they return to more traditional eating practices as they age is not known.

The proportion of men and women whose fat and cholesterol intakes exceeded the AHA recommendations was high. Similar findings were observed previously (3,20,27). The DRI (23) recommend that a fat intake of up to 35% of energy can fit in a healthy diet. We suggest that traditional sources of fat, such as those in Native foods, are preferable to fats from other sources. Despite higher total fat and cholesterol intakes it is possible that a more traditional diet is associated with less CVD, in the same manner in which traditional foods have been associated with reduced glucose intolerance. It also may be that the active lifestyle associated with traditional food procurement is an important factor.

Although the AHA has not recommended an ideal amount of (n-3) fatty acids for the general public, large-scale epidemiologic studies suggest that people at risk for coronary heart disease benefit from consuming (n-3) fatty acids (28). The DRI recommend both an AI for α-linolenic acid (1.6 g/d for men and 1.1 g/d for women) and an Acceptable Macronutrient Distribution Range of (n-3) fatty acids (α-linolenic acid) (0.6 to 1.2% of energy), of which approximately 10% of the (n-3) fatty acids can be consumed as the longer-chain fatty acids eicosapentaenoic acid and/or docosahexaenoic acids; however, a Tolerable Upper Intake Level for (n-3) fatty acids has not been established (23). The upper boundary for α-linolenic acid (1.2%) represents the highest levels consumed in the form of foods by individuals in North America (23). The values we report are higher than the recommended levels for α-linolenic acid, which is explained in part by the fact that we report the sum of 5 (n-3) fatty-acids. Whether the levels of (n-3) fatty acids in this population are high enough to suppress immune functions or contribute to stroke, or are beneficial in preventing coronary artery disease remains to be investigated.

Pending the results of our further analysis, we propose provisional dietary recommendations that may assist Alaskan Eskimos in making food choices today. They reaffirm previous general dietary recommendations for AN aimed at promoting health and preventing disease (21). We recommend the following: *1*) eating traditional fish, lean meat, and sea mammals rather than meats high in saturated fat; *2*) minimizing intake of foods high in SFA such as butter, and fatty beef, and substituting nonfat evaporated milk for whole evaporated milk; *3*) encouraging cooking without frying or adding solid fats, such as Crisco, which contain undesirable *trans* fatty acids (29); *4*) limiting other sources of *trans* fatty acids, such as stick margarine, and substituting traditional fats for Crisco when making agutuk; *5*) encouraging intake of sea mammals and their oils, which are good sources of monounsaturated (MUFA) and (n-3) fatty acids as well as other nutrients; *6*) when fat is purchased, encourage choosing oils high in monounsaturated fats (e.g., canola or olive) or polyunsaturated fats (corn and safflower oils); *7*) when carbohydrate foods are eaten, encourage whole grains, fruits, and vegetables over white bread and sugars; 100% juices or water over soda and soft drinks; *8*) finally, and of major importance to health, balance intake of energy with output to maintain a healthy body weight. Greater emphasis on reducing saturated fat and *trans* fat from store bought sources could result in reduced coronary risk without affecting the use of Native foods.

There are limitations in this survey. First, by selecting people from the same family and household, the foods consumed may be more similar than what might be observed in a random sample. By selecting only adults for the survey we cannot comment on intakes of children or teenagers whose diets may be the least traditional. The use of FFQs in any survey introduces limitations. The food list may lack precision, e.g., using a recipe for berry agutuk made with sugar and Crisco could explain why we found that 14% of *trans*-fatty acids were derived from Native food (Table 3) where none would be expected. Values for energy appeared to be high. Possible explanations include overestimation of food intake, too many foods on the FFQ, and/or actual greater energy consumption by some participants based on a more active lifestyle or on additional energy expended wearing heavier clothes much of the year. Surveys using FFQs commonly underreport energy (30).

Finally, when interpreting results based on absolute values from a FFQ, caution should be exercised. We did not incorporate any measure of energy expenditure to evaluate the reliability of reported energy intake. Our goal was to include as many participants in the dietary analysis as possible. This wider range of intakes, used elsewhere to eliminate extreme outliers (31), should be useful in evaluating the comparative influence of dietary factors on CVD within our study.

In summary, the dietary data reported here show significant trends with age and gender, quite different from non-Alaskan populations. With further evaluation of CVD outcomes, the data will contribute to a better understanding of dietary risk factors. Following this same population longitudinally will further evaluate changing dietary practices and help to define the role of diet in the etiology and prevention of CVD among Alaskan Eskimos, leading to effective intervention strategies.

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