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Estimated Nutrient Intakes from Food Generally Do Not Meet Dietary Reference Intakes among Adult Members of Pacific Northwest Tribal Nations[1–3]

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Abstract

Diet is influential in the etiology of chronic diseases in many populations including Native Americans. The objective of this report is to present the first comprehensive dietary survey, to our knowledge, of a representative sample of nonpregnant adults from Pacific Northwest tribal nations participating in the Communities Advancing the Studies of Tribal Nations Across the Lifespan (CoASTAL) cohort. Only participants who completed 1–4 d of dietary records and had weights and heights measured in the laboratory were eligible for this analysis (n = 418). Mean nutrient intakes were stratified by gender for the total sample, those with plausibly reported energy intakes (rEI), and those with implausibly rEI. Estimates of nutrient intakes were compared with Dietary Reference Intakes (DRI). Nutrient estimates from NHANES 2001–2002 were used as a reference. Among both men and women, total fat contributed 34–37% of energy intake and saturated fat contributed 11–12% of energy intake. Daily cholesterol intakes ranged from 262 to 442 mg. A majority of men and women were not meeting recommendations for vitamins A, C, and E, magnesium, and sodium. For a majority of the nutrients examined, plausibility resulted in higher mean estimates. The CoASTAL cohort nutrient profile is similar to NHANES 2001–2002, with a majority of DRI recommendations not being met. Adequate dietary intake information may be more important for this population, because Native Americans experience a disproportionate burden for diseases. J. Nutr. 140: 992–998, 2010.

Introduction

Across the United States, there are over 500 federally recognized and 200 unrecognized indigenous communities (1). There is a disproportionate burden for chronic diseases such as cardiovascular disease, cancer, and diabetes in Native Americans and Alaska Natives (2). Diet is influential in the maintenance of health and the etiology of disease (3). Determining the dietary profiles of specific Native communities will be essential to the development of community-specific programming to improve diet and reverse the current chronic disease trends (4,5). Unfortunately, the dietary intake data available to date does not comprehensively cover these heterogeneous population groups. Information on the diets of Native Alaskans (6–10) and Native Americans of the Southwest (11–18), the Plains (15,18), California (19), and the Southeast (20–22) have been previously published.

The current consensus on the diet of select groups of Native Americans and Alaska Natives is that, similar to the general U.S. population (23), they are not meeting the recommendations set for a healthy lifestyle (24). For many of the Native American and Alaska Native communities, intakes of fat, saturated fat, cholesterol, and sodium exceeded dietary guidelines (7,8, 12,13,17–19,21,22). Prolonged excessive intakes of nutrients such as fat, saturated fat, and sodium increase the risk for the development of chronic diseases such as diabetes and heart disease (25–27).

There are no published reports, to our knowledge, about the dietary intakes of a representative sample of people from the Pacific Northwest Tribal Nations (PNwT).[10] This study is a step

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[3] Supplemental Tables 1–3 are available with the online posting of this paper at jn.nutrition.org.
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[10] Abbreviations used: CoASTAL cohort, Communities Advancing the Studies of Tribal Nations Across the Lifespan cohort; DHA, docosahexanoic acid; DRI, Dietary Reference Intake; EPA, eicosapentanoic acid; PNwT, Pacific Northwest Tribal Nations; rEI, reported energy intake; SHS, Strong Heart Study.

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toward filling this void using dietary intake data based on 1–4 d of dietary records collected over 1 y. Our objectives were to describe the nutrient intakes of the Communities Advancing the Studies of Tribal Nations Across the Lifespan (CoASTAL) cohort and compare with the nutrient intakes estimated by NHANES 2001–2002 to determine whether nutrient intakes differ between those individuals classified as having plausible compared with implausible reported energy intakes (rEI), to compare nutrient intakes to current Dietary Reference Intake (DRI) recommendations, and to determine whether accounting for reporting plausibility influences the assessment as to whether a population is meeting dietary recommendations. These results will provide a foundation for nutritional recommendations, policies, and interventions applicable to the people of the PNwT.

Materials and Methods

Sample and participant recruitment. The CoASTAL cohort, from the Pacific northwest coast of Washington state, evolved from the invited collaboration of 1 of the participating Tribal Nations. After conducting the initial feasibility pilot study, the investigators worked with tribal leaders from 3 neighboring Tribal Nations to develop and implement the cohort study in their respective communities. This included working with persons from tribal councils and tribal fisheries, natural resources, and health departments as well as community advisory groups. The process included establishing trusting working relationships; hiring and training tribal members to staff and lead field teams; and maintaining ongoing communication channels for study recruitment, retention, feedback, and education of the cohort.

Individuals aged 6–10 y and ≥18 y were randomly selected from tribal registries for the CoASTAL cohort (n = 646). Enrollment for the 5-y prospective study began in 2005. Data from children and pregnant women were excluded from this report. The sample for this cross-sectional analysis was selected from the 520 women (n = 295) and men (n = 225) participating in the cohort (≥18). Our criteria for inclusion were individuals who completed at least 1 dietary record and had weight and height information collected during their first year (418/520; 80%). The Institutional Review Boards from the University of Maryland and Purdue University approved the study protocol.

Characteristics. At the enrollment visit, participants completed 2 questionnaires: a FFQ and an occupational and environmental neurology questionnaire. For the latter, participants completed questions on education, occupation, occupational exposure, hobbies, home repair, current health status (past 6 mo), personal and family medical history, pharmaceutical history, and environmental exposures. During this visit, participants also received instruction on completing a dietary record and had their heights and weights measured.

Dietary assessment. Nutrient intake was assessed by a FFQ and dietary records. For evaluating attainment of nutrient recommendations, the Institute of Medicine specifies using the information from 24-h dietary recalls, observation, or dietary records (28). The use of a FFQ for this is discouraged due to the fixed variation in the method (29); therefore, data from the dietary records only are reported here. Dietary records were requested every 4 mo as 2 1-d dietary records and 1 2-d dietary record yielding 4 recorded days for 1 y. Respondents were assigned days to record based on the day of their first visit. At least 1 of the assigned days included a weekend day. This approach was designed to capture variation by season and day of the week and reduce respondent fatigue (30). Techniques were used to improve accuracy of the information in the dietary records (31). Trained field coordinators, who were registered Tribal Nation members, instructed the participants in record-keeping techniques, provided a tool kit of measuring devices (e.g. measuring cups and spoons), provided recording materials, and followed-up with phone calls. The field coordinators reviewed all completed dietary records with the participants (e.g. completeness of food entries, portion size estimation, food preparation methods, accuracy of recording data) before the forms were submitted for analysis. Data coding and entry were performed by staff trained in the use of the Nutrition Data System for Research Database version 4.07 (Regents of the University of Minnesota). The intakes from the dietary records were calculated as the mean of the number of days reported. At least 2 d were reported by 148 men (148/175; 85%) and by 214 women (214/243; 88%).

Anthropometric measures. Weight and height were measured by trained field coordinators with the participant wearing lightweight clothing, no shoes, and emptied pockets. Height was measured to the nearest inch using a portable stadiometer (Shorr Infant/Child/Adult Portable Height-Length Measuring Board). Weight was measured on a calibrated electronic scale and recorded to the nearest pound (SECA Digital Floor scale). BMI was calculated using the formula weight (kg)/height $(m)^2$.

Statistical analysis. Ages were calculated from date of birth and date of first visit. The means of selected nutrients were computed for each individual based on the number of recorded days. Group means of nutrient intakes by gender were used for comparison to DRI recommendations. The proportions of individuals who fell below the Estimated Average Requirements, above the adequate intakes, and within the acceptable macronutrient distribution ranges were determined. DRI equations were used to calculate predicted energy requirements (32–34). Physical activity levels were imputed as low active at 1.12 for women and 1.11 for men. These coefficients coincide with being low active (typical daily living activities plus 30–60 min of daily moderate activity) (28). Based on observations of the communities, low active was the best compromise for categorizing physical activity level, falling between sedentary and active. rEI were classified as plausible or implausible using the 1.4 SD cutoff method (32,33). Age, gender, BMI, education, and employment did not differ between those considered to have plausibly and implausibly rEI. Variables were evaluated for meeting the assumptions of normal distributions (35). No variable was determined to need transformation.

Men and women were analyzed separately. The differences in the means of nutrient intakes between the implausible reporters of energy intake and the plausible reporters of energy intake were examined by linear regression adjusting for age. The proportions of those meeting or not meeting the DRI were evaluated by binary logistic regression after adjustment for age. Each nutrient was assessed separately. The most recent NHANES data available at the time were used as a reference (36,37). Thus, the nutrient intakes and proportion of participants meeting DRI recommendations from NHANES 2001–2002 are presented. All analyses were conducted with SPSS 16.0. Results were considered significant at $P < 0.05$.

Results

The men and women were similar in age and completed a similar number of dietary records (**Table 1**). Of the adults participating in the cohort, 86% (n = 444) completed ≥1 d and of those, a majority (94%) had complete height and weight measures (n = 418). Completion of dietary records varied from 13% for 1 d, 12% for 2 d, 25% for 3 d, and 50% for 4 d. There were no significant differences by age or gender between those individuals included in this analysis and those excluded. Further, mean nutrient intakes did not differ significantly by number of dietary records completed. A large proportion of the sample was between the ages of 31 and 50 y and had at least a high school education. The majority of individuals were overweight or obese. More than one-half of the men and women were considered to have reported plausible dietary intakes (Table 1).

Energy, macronutrient, and dietary fiber intakes are presented for the total sample separated by men and women and as separated by plausibly rEI or implausibly rEI (**Table 2**). Among the men, the absolute values of estimated energy, macronutrient, cholesterol, and dietary fiber intakes were significantly higher among

TABLE 1 Characteristics of adults (≥18 y) participating in the CoASTAL cohort with complete diet, weight, and height information[1,2]

Variables	Men, *n* = 175	Women, *n* = 243
Anthropometrics		
Age, *y*	41 ± 14	43 ± 14
Height, *cm*	171 ± 8	158 ± 8
Weight, *kg*	92 ± 19	83 ± 20
BMI, kg/m^2	31 ± 6	33 ± 8
Dietary records completed, *n*	3 ± 1	3 ± 1
Age categories, *n*(%)		
18–30 y	49 (28)	54 (22)
31–50 y	82 (46)	124 (51)
51–84 y	46 (26)	64 (26)
Employed, *n*(%)	78 (45)	135 (56)
Educational level, *n*(%)		
Less than high school	41 (23)	53 (22)
High school	80 (46)	73 (30)
Vocational/technical/associates degree/ some college	47 (27)	96 (40)
Bachelor/master/doctoral degree	7 (4)	21 (9)
Self-reported medical conditions, *n*(%)		
Diabetes	17 (12)	36 (17)
Cancer	4 (3)	17 (8)
Stroke	9 (6)	12 (6)
Hypertension	39 (27)	56 (26)
Weight status, *n*(%)		
Overweight/obese (BMI ≥25)	149 (85)	213 (88)
Obese (BMI >30)	95 (54)	147 (61)
rEI, *n*(%)		
Overreporter	8 (5)	18 (7)
Underreporter	78 (45)	78 (32)
Plausible reporter	89 (51)	147 (61)

[1] Values are mean ± SD or *n* (%).
[2] Numbers and proportions may vary due to missing data.

the plausible reporters of energy intake group compared with the implausible reporters of energy intake group. The same was true for this sample of women except there were no differences in daily intakes of docosahexanoic acid (DHA) and eicosapentanoic acid (EPA) combined (g/d) or of cholesterol (mg/d). However, when macronutrients were assessed as their overall contributions to energy, the plausible reporters of energy intake group and the implausible reporters of energy intake group among the men did not differ. This same observation was made for women except in the case of percent energy from total fat being significantly higher among the plausible reporters of energy intake group compared with the implausible reporters of energy intake group.

Using NHANES 2001–2002 as a reference (Table 2), the mean daily intakes among all men of the CoASTAL cohort were lower for energy, most dietary fats, and dietary fiber. Only dietary cholesterol was higher. For the women of the CoASTAL cohort, their mean daily intakes were consistently higher, except for protein and dietary fiber, than NHANES 2001–2002. Mean daily vitamin intakes of the CoASTAL cohort were evaluated in relation to NHANES 2001–2002 (**Table 3**). Compared with NHANES 2001–2002, the men and women of the CoASTAL cohort had substantially higher mean intakes of vitamin B-12 (μg/d). When vitamin intakes differed significantly, those of the plausibly reporting for energy intake men and women were consistently greater than those of the implausibly reporting for energy intake men and women. Mineral intakes of the men and women plausibly reporting energy intakes were significantly higher than those of the implausibly reporting men and women, except for sodium in men and calcium in women (**Table 4**). Among the women, the plausibly rEI group had significantly higher intakes for all minerals, except calcium, compared with the implausibly rEI group. Sodium intake was substantially lower in the CoASTAL cohort than in the NHANES 2001–2002 study sample.

The proportion of individuals who met the DRI recommendations for macronutrients, dietary fiber, and selected vitamins and minerals was also evaluated (Supplemental **Tables 1–3**, respectively). For reference purposes, corresponding proportions from NHANES 2001–2002 are shown. The majority of men and women, regardless of plausibility classification, were within acceptable recommended ranges for percent energy from protein and total carbohydrate intakes. Men and women classified as plausible reporters were significantly more likely to be within the acceptable recommended intakes for protein [g/(kg·d)], linoleic acid, and linolenic acid compared with implausible reporters. Similarly, in all instances where the proportions of plausible or implausible reporters were significantly different for meeting dietary recommendations for vitamin intakes, the plausible reporters of energy intake had larger proportions of individuals meeting dietary recommendations (Supplemental Table 2). The same was true for the mineral intakes (Supplemental Table 3). For nutrients such as the B vitamins, iron, calcium, and sodium, a larger proportion of the CoASTAL cohort met the DRI recommendations compared with the NHANES 2001–2002 cohort. For other nutrients such as protein and vitamin C, the proportions meeting DRI recommendations were higher among those in the NHANES 2001–2002 cohort.

Discussion

The individuals participating in the CoASTAL cohort provided the first general description of the nutrient profile of nonpregnant adults of the PNwT. The nutrient profiles exhibited by the CoASTAL cohort are poor but similar to those documented among non-Native populations (36,37). However, we found that for 2 of the nutrients examined, the CoASTAL cohort had a better profile compared with NHANES. First, the CoASTAL cohort had higher mean intakes of vitamin B-12 compared with the NHANES cohort. Vitamin B-12 is naturally found in foods of animal origins such as seafood (28). Second, none of the CoASTAL men were inadequate for selenium compared with <3% of the NHANES 2001–2002 cohort. Similarly to vitamin B-12, seafood is an excellent source of selenium (28). The isolated coastal location of the PNwT may be advantageous for meeting these nutrient requirements. On the other hand, the estimated intake levels of (n-3) fatty acids, which are predominately from seafood sources, did not reflect a similarly favorable pattern. This paradox may be due to the variation of seasons for specific seafood sources rich in (n-3) fatty acids. Harvesting seasons range from 1 mo for a food such as salmon to 8 mo for foods such as razor clams (38). Of greater concern, this important Native food group may not be as available as in the past due to environmental changes, more stringent fishing regulations, or the cost of maintaining equipment and nets (38). The possibility of these populations losing important food sources of potentially protective compounds, such as DHA and EPA, merits further investigation.

Comprehensive surveys of dietary intakes have also occurred in other Native Peoples such as the Navajo (17) and Native Americans in the Strong Heart Study (SHS) (18). Compared with

TABLE 2 Daily intakes of macronutrients, cholesterol, and fiber as estimated by dietary records of adult (≥18 y) men and women participating in the CoASTAL cohort compared with adult (≥20 y) men and women sampled in NHANES 2001–2002[1–3]

	Men				Women			
Variables	Total sample	Plausible rEI	Implausible rEI	NHANES 01–02	Total sample	Plausible rEI	Implausible rEI	NHANES 01–02
n	175	89	86	2250	243	147	96	2494
Energy, *kJ/d*	9479 ± 343	11066 ± 239	7838 ± 607***	10974 ± 147	7900 ± 180	8487 ± 134	7009 ± 394***	77255 ± 75
Macronutrients[4]								
PRO, *g/(kg body weight · d)*	1.0 ± 0.04	1.2 ± 0.04	0.9 ± 0.08**	1.3 ± 0.02	0.9 ± 0.02	1.0 ± 0.02	0.8 ± 0.05***	1.1 ± 0.02
PRO, *% energy*	17 ± 0.3	16 ± 0.4	17 ± 0.6	—	15 ± 0.2	15 ± 0.3	16 ± 0.4	—
CHO, *% energy*	47 ± 0.7	47 ± 0.9	48 ± 1.0	—	50 ± 0.6	49 ± 0.7	51 ± 1.1	—
TFA, *% energy*	36 ± 0.5	37 ± 0.6	35 ± 0.8	—	36 ± 0.5	37 ± 0.5	34 ± 0.8**	—
SFA, *% energy*	12 ± 0.2	12 ± 0.3	12 ± 0.3	—	12 ± 0.2	12 ± 0.3	11 ± 0.35	—
Linoleic acid, *g/d*	16 ± 0.7	19 ± 0.9	13 ± 1.1***	17 ± 0.3	14 ± 0.5	16 ± 0.5	12 ± 0.9***	13 ± 0.2
ALA, *g/d*	1.5 ± 0.06	1.8 ± 0.07	1.1 ± 0.08***	1.7 ± 0.03	1.4 ± 0.05	1.5 ± 0.6	1.2 ± 0.09**	1.3 ± 0.02
EPA + DHA, *g/d*	0.3 ± 0.05	0.4 ± 0.08	0.2 ± 0.03*	—	0.2 ± 0.03	0.2 ± 0.04	0.1 ± 0.02	—
Cholesterol, *mg/d*	364 ± 19.9	442 ± 28.9	284 ± 24.5***	346 ± 8.0	288 ± 11.7	305 ± 12.4	262 ± 22.5	233 ± 3.7
Dietary fiber, *g/d*	15 ± 0.6	17 ± 0.7	12 ± 0.8***	18 ± 0.4	14 ± 0.4	15 ± 0.5	12 ± 0.6***	14 ± 0.2

[1] Values are mean ± SEM. Asterisks indicate different from plausible rEI: ** $P < 0.01$, *** $P < 0.001$.
[2] Estimated by 24-h recall from (36).
[3] NHANES 2001–2002 sample size for men (n = 2258) and women (n = 2160) and age ranges (≥20 y) differs for grams of protein consumed per kg body weight from (35).
[4] PRO, protein; CHO, carbohydrate; TFA, total fat; ALA, linolenic acid.

these groups, the CoASTAL cohort similarly reported high mean intakes of total fat, saturated fat, and cholesterol. Interestingly, the mean intakes of sodium among the men and women of the CoASTAL cohort were lower than the Navajo and the SHS. Similarly to the other Native groups, the CoASTAL cohort had inadequate intakes of vitamin C, folate, and calcium. These comparisons, however, are made with caution. There were both methodological and age differences between these studies. For example, the SHS used 24-h recalls to assess diet and included only men and women above the age of 45 y (18). Also important to consider is the diversity among Native Peoples (1) and the possible interactions of diet with the environment, levels of physical activity, or genetics (39). To date, these interactions have not been fully investigated in any Native group. Nevertheless, the CoASTAL cohort, like other Native Peoples, is nutritionally at risk.

Previous studies in other Native American and Alaska Native communities have not accounted for plausibility (13,17,18). We found that plausible reporters reported much higher mean intakes for a majority of nutrients. This was especially apparent with mean intakes of cholesterol in men. The mean cholesterol intake of the plausible energy-reporting sample was 78 mg/d higher than the total sample, which exceeded the 2005 U.S. Dietary Guidelines (24). Therefore, the failure of previous studies to account for implausible energy intake reporters suggests that the diets may be worse (e.g. cholesterol) or better (e.g. vitamin B-12) for certain nutrients.

Two intriguing observations emerged from this unique population. More than one-half of the CoASTAL cohort is considered to have plausibly rEI. This is in contrast to previous studies that showed less than one-half of respondents being plausible reporters (32,33). Typically, there is more underreporting among

TABLE 3 Daily intakes of vitamins as estimated by dietary records of adult (≥18 y) men and women participating in the CoASTAL cohort compared with adult (≥20 y) men and women sampled in NHANES 2001–2002[1,2]

	Men				Women			
Vitamins	Total sample	Plausible rEI	Implausible rEI	NHANES 01–02	Total sample	Plausible rEI	Implausible rEI	NHANES 01–02
n	175	89	86	2380	243	147	96	2267
Vitamin A,[3] *RAE/d*	607 ± 39	663 ± 34	549 ± 70	656 ± 29	560 ± 21	585 ± 27	523 ± 33	564 ± 18
Vitamin E, *mg α- tocopherol/d*	6.9 ± 0.4	8.1 ± 0.4	5.6 ± 0.5**	8.2 ± 0.2	6.8 ± 0.3	7.8 ± 0.4	5.3 ± 0.4***	6.3 ± 0.2
Vitamin C, *mg/d*	68 ± 4.6	82 ± 6.7	54 ± 5.9**	105 ± 37	72 ± 4.6	79 ± 4.4	62 ± 5.5*	84 ± 2.6
Vitamin K, *μg/d*	71 ± 7.0	89 ± 12.9	52 ± 4.2**	89 ± 4.7	76 ± 4.3	80 ± 4.8	70 ± 8.1	96 ± 6.5
Thiamin, *mg/d*	1.9 ± 0.09	2.0 ± 0.06	1.8 ± 0.2	1.9 ± 0.04	1.6 ± 0.09	1.7 ± 0.4	1.4 ± 0.08***	1.4 ± 0.03
Riboflavin, *mg/d*	2.6 ± 0.1	3.1 ± 0.2	2.1 ± 0.2**	2.6 ± 0.06	2.1 ± 0.07	2.2 ± 0.08	1.8 ± 0.1**	1.9 ± 0.04
Niacin[4], *mg/d*	26 ± 1.0	30 ± 1.0	23 ± 1.7***	27 ± 0.6	21 ± 0.5	23 ± 0.6	18 ± 0.9***	19 ± 0.4
Vitamin B-6, *mg/d*	2.1 ± 0.1	2.5 ± 0.1	1.8 ± 0.1**	2.2 ± 0.06	1.7 ± 0.06	1.9 ± 0.08	1.5 ± 0.08***	1.5 ± 0.04
Folate,[3] *DFE/d*	565 ± 25	606 ± 22	523 ± 46	636 ± 18	511 ± 16	554 ± 20	446 ± 26**	483 ± 17
Vitamin B-12, *μg/d*	9.3 ± 0.8	11.0 ± 1.3	7.6 ± 0.9*	6.5 ± 0.3	8.6 ± 0.8	9.3 ± 1.2	7.5 ± 1.1	4.3 ± 0.2

[1] Values are mean ± SEM. Asterisks indicate different from plausible rEI: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.00$.
[2] As estimated by 24-h recall from (36).
[3] RAE, retinol activity equivalents; DFE, dietary folate equivalents.
[4] Preformed niacin only.

TABLE 4 Daily intakes of minerals as estimated by dietary records of adult (≥18 y) men and women participating in the CoASTAL cohort in comparison to adult (≥19 y) men and women sampled in NHANES 2001–2002[1,2]

	Men				Women			
Minerals	Total sample	Plausible rEI	Implausible rEI	NHANES 01–02	Total sample	Plausible rEI	Implausible rEI	NHANES 01–02
n	175	89	86	2380	243	147	96	2267
Calcium, *mg/d*	764 ± 40	858 ± 38	666 ± 69*	984 ± 23	669 ± 24	696 ± 28	627 ± 42	735 ± 18
Phosphorous, *mg/d*	1349 ± 52	1523 ± 46	1169 ± 92**	1552 ± 25	1101 ± 27	1169 ± 27	997 ± 52**	1109 ± 18
Magnesium, *mg/d*	266 ± 8.7	306 ± 10	225 ± 13***	322 ± 6.2	233 ± 5.6	254 ± 6.4	202 ± 9.7***	240 ± 5.0
Iron,[3] *mg/d*	17 ± 0.6	18 ± 0.6	15 ± 1.0**	18 ± 0.4	15 ± 0.5	16 ± 0.6	13 ± 0.7**	13 ± 0.3
Potassium, *mg/d*	2696 ± 91	3200 ± 113	2175 ± 119***	3141 ± 55	2342 ± 57	2504 ± 59	2094 ± 107***	2341 ± 39
Zinc, *mg/d*	13 ± 0.5	14 ± 0.5	11 ± 0.9**	14 ± 0.3	10 ± 0.3	11 ± 0.4	9 ± 0.5***	10 ± 0.2
Copper, *mg/d*	1.1 ± 0.05	1.6 ± 0.07	1.1 ± 0.06***	1.5 ± 0.04	1.3 ± 0.03	1.2 ± 0.04	1.0 ± 0.06**	1.1 ± 0.02
Selenium, *μg/d*	135 ± 5.4	155 ± 5.9	115 ± 8.6***	125 ± 2.6	111 ± 2.9	119 ± 3.1	98 ± 5.5***	89 ± 1.8
Sodium, *mg/d*	1778 ± 115	2015 ± 133	1533 ± 186	3964 ± 55	1369 ± 70	1522 ± 96	1135 ± 92**	2853 ± 47

[1] Values are mean ± SEM. Asterisks indicate different from plausible rEI: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.
[2] As estimated by 24-h recall from (36).
[3] Iron was normally distributed in both men and women of the CoASTAL cohort.

the overweight and obese (40); however, this population, which is ≥85% overweight or obese, does not mimic that pattern. Second, the CoASTAL cohort had a fairly large proportion of women considered to be overreporters compared with previous findings among non-Native women (41,42). In women, a more frequent occurrence has been underreporting (41–45). The unexpectedly high proportion of overreporters is consistent with Cassidy's (46) description of a culture closer to its roots and the sentiment that food abundance is a symbol of wealth rather than something to hide. An assumption that few women overreport may be erroneous among some diverse groups. Although we randomly sampled the respective tribal registries, we cannot eliminate selection bias.

Overall, we found that the comparison of nutrient intakes based on dietary records to DRI recommendations varied by gender, plausibility classification, and nutrients. For many of the nutrients examined, such as total fat, saturated fat, cholesterol, protein, vitamin A, vitamin E, vitamin C, magnesium, and zinc, a large proportion of individuals did not meet DRI recommendations. Such insufficiencies over an extended period of time may increase risk for diet-associated diseases (47). This is worthy of investigation using prospective methods.

An adult's ability to accurately self-report dietary intake over a 24-h period poses challenges (48,49). For example, all participants did not complete 4 d of records despite many reminders. On the other hand, a majority completed more than 1 d. In Native American and Alaska Native populations, the most frequently used methodology to assess diet has been the single 24-h recall (8,10,11,13–17,19) or multiple 24-h recalls (9,12). Unlike the 24-h recall, the dietary record does not rely on people's memories and allowed for the collection of dietary information without interference of scheduling for an interview. Spacing the dietary records over the course of 1 y may have reduced respondent fatigue. We may have improved accuracy of nutrient intakes through the application of a method to estimate plausible reports of energy intake (32,33).

Results based on the CoASTAL cohort could inform the PNwT of potential dietary interventions. The coastal location of these nations provides ready access to seafood, which is one of the richest food sources for (n-3) fatty acids. Fish and shellfish are traditional food items of the PNwT and may be protective against coronary heart disease (26,27,50). The low consumption of seafood may portend the loss of traditional dietary practices. This may be unfortunate, because traditional food systems have been documented as an excellent avenue for healthy diets (51,52). In addition, all participants of the CoASTAL cohort resided on reservations in remote areas of the Pacific Northwest. Most of the families had limited monetary resources, food selection, and access to fresh fruits and vegetables. An effective method to disseminate these findings among the PNwT may be a community-based participatory approach.

In conclusion, similar to the general U.S. population, the CoASTAL cohort does not meet U.S. Dietary Guidelines for the majority of nutrients assessed. This is especially evident when limiting the analysis to plausible reporters of energy. The dietary information gained during the duration of the CoASTAL cohort prospective study will be useful in providing more detailed dietary data about the Native Peoples of the Pacific Northwest Coast. Moreover, such work will offer greater clarity on the cultural and traditional distinctions across groups such as Native Americans.

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