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Dietary Supplement Use Within a Multiethnic Population as Measured by a Unique Inventory Method

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Abstract

Use of dietary supplements is widespread, yet intakes from supplements are difficult to quantify. The Supplement Reporting (SURE) study utilized a unique inventory method to quantify dietary supplement use across one year in a sample of 397 supplement users. Interviewers visited participants' homes in 2005–2006 to record supplement purchases and the number of pills in each supplement bottle every three months. Total use for the year was calculated from these inventories. Participants in this observational study were older adults (average age = 68 years) from the Multiethnic Cohort in Hawaii and Los Angeles, with approximately equal representation of males and females and six ethnic groups (Caucasian, Japanese-American, Hawaiian, African-American, Latinos born in the United States and Latinos born elsewhere). The most commonly used supplement type was one-a-day multivitamins/minerals, which were taken at least once during the year by 83% of men and 73% of women. Other common supplements were

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multivitamins, vitamin C, fish oil, vitamin E and bone or joint supplements. Participants used a median of 7 (women) and 5.5 (men) different supplements over the year. There were few differences in supplement use across ethnic groups for men, but usage tended to be highest for Caucasian and Japanese-American women. Use of non-vitamin/non-mineral supplements was common among these older adults, sometimes at high doses. When assessing intakes, supplement use should be correctly quantified because users tend to take many different supplements and nutrient intakes from supplements can be substantial. The inventory method may help improve the measurement of supplement use.

Keywords

Dietary supplement use; nutrient intakes; non-vitamin non-mineral supplements

INTRODUCTION

Dietary supplement use is widespread in the United States (US), with over 50% of adults taking at least one supplement, and 35% taking a multivitamin/mineral supplement, in the past month in 1999–2000 (1). Furthermore, growth in supplement use has accelerated rapidly in recent years (2,3). Among some segments of the population, such as older adults, use is particularly high (4–8). Furthermore, the dose of a nutrient taken as a supplement often exceeds levels of the same nutrient in the diet. Thus, accurate estimates of total nutrient intakes must include consumption from dietary supplements. For example, mean dietary intake of vitamin C in the 1988–94 National Health and Nutrition Examination Survey (NHANES) III data for adults 51–70 years of age was approximately 100 mg/d from food, and doubled to 200 mg/d when intakes from supplements were included (9). The high level of nutrients available from some supplements may be undesirable. Tolerable Upper Intake Levels (ULs) have been set for many vitamins and minerals and may be used to assess the prevalence of potentially excessive nutrient intakes (10).

Almost all published reports of dietary supplement use are based on self-reported information, and the validity of the collection methods is uncertain (11–16). Although participants are often asked to show their bottles to the interviewer, the list of supplements will be incomplete if the participant forgets to bring some of the bottles, or discards others. Information on amounts consumed may also be incorrect, depending on the participant's memory and ability to accurately report frequency of use. As a result, published estimates of supplement use, doses, and nutrient intakes may not be accurate.

The Supplement Reporting (SURE) study was designed to more accurately measure supplement use with a unique inventory system in which interviewers visited participants' home to take an inventory of the contents of all supplement containers. Details of this methodology, and the resulting findings on use of dietary supplements across one year by older adults in Hawaii and Los Angeles, are reported in this paper.

METHODS

Inventory protocol

The SURE inventory protocol was developed based on methods used to determine compliance with use of pre-natal supplements (17). However, it was refined and extended to consider the simultaneous use of many different products. The SURE protocol required 5 home visits, one at the beginning of the study, and the other four approximately every 3 months over the course of a year. For the purposes of the study, a dietary supplement was considered to be a product that was intended to supplement the diet, but not to be used as a

conventional food. Also, the product's label should identify it as a dietary supplement. Food items such as meal replacement drinks or energy bars were not considered dietary supplements, even if they were highly fortified. At the first in-home visit the interviewer asked the person to collect all dietary supplement containers. Each container was labeled with a sequentially numbered sticker which corresponded to the number on an inventory log that the interviewer maintained. This form was used to keep a continuous list of all supplements taken by the participant over the course of the year. At each visit, the interviewer physically counted all pills in the container and entered the information on the inventory log, along with the original product count on the label. If the supplement was in a form such as a powder or liquid, it was weighed on a portable scale. Participants were asked to save all empty containers, which allowed the interviewer to confirm that they had been emptied. To ensure proper identification, pictures were taken of each container, including the front of the bottle and the Supplement Facts panel.

A copy of the log was left with the participant, who was asked to add any new containers that were purchased. If other people in the household used the same bottles, some pills were transferred to a newly-provided (empty) bottle, and the participant was asked to only use pills from this bottle. However, space was also provided for the participant to indicate whether others had taken any pills from any supplement bottle, and if so, how many.

Assignment of supplements to categories

Each specific dietary supplement was assigned to a category from a pre-determined list representing specific types of supplements. The categories could be combined into four broad groups: multivitamins/minerals, single nutrient supplements (subdivided into vitamins and minerals), herbal/botanical supplements, and miscellaneous supplements (such as fish oils, fiber, and amino acids). Supplements that did not fit within any of the specific categories were put into "other" categories, such as "other multivitamin/mineral combinations." Figure 1 shows the complete list of 54 supplement types. Supplements were assigned based on the name of the product and the nutrients present in the product as shown on the supplement facts label. Multivitamin/minerals were defined as supplements containing two or more nutrients.

Quantification of supplement use and nutrient intakes

The number of doses of each supplement that was taken between the quarterly inventory visits was calculated by subtracting the number of pills in a bottle at the end of the quarter from the number that were in the bottle at the beginning of the quarter, divided by the number of pills per dose. Doses across the year were accumulated for each participant, and then divided by the number of days between the first and last inventory measure to give doses per day. Nutrient intakes from supplements were quantified using the Cancer Research Center of Hawaii's (CRCH) Supplement Composition Table, which was expanded and updated for the SURE study (18). Intakes across the year were calculated for each participant from the doses per day that were taken for each supplement and the nutrient composition of the supplement. Intakes of 15 nutrients that are commonly contained in dietary supplements are included in this report.

Participants

Participants in the SURE study were supplement users selected using stratified random sampling from the ongoing Multiethnic Cohort (MEC) (19). Potential participants (n=33,697) had previously completed two food frequency questionnaires and a blood draw, and had reported taking dietary supplements. Twenty-four strata were defined by sex, six ethnic groups, and age group (<65, 65+). Separate strata were created for US-born and non-US born Latinos, because acculturation might affect supplement use. The goal was to retain

at least 15 participants in each of the strata, for a total of 360 participants. African Americans and Latinos were recruited in Los Angeles, while Japanese-Americans, Native Hawaiians, and Caucasians were recruited on the island of Oahu in Hawaii.

SURE participants were recruited from March 2005 to August 2006, and were initially contacted by mail, and then by telephone. To be eligible for the study, participants had to report current regular use of a dietary supplement (at least once a week for the past year) and allow home visits with a study interviewer. Because participants were asked to record supplement purchases, those who were cognitively impaired or illiterate (as evaluated by a caregiver or by the interviewer) were deemed ineligible. All participants provided written informed consent. The study was approved by the Institutional Review Boards at the University of Hawaii and the University of Southern California.

Statistical analysis

Statistical analyses were conducted using SAS (version 9.1, 2002, SAS Institute, Cary, NC). Fisher's exact test (20) was used to statistically compare supplement use across ethnic categories within sex. The median test (20) was used to identify significant differences in daily nutrient intakes among ethnic groups within sex.

RESULTS

Of the 1073 MEC participants who were contacted by phone and eligible for the SURE study, 443 (43%) agreed to enroll in the study. Response rates varied across ethnic groups from 27% for Japanese-Americans to 47% for African-Americans, and was lowest for Latino men born outside the US (20%). Attrition across the year averaged 10%, and was similar across sex and ethnic groups. The final sample included 397 participants who were retained through visit 5. Missed visits were rescheduled whenever possible and only one skipped visit was allowed; 96% of the final sample completed all five in-home visits.

The sample was well-balanced by location (196 participants in Hawaii and 201 in Los Angeles), sex (48.4% men and 51.6% women, respectively), and by ethnic group within sex (percentages for Caucasians, Japanese-Americans, Native Hawaiians, African Americans, US born Latinos, and non-US born Latinos were 19, 17, 16, 19, 17, and 12% for men and 17, 16, 15, 18, 18, and 17% for women). Educational level was similar among the ethnic groups, although men were more likely to have attended graduate school (31%) than were women (19%). The highest attained education level was a high school degree for approximately 25% of both men and women. The mean (SD) age was 67.8 (8.0) years.

Among the supplement users in the SURE study, the most commonly used supplement type was one-a-day multivitamins/minerals, which were taken at least 52 times during the past year by 80% of men and 68% of women (Table 1). The percent reporting any use of one-a-day supplements was slightly higher, 83% for men and 73% for women. Other commonly-used supplements were vitamin C, fish oil, bone supplements, joint supplements, and vitamin E. Sex differences were particularly large for bone supplements (taken by 70% of women, but only 39% of men), calcium single supplements (taken by 20% of women and 8% of men) and saw palmetto, which is marketed as promoting prostate health (taken by 12% of men, but only one woman (0.5%)). Supplements with a median of at least five doses per week among users of that product type included one-a-day multivitamin/minerals, bone supplements, vitamin C, and folic acid for both men and women, and vitamin E, stress multivitamins, vitamin B12, flaxseed, potassium, and saw palmetto for men only. For most supplements, women tended to take fewer doses per week compared to men, with the exceptions of iron and enzyme supplements, where women took more than twice as many doses per week. The maximum values were high for some supplement types (Table 1), with

one man reporting 47 doses per week for joint supplements. The maximum doses for one woman were excluded from Table 1 because of extreme values: across the year, averaging 96 doses/week of enzyme supplements, 91 of joint supplements, and 149 of other herbal/botanical products. The median number of different supplement types taken across the year among the 54 possible categories was 5.5 for men and 7.0 for women, and the respective maximums were 30 and 50. Only 6% of men and 3% of women took just one supplement during the year.

Ethnic differences in supplement use

The use of several supplement types varied across ethnic categories (Table 1). Among men, two differences reached statistical significance ($p < 0.05$). The percent using joint supplements was over 40% among Caucasians, Japanese-Americans and Latinos born in the US; other groups used this product less commonly. Hawaiian men were at least twice as likely to use fruit and vegetable extracts as were men in the other ethnic groups. Use of three types of supplements varied by ethnic group for women: vitamin C was used by over 50% of the Caucasian and African-American women, and vitamin B12 was used by about one-third of the Caucasian women. Japanese-Americans and Hawaiians were most likely to use fruit/vegetable extracts. While not significant ($p = 0.09$), Caucasian and Japanese-American women appeared to be more likely to use bone multivitamin/minerals, with >80% reporting use.

Ethnic differences in nutrient intakes from supplements

No significant differences in daily nutrient intakes were found among ethnic groups for men (Table 2). However, for women, differences were found between ethnic groups for most nutrients. Generally, the highest intakes from supplements were for Japanese-Americans, followed by Caucasians. Exceptions were for the B vitamins (vitamin B-12, thiamin, riboflavin and vitamin B-6), with intakes highest among Caucasians, and iron, with intakes highest among Hawaiians. Nutrient intakes from supplements tended to be lowest among both groups of Latinos and African-Americans.

When median nutrient intakes from supplements for all men and women were compared to the corresponding recommended daily intake (RDA or AI) (21), several were above the recommendations for both sexes: vitamin C, vitamin E, folic acid, vitamin B12, zinc, thiamin, riboflavin, niacin, and vitamin B6 (Table 2). However, the median intake did not exceed the UL for any nutrient for either sex, nor for any ethnic group. The prevalence of intakes from supplements above the UL in this study was low (< 3%) for all nutrients except niacin (19.8% above the UL of 35 mg/d) and folic acid (3.2% above the UL of 1700 ug DFE/d), although these prevalences may have been higher if diet was included.

DISCUSSION

Unique aspects of the SURE study methodology

The SURE study measured dietary supplement use through a unique inventory method in which the participants kept all of their supplement containers, and interviewers counted the pills in each container at baseline and four times across a year. To our knowledge, this is the first study to measure both the specific supplement product and the number of doses taken. The exact name of the supplement and the Supplement Facts label were available from the container photographs for use in determining the nutrients in each supplement. This information augmented our extensive supplement composition table (16) used to quantify nutrient intakes from supplements. Although other studies have reported on an “inventory” of supplement use (22), this typically refers to an inventory of the bottles, and not to quantification of the pills within the bottles at multiple time points.

Comparison to a national survey of supplement use

The results from the SURE study extend other reports of supplement use in the United States. NHANES is one of the most comprehensive surveys of supplement use, collecting self-reported use data for the past month. The six most commonly used types of supplements from NHANES 1999–2000 were: multivitamin/minerals, vitamin E, vitamin C, calcium, and B-complex vitamins (23). For the SURE study, these types of supplements were also commonly used, but fish oil and joint supplements were more frequently used than either vitamin E or B-complex vitamins. Both NHANES and the SURE study found that women were more likely than men to use supplements containing calcium.

Differences in types of supplements used were seen across ethnic groups in both NHANES and the SURE study. In the 1999–2000 NHANES, non-Hispanic Whites were much more likely to use all types of supplements examined, compared to non-Hispanic Blacks and Mexican Americans (23).

Comparison to other reports of nutrient intakes from supplements

Intakes of vitamin C, vitamin E, and selenium were 50–100% higher among SURE participants than those reported for older adults in NHANES 1999–2002 (24). This difference would be expected because the SURE study included only supplement users, while only 48% of the NHANES participants took at least one supplement per day. Nutrient intakes from supplements were also reported in the Iowa Women's Health Study (n=18,346), where only 14.6% were not users of supplements (25). In general, the mean intakes from supplements were similar between the two studies, although vitamin A was considerably higher in Iowa.

Several reports have quantified the prevalence of use of non-vitamin non-mineral (NVNM) supplements. Radimer et al. reported that herbal and other biologic supplements were the most common categories of NVNM in NHANES III (26), but did not include details on specific types. In our study of supplement users, joint supplements (primarily, glucosamine and chondroitin) were the most common type of non-nutrient supplements taken, used by 35% of women and 36% of men, and were also commonly reported by other studies (27–29). In a 2002 survey, Echinacea was commonly reported (20%) by adults aged 18 and older (29), while little use of Echinacea was found among the SURE older adults (about 2%), perhaps because its use declines with age (28). Detailed information on NVNM use was reported for the 2000 National Health Interview Survey (30). Echinacea was again commonly used, but similar to our findings, the next most common NVNM supplements were Ginkgo biloba and garlic. To our knowledge, there is no published information on the number of doses that are typically taken for non-nutrient supplements. SURE NVNM users reported surprisingly high levels of use, a median of approximately 3–4 doses per week for most types of herbal supplements. Thus, an accurate assessment of the use of these supplements may be important when evaluating their associations with health outcomes, and also when examining interactions with prescription medications. Gardiner et al. reported that 21% of adult users of prescription medications reported using NVNM supplements in the past 12 months (31).

Limitations of the SURE study

Although the SURE inventory protocol should provide accurate information on supplement use across a year, it is possible that some errors occurred. For example, if a supplement bottle was purchased, consumed, and discarded between visits, without registration in the log, the contents would be missed. This type of error should be minimized by the use of a purchase log, and the container that was supplied for empty bottles. Use of the same supplements by other members of the household would also result in an incorrect calculation

of supplement use by the participant, but provision of separate bottles for use by others, and a place to record this type of use on the supplement log, were intended to reduce this type of error. Ultimately, a biomarker validation of the inventory protocol would be desirable. Another limitation of the inventory method is the inability to identify whether supplement use is regular or sporadic, because only the total number of pills taken is known. For this reason, Table 1 reports the percent of participants who took a supplement at least 52 times within the year, rather than at least once a week.

Because all of the SURE participants resided in Hawaii and Los Angeles, these findings may not apply to other populations. Furthermore, over half of those contacted declined to participate in the year-long study. However, comparisons to other reports imply that the supplement users in the SURE population are similar to supplement users from other groups of older adults. Although we found several differences across ethnic groups, more modest differences may not have reached significance due to the relatively small samples within each ethnic-sex group.

CONCLUSIONS

An important implication of this study is that it is essential to include well-quantified supplement use when assessing nutrient intakes. Users tend to take many different supplement types during a year and intakes from supplements can be substantial. If a study or survey depends on an accurate assessment of total nutrient intakes, then an inventory protocol such as the one used in the SURE study should be considered. The SURE results illustrate that daily use cannot be assumed, even for multivitamin/mineral products. The use of non-vitamin/non-mineral supplements was common in the SURE study, sometimes at high doses, emphasizing the importance of collecting information about these types of supplements as well. Thus, the extra staff time needed for an inventory method may be justified by the ability to capture intermittent or irregular use of all types of supplements by study participants.

The findings reported here also have implications for designing questionnaires to collect information about the types and frequency of supplements used. Information on the most common types of supplements (Table 1) and on intakes of nutrients from supplements (Table 2) can guide this process. These results also may be used to design supplement use questionnaires for populations that differ by sex or ethnicity. For example, several differences in types of supplements used were identified for men versus women. While ethnic differences were not pronounced among men, it may be particularly important to determine supplement use among Caucasian and Japanese-American women.

Poorly quantified supplement use may be the reason it has been difficult to show associations with chronic diseases (3) or possible interactions with drugs or cancer treatments (32). The SURE inventory method could improve intake estimates in future studies. When this approach is not practical, the descriptive information from the SURE may be helpful in refining both interviewer-assisted and self-reported methods of collecting information on supplement use. Use of better supplement assessment methods may reveal new effects on health outcomes.

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Multivitamins/minerals (with or without herbals)

One-a-day type

Stress/B vitamin type

Antioxidant type

Bone type/calcium plus other nutrients

Multimineral (not bone type)

Other multivitamin & multimineral combinations (none of the above)

Single nutrients

Single vitamins:

Vitamin C

Vitamin A

Vitamin E

Carotenoids

Thiamin

Riboflavin

Niacin

Folate

Vitamin B-12

Vitamin B-6

Pantothenic acid

Biotin

Choline

Vitamin D

Vitamin K

Single minerals:

Iron

Zinc

Calcium

Selenium

Magnesium

Potassium

Chromium

Copper

Other minerals^a (includes manganese, molybdenum, boron, strontium, aluminum)**Herbals/botanicals**Saw palmetto

Garlic
Ginkgo biloba
Flaxseed
Fruit or vegetable extracts
Echinacea
Ginseng
Wheat grass
Chlorophyll
Bilberry
Black cohosh
Green tea extracts
Phytosterols
Other herbals/botanicals ^a (includes aloe vera, St. John's wort, grape seed extract, milk thistle, evening primrose oil, spirulina, cinnamon, and herbal blends.)
Miscellaneous supplements (with or without nutrients)
Fish oils (includes omega-3, DHA (docosahexaenoic acid), EPA (eicosapentaenoic acid))
Fiber
Joint supplements (glucosamine/chondroitin/MSM (methylsulfonylmethane))
Coenzyme Q10
Amino acids
Enzymes
SAM-e (S-adenosyl methionine)
Prebiotics/probiotics
DHEA (dehydroepiandrosterone)
Other miscellaneous supplements ^a (includes alpha lipoic acid, lecithin, melatonin, red yeast rice, soy isoflavones, apple cider vinegar, bee pollen, royal jelly, shark cartilage, and blends of miscellaneous supplements)

^aThe most common supplements assigned to this category are listed.

Figure 1.
Supplement type categories used for the SURE study

Table 1

Percent using supplements within the study year by sex and ethnic group^a

Supplement Type	% using 52x+/yr	% using any	Cauc	J- Amer	Haw	Af- Amer	Latino- US	Latino- Mex	p- value ^b	Median dose/wk ^c	Max dose/wk ^c
Men (n)	192	192	36	32	31	37	33	23			
One-a-day multivitamin/mineral	80	83	75.0	90.6	67.7	86.5	87.9	91.3	0.10	6.2	15.5
Bone multivitamin/mineral	32	39	38.9	40.6	29.0	37.8	39.4	47.8	0.84	5.5	17.9
Vitamin C	38	41	47.2	37.5	54.8	40.5	36.4	21.7	0.22	6.3	21.6
Fish Oils, Omega-3, EPA ^d , DHA ^e	36	41	38.9	37.5	48.4	54.1	33.3	26.1	0.27	4.4	13.4
Joint Supplement	28	35	44.4	50.0	29.0	21.6	45.5	17.4	0.03	3.3	46.9
Vitamin E	32	34	41.7	28.1	25.8	43.2	42.4	17.4	0.18	5.0	17.5
Stress or B vitamin multi	20	21	13.9	9.4	35.5	24.3	30.3	13.0	0.07	5.2	18.7
Other multivitamin/mineral	15	19	27.8	15.6	25.8	27.0	9.1	4.3	0.07	4.8	15.6
Other herbal/botanicals	14	17	11.1	18.8	25.8	27.0	9.1	4.3	0.09	3.2	27.1
Other miscellaneous supplement	13	16	13.9	12.5	19.4	21.6	18.2	4.3	0.54	4.7	21.9
Garlic	12	15	13.9	9.4	29.0	13.5	12.1	8.7	0.33	4.3	16.2
Vitamin B12	11	13	11.1	15.6	6.5	18.9	9.1	13.0	0.70	5.7	10.3
Calcium	6	8	2.8	6.3	3.2	5.4	12.1	21.7	0.13	3.3	11.5
Fruit/veg extracts/concentrates	6	7	8.3	6.3	19.4	8.1	0.0	0.0	0.05	3.3	7.8
Folic acid	8	9	13.9	6.3	12.9	5.4	6.1	8.7	0.75	6.5	18.2
Flaxseed	3	4	5.6	3.1	3.2	5.4	0.0	4.3	0.87	5.7	6.8
Coenzyme Q10	5	6	2.8	9.4	12.9	2.7	6.1	0.0	0.32	4.7	12.3
Ginkgo Biloba	6	8	2.8	6.3	9.7	16.2	3.0	8.7	0.33	3.8	12.7
Zinc	5	7	5.6	6.3	9.7	10.8	9.1	0.0	0.68	1.6	6.7
Enzymes	2	3	8.3	3.1	3.2	0.0	0.0	0.0	0.22	2.3	8.1
Potassium	4	5	2.8	3.1	6.5	2.7	3.0	13.0	0.54	6.5	9.3
Saw Palmetto	12	12	16.7	21.9	6.5	13.5	6.1	4.3	0.25	6.9	19.9
Vitamin B6	5	6	8.3	3.1	3.2	10.8	6.1	4.3	0.81	3.6	8.7
Vitamin D	3	3	5.6	3.1	0.0	2.7	3.0	4.3	0.92	3.8	7.2
Iron	3	4	2.8	0.0	9.7	0.0	3.0	8.7	0.13	1.5	6.6
Women (n)	205	205	34	32	31	37	36	35			

Supplement Type	% using 52x+/yr	% using any	Cauc	J- Amer	Haw	Af- Amer	Latino- US	Latino- Mex	p- value ^b	Median dose/wk ^c	Max dose/wk ^c
One-a-day multivitamin/mineral	68	73	67.6	81.3	71.0	75.7	75.0	68.6	0.82	5.5	12.3
Bone multivitamin/mineral	63	70	82.4	84.4	67.7	56.8	66.7	65.7	0.09	5.6	25.1
Vitamin C	36	41	55.9	46.9	32.3	56.8	16.7	34.3	0.00	5.8	20.8
Fish Oils, Omega-3, EPA ^d DHA ^e	26	34	44.1	31.3	32.3	35.1	30.6	31.4	0.86	2.9	27.5
Joint Supplement	30	36	44.1	37.5	45.2	21.6	25.0	45.7	0.11	3.7	16.1
Vitamin E	25	29	35.3	37.5	29.0	32.4	25.0	14.3	0.28	4.1	13.0
Stress or B vitamin multi	22	25	38.2	25.0	25.8	24.3	11.1	25.7	0.21	2.9	11.4
Other multivitamin/mineral	17	22	26.5	15.6	38.7	16.2	13.9	25.7	0.16	2.8	31.7
Other herbal/botanicals	15	21	23.5	21.9	25.8	24.3	11.1	17.1	0.63	2.9	24.9
Other miscellaneous supplements	13	17	17.6	12.5	25.8	16.2	16.7	11.4	0.73	3.3	28.7
Garlic	11	13	2.9	12.5	9.7	24.3	13.9	11.4	0.18	2.1	9.9
Vitamin B12	12	15	32.4	9.4	16.1	2.7	19.4	8.6	0.01	4.2	13.5
Calcium	18	20	14.7	12.5	19.4	16.2	16.7	37.1	0.17	3.3	13.9
Fruit/veg extracts/concentrates	7	12	5.9	21.9	22.6	2.7	13.9	8.6	0.05	1.2	22.9
Folic acid	8	10	17.6	6.3	6.5	10.8	11.1	5.7	0.62	5.0	34.1
Flaxseed	11	13	17.6	12.5	12.9	13.5	13.9	5.7	0.78	2.2	14.6
Coenzyme Q10	8	10	11.8	9.4	22.6	8.1	8.3	2.9	0.22	3.5	27.1
Ginkgo Biloba	5	6	5.9	3.1	12.9	0.0	2.8	11.4	0.13	3.2	14.1
Zinc	2	5	11.8	3.1	0.0	8.1	2.8	2.9	0.28	0.8	7.6
Enzymes	7	10	11.8	12.5	19.4	8.1	8.3	0.0	0.12	4.7	17.1
Potassium	5	7	11.8	0.0	9.7	5.4	11.1	5.7	0.38	3.1	21.0
Saw Palmetto	1	1	0.0	0.0	3.2	0.0	0.0	0.0	0.15	2.8	2.8
Vitamin B6	4	5	11.8	0.0	9.7	2.7	0.0	5.7	0.08	2.9	7.0
Vitamin D	5	7	8.8	9.4	3.2	10.8	8.3	0.0	0.37	3.4	13.2
Iron	5	6	2.9	3.1	12.9	13.5	2.8	2.9	0.19	3.8	18.6

^a Caucas = Caucasian; J-Amer = Japanese-American; Af-Amer = African-American; Latino-US = Latinos born in the US; Latino-Mex = Latinos not born in the US, primarily Mexico and South and Central America

^b Fisher exact test

^c For those reporting any use of the supplement type. One woman was excluded from the computation of the maximum doses (but not from other analyses) because of extreme values.

d Eicosapentaenoic acid
 e Docosahexaenoic acid

Table 2

Median daily nutrient intake from dietary supplements by ethnic group

Nutrient	All	Caucasian	Japanese American	Hawaiian	African American	Latino-US ^a	Latino-Mex ^b	p-value ^c	RDA/AI ^d	UL ^e
Men (n)	192	36	32	31	37	33	23			
Retinol (ug/d)	646	645	683	610	694	614	645	0.97	900	3000
Beta-Carotene (ug/d)	436	511	593	306	330	427	309	0.32	ND	ND
Vitamin C (mg/d)	160	203	103	277	229	147	83	0.06	90	2000
Vitamin E (α -tocopherol) (mg/d)	24	27	22	25	29	22	19	0.17	15	1000
Folic acid (ug DFE/d)	614	611	665	661	605	497	536	0.24	400	1700
Vitamin B-12 (ug/d)	16	15	25	15	18	14	15	0.45	2.4	ND
Vitamin D (IU/d)	356	342	390	299	367	292	368	0.23	400–600	2000
Calcium (mg/d)	197	211	219	164	177	173	224	0.43	1200	2500
Selenium (ug/d)	20	19	22	19	17	20	30	0.62	55	400
Iron (mg/d)	0.00	0	0	0	0.6	0	2.3	0.45	8	45
Zinc (mg/d)	13.6	14.2	14.7	13.5	14.6	10.3	13.6	0.10	11	40
Thiamin (mg/d)	1.5	1.5	1.5	2.2	1.5	1.7	1.5	0.71	1.2	ND
Riboflavin (mg/d)	1.7	1.6	1.7	2.5	1.7	1.8	1.7	0.74	1.3	ND
Niacin (mg/d)	19	19	20	20	19	20	16	0.18	16	35
Vitamin B-6 (mg/d)	2.8	2.7	2.9	3.2	2.8	2.7	2.9	0.76	1.7	100
Women (n)	205	34	32	31	37	36	35			
Retinol (ug/d)	470	577	655	314	356	467	283	0.09	700	3000
Beta-Carotene (ug/d)	379	545	518	554	254	236	304	0.27	75	ND
Vitamin C (mg/d)	123	251	267	194	223	52	67	0.00	ND	2000
Vitamin E (α -tocopherol) (mg/d)	20	25	27	19	20	17	14	0.04	15	1000
Folic acid (ug DFE/d)	522	578	627	568	391	482	323	0.05	400	1700
Vitamin B-12 (ug/d)	18	60	23	16	10	15	14	0.05	2.4	ND
Vitamin D (IU/d)	315	353	568	255	229	333	190	0.02	400–600	2000
Calcium (mg/d)	422	529	888	486	271	344	316	0.00	1200	2500
Selenium (ug/d)	16	20	20	18	10	10	14	0.01	55	400

Nutrient	All	Caucasian	Japanese American	Hawaiian	African American	Latino-US ^a	Latino-Mex ^b	p-value ^c	RDA/AI ^d	UL ^e
Iron (mg/d)	0	0	0	5.2	3.9	0	0	0.04	8	45
Zinc (mg/d)	9.9	13.1	14.1	11.0	7.2	9.1	7.1	0.03	8	40
Thiamin (mg/d)	1.5	3.2	2.1	1.5	1.5	1.2	1.4	0.06	1.1	ND
Riboflavin (mg/d)	1.7	3.3	2.4	1.7	1.7	1.4	1.7	0.13	1.1	ND
Niacin (mg/d)	17	18	21	19	12	12	15	0.01	14	35
Vitamin B-6 (mg/d)	2.8	7.2	4.2	3.0	1.7	1.9	2.6	0.07	1.5	100

^aMedian test for differences across ethnic groups;

^bFrom (21)

^cLatino-US = born in the US;

^dLatino-Mex = not born in the US, primarily Mexico and South and Central America;

ND = not determined