Nutrient Intake and Supplementation in the United States (NHANES II)

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Abstract: Data from the second United States Health and Nutrition Examination Survey (NHANES II) suggest that almost 35 per cent of the US population 18 to 74 years of age takes vitamin/mineral supplements regularly. Both higher nutrient intake and use of vitamin supplementation are associated with older ages, higher income, higher education level, and White race. Accounting for differences associated with sex, age, race, income, and education, persons with higher nutrient intakes remain more likely to take vitamin supplements. *Am J Public Health* 1986;76:287–289.)

Introduction

Vitamins and mineral supplements are among the most common non-prescription pharmaceuticals ingested in the United States.[1] Their use is the major pharmaceutical form of self-directed health promotional behavior practiced by the public. Yet there is little published information relating nutrient supplementation to adequacy of dietary intake for a broad cross-section of the adult US population.

Data from the second National Health and Nutrition Examination Survey (NHANES II) for persons aged 18–74 years were used to determine dietary intake of selected nutrients, the use of nutrient supplements, and the relationship between dietary intake and various demographic and behavioral factors.

Methods

The NHANES II was a cross-sectional survey conducted from February 20, 1976 through February 27, 1980 with a sample of 27,801 persons residing in the United States. The sample was selected to be representative of the civilian, non-institutionalized population ages 6 months through 74 years. Details of the complex survey sample design are presented elsewhere.[2,3]

A sub-sample of 12,503 adults ages 18–74 years (5,915 men and 6,588 women) received dietary interviews in the NHANES II. The total nutrient intakes (in milligrams per day) of six selected nutrients—calcium, iron, thiamin, riboflavin, niacin, and vitamin C—based on 24-hour dietary recalls were recorded. The survey questionnaire did not ask for an account of all vitamins and minerals taken.

The total niacin intake values included the consumption of the preformed niacin plus the fraction of dietary protein which result in the metabolic conversion of tryptophan into active nicotinic acid.[4] Since 60 mg of tryptophan is converted into 1 mg of niacin and since approximately 1 per cent of dietary protein is tryptophan, we assumed that 1/6000 of dietary protein intake (in milligrams) is converted into niacin.[4] Races other than Black or White, those with incomplete 24-hour recalls, those who reported they were on special diets or did not eat their usual diet because of illness, and pregnant or breast-feeding women were excluded from the study. The remaining sample consisted of 5,012 men and 4,965 women.

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TABLE 1—Per Cent of Persons 18–74 Years of Age in the United States Who Reported Taking Vitamins or Minerals: NHANES II, 1976–80

Demographic Variables	Both Sexes	Men (Per Cent)*	Women
Persons, 18–74 years	34.9	30.1	39.8
Age			
18–50 years	33.3	28.9	38.1
51–74 years	38.6	33.2	43.6
Race			
White	35.8	30.9	40.9
Black	26.7	22.7	30.5
Annual Family Income			
Less than $6,000	33.8	28.5	37.2
$6,000–$14,999	32.9	27.7	37.9
$15,000 or more	37.1	32.4	43.0
Education			
Less than high school	25.1	20.1	30.4
High school or equivalent	33.0	27.1	38.1
College level or more	41.8	37.6	47.0

*All standard errors of these estimates were less than 0.03 per cent.

Examinees who reported taking vitamins or minerals regularly (daily) or irregularly (at least once a week) were defined as taking vitamin supplements. All other examinees were considered as not taking vitamins or minerals.

The statistical analysis of the weighted data took into account the complex sample design.[2] Since the data best fitted a log-normal distribution, the natural log nutrient intake values were used in the statistical analysis, and geometric means are used to express average nutrient intakes.[5,6]

The association between vitamin supplementation and dietary intake of vitamins and minerals was examined separately for men and for women by multiple regression. The regression model included the linear and second order effects of age and appropriate indicator variables to account for the effects of race, annual family income, and education.[7] Preliminary analysis using SAS STEPWISE regression with the MAXR-squared option[8] indicated that the effects of other demographic variables, i.e., degree of urbanization of place of residence, region and season, were of no importance.

Results

Almost 35 per cent of respondents took a vitamin and/or mineral preparation (Table 1)—21.4 per cent regularly and 13.5 per cent irregularly. There is no significant difference in descriptive characteristics and dietary intakes between regular and irregular supplement users when these subgroups are analyzed separately. Overall, vitamin or mineral supplementation is more common among older persons, females, Whites, the more affluent, and more highly educated individuals.

Mean levels of intake estimated from the weighted data for the six nutrients studied for all subjects are shown by age

TABLE 2—Total Daily Dietary Intake of Selected Nutrients* for Persons 18–74 Years of Age in the United States: NHANES II, 1976–80

	Men			Women		
Nutrient	Ages: 18–74	18–50	51–74	18–74	18–50	51–74
Calcium	743	789 (800)	640 (800)	478	483 (800)	466 (800)
Iron	14.6	15.2 (10)	13.2 (10)	9.5	9.6 (18)	9.3 (10)
Thiamin	1.37	1.43 (1.4–1.5)	1.23 (1.2)	0.89	0.89 (1.0–1.1)	0.88 (1.0)
Riboflavin	1.90	2.01 (1.6–1.7)	1.66 (1.4)	1.18	1.19 (1.2–1.3)	1.14 (1.2)
Niacin	38.0	40.6 (18–19)	32.1 (16)	23.2	23.8 (13–14)	21.8 (13)
Vitamin C	63	64 (60)	63 (60)	53	49 (60)	64 (60)

*Geometric Mean, in mg; RDA in parentheses.

TABLE 3—Daily Dietary Intake of Selected Nutrients* (Mg) by Vitamin or Mineral Supplementation: NHANES II, 1976–80

	Male		Female	
Nutrient	Vitamins	No Vitamins	Vitamins	No Vitamins
Calcium	805	718	534	445
Iron	15.2	14.4	10.0	9.2
Thiamin	1.43	1.35	0.92	0.86
Riboflavin	2.02	1.85	1.27	1.12
Niacin	39.3	37.5	24.3	22.4
Vitamin C	79	58	65	47

*Unadjusted geometric mean values.

and sex in Table 2. Younger age persons tend to have higher dietary intakes except for women who have higher intakes of vitamin C at older ages. Taking vitamin supplements is associated with higher unadjusted daily intakes for all six nutrients studied for both sexes (Table 3).

Regression analysis (available on request to author) indicate that Blacks had lower dietary intakes than Whites for all nutrients except vitamin C. Higher levels of income and education were also associated with higher dietary intakes of most nutrients.

After adjusting for the influence of race, income, and education, the mean intake of most nutrients is still higher for those persons taking vitamin supplementation than for those not taking supplements (Table 4). The only exception is iron, for which Black males and low income males who take supplements have lower dietary intakes than those that do not do so.

When dietary intake is adjusted for total caloric intake, the association between intake and supplementation persists.

Discussion

For several nutrients, mean 24-hour intakes are less than the Recommended Dietary Allowances (RDA).[9] The importance of this finding is unclear. The 24-hour food recall interview for NHANES II was conducted on weekdays. Weekend intake may be greater for many persons and an averaged intake based on a history of a week or longer might reveal higher mean nutrient intakes. It should be born in mind that the RDA is a population-based measure purposely chosen to be higher than the daily needs of almost all individuals. The World Health Organization recommends lower daily intakes of some nutrients.[10]

Since very few dietary interviews of NHANES II examinees were conducted on the weekend, the nutrient intakes may be somewhat over- or under-estimated with respect to the demographic categories used in the regression model. However, trends in the nutrient intake data with respect to the vitamin or mineral supplementation should not be affected by the logistics of the survey.

It is not surprising that age, sex, race, income, and education are associated with both level of daily nutrient intake and with nutrient supplementation. The association of daily nutrient intake and nutrient supplementation, however, is striking. Those persons with higher nutrient intakes are the most likely to supplement their diet, even after adjustment for the other variables. While the behavioral basis for this association is unclear, it does suggest that persons most likely to take supplemental nutrients are less likely to need them, and vice-versa.

The appropriateness of vitamin and mineral supplementation has important economic, clinical, and public health ramifications. Although between $1.3 billion and $1.7 billion are spent annually on vitamin supplementation,[11,12] there are inadequate data to develop a measure of the cost-effectiveness of this practice. Supplementation often is practiced without medical indication or scientific justification,[13,14] and can have risks which include chronic over-medication and acute overdose.[15–17]

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TABLE 4—Daily Dietary Intakes* of Selected Nutrients (Mg) by Population in Subgroups: NHANES II, 1976–80

	All	White	Black	Low Income	Medium Income	High Income	Less Than High School	High School	College
CALCIUM									
Men									
Vitamin Supplement**	750	781	524	—***	—	—	693	761	759
No Vitamin Supplement	676	703	472	—	—	—	624	686	684
Women									
Vitamin Supplement	520	541	384	526	491	549	500	500	567
No Vitamin Supplement	445	462	328	468	438	438	428	428	485
IRON									
Men									
Vitamin Supplement	14.8	15.3	10.6	13.0	15.1	15.2	13.9	14.7	15.2
No Vitamin Supplement	14.6	14.9	12.4	13.3	14.6	15.0	13.5	14.7	14.8
Women									
Vitamin Supplement	10.1	10.2	8.9	9.8	10.0	10.3	9.2	10.1	10.5
No Vitamin Supplement	9.4	9.5	8.3	9.1	9.3	9.6	8.5	9.3	9.9
THIAMIN									
Men									
Vitamin Supplement	1.43	1.45	1.26	1.38	1.46	1.42	1.37	1.48	1.40
No Vitamin Supplement	1.35	1.37	1.19	1.31	1.33	1.38	1.31	1.40	1.31
Women									
Vitamin Supplement	0.92	0.93	0.81	—	—	—	0.85	0.91	0.96
No Vitamin Supplement	0.87	0.88	0.77	—	—	—	0.81	0.86	0.91
RIBOFLAVIN									
Men									
Vitamin Supplement	1.95	2.00	1.52	—	—	—	1.82	1.98	1.96
No Vitamin Supplement	1.80	1.85	1.40	—	—	—	1.67	1.83	1.81
Women									
Vitamin Supplement	1.28	1.31	1.06	1.30	1.25	1.30	1.22	1.26	1.37
No Vitamin Supplement	1.15	1.17	0.95	1.16	1.13	1.16	1.06	1.12	1.23
NIACIN									
Men									
Vitamin Supplement	40.2	41.0	33.9	37.0	40.1	41.4	37.9	41.2	39.9
No Vitamin Supplement	38.2	39.0	32.2	35.2	38.2	39.3	36.1	39.2	38.0
Women									
Vitamin Supplement	24.5	24.7	22.8	23.9	24.2	25.1	21.4	24.7	25.5
No Vitamin Supplement	22.8	23.0	21.3	22.3	22.5	23.4	20.6	22.7	24.0
VITAMIN C									
Men									
Vitamin Supplement	72	—	—	67	67	79	57	68	85
No Vitamin Supplement	55	—	—	51	51	61	44	52	65
Women									
Vitamin Supplement	60	—	—	58	58	65	48	55	79
No Vitamin Supplement	47	—	—	44	44	50	37	42	61

*Geometric mean values adjusted for age, race, income, and education by regression.
**Vitamin supplement indicates persons who report taking supplemental vitamins or minerals.
***Dashes indicate no differences at the 0.05 level between subgroups.
The geometric means in Table 4 were computed from predicted natural-log values from the regression equation (reduced model) for each nutrient. Each regression equation included terms for vitamin or mineral supplementation, age, race, annual family income, education, and first and second order interaction terms that reached at the 0.05 level of probability.

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