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Prevalence of Leading Types of Dietary Supplements Used In the Third National Health and Nutrition Examination Survey, 1988–94

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Abstract

This report presents the prevalence of the leading types of dietary supplements taken during the third National Health and Nutrition Examination Survey (NHANES III), 1988–94. Approximately 40 percent of the U.S. population 2 months of age and older reported taking some type of dietary supplement in NHANES III, and the leading supplements taken were multivitamin/multiminerals (22 percent), multivitamins plus vitamin C (15 percent), vitamin C as a single vitamin (13 percent), other dietary supplements such as herbal and botanical supplements (7 percent), and vitamin E as a single vitamin (6 percent). To some extent, the leading types of supplements and order changed after stratifying the results by sex and age groups. Other major contributors were multivitamins with iron or fluoride taken by children, iron taken by adolescent and young adult females, and calcium taken by middle-aged and elderly females. There was also a high prevalence of use of potassium among middle-aged and elderly adults but this probably reflects its use as a medication rather than as a dietary supplement. Collecting information on dietary supplement use is an important part of monitoring the nutritional status of the U.S. population.

Keywords: Dietary supplements • vitamin and mineral supplement • National Health and Nutrition Examination Survey

Introduction

In the third National Health and Nutrition Examination Survey (NHANES III), conducted between 1988 and 1994, approximately 40 percent of the U.S. population 2 months of age and older reported taking some type of dietary supplement (1). In earlier national surveys, between 36 to 51 percent of adults (2–6) and 43 percent of children 2–6 years of age (3) reported taking dietary supplements. Industry sources report sales of supplements are growing. *Nutrition Business Journal* reported that supplement sales grew from $8.6 to $14.9 billion dollars between 1994 and 1999, with growth in sales of all categories of supplements (7,8).

Some of the reasons people have given for taking supplements include: to improve nutrition, to make up for nutrients missing in the food supply, to decrease susceptibility to or severity of disease, to promote weight loss, or to increase energy or improve performance (9–13). Herbs and other dietary supplements may be taken as an alternative to conventional medical therapies (14,15). Another factor that may contribute to increased interest in use of supplements is scientific evidence linking diets high in some nutrients (for example, vitamins A, C, and E; folate; beta carotene; calcium) with a lower risk for certain diseases or other conditions (for example, certain cancers, heart disease, osteoporosis, or neural tube defects) (16–20).

An earlier report contained information on the prevalence of supplement use in NHANES III in relation to several demographic variables (1). Supplements were classified into six broadly defined categories: single vitamins, single minerals, multiple vitamins, multiple minerals, combination vitamins and minerals, and other dietary supplements such as herbal and botanical

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supplements. The earlier report presented prevalence estimates for these broad supplement categories stratified by the number of supplements taken (1). In contrast, this report identifies the leading dietary supplements reported in NHANES III, and reports their prevalence of use stratified by sex and age.

Methods

Sample population and definitions

The NHANES III was a cross-sectional survey conducted between October 1988 and October 1994. A sample representative of the civilian, noninstitutionalized population, 2 months of age and older, living in the United States was selected using a stratified multistage probability design. A detailed description of the NHANES III sample design and data collection methods are described elsewhere (21). Of the 39,695 persons eligible for the survey, 33,994 respondents (86 percent) were interviewed in the household in NHANES III, and 33,905 of these respondents provided valid yes or no responses to the supplement use question. The remaining 89 respondents had missing or unknown responses to the supplement use question and were not included in the calculations. Supplement users took a total of 17,408 dietary supplements during the month prior to the interview; 16,930 (97 percent) of these supplements could be identified and they form the basis for the analyses reported in this report. The remaining 478 supplements were products either that the respondent did not know the name of the supplement or the National Center for Health Statistics (NCHS) staff could not identify it. The nutrient/ingredient information is missing for these products and they were not included in the analyses.

Age was defined as the respondent's age in years at the time of the household interview. It was collapsed into the four age categories used in the earlier report (1). These categories were: children (2 months–11 years old), adolescents (12–19 years old), young adults (20–39 years old), and middle-aged and older adults (40 years and older).

Evaluating dietary supplement types

During the household interview respondents were asked whether they used any vitamin and/or mineral supplements in the past month. If the respondent answered yes, he or she was asked the name(s) of the supplement(s) taken and the manufacturer(s). These supplements were matched to brand name products. NHANES staff used default supplements and nutrient values when they did not have enough information to match the reported supplement with a brand name product but still knew what type of supplement it was. There were 55 supplements that respondents reported where the name was too vague for staff to code specific nutrient/ingredient information (such as vitamin B or minerals) or they could not get that information from the manufacturers. Since nothing was known about the composition of these supplements, all the nutrient/ingredient fields were coded as blank but applicable. In this report they fall in the all other supplements category. The NHANES III public-release files contain a detailed description of the supplement questions and how the dietary supplements were coded (22).

Some respondents reported using other types of dietary supplements, such as herbs or other botanical products, fiber, sports drinks, amino acids, or other biological extracts. Since the survey question did not specifically ask about use of other types of supplements, our estimates are likely to underestimate the actual intakes of these types of products. Prescription medicines and laxatives such as calciferol, niacin, calcitriol, potassium, and psyllium-containing laxatives were re-coded as dietary supplements in order to keep track of the nutrients and fiber in them, although the main purpose for taking these products may have been other than as a dietary supplement. Because the questions asked in the medicine section of the questionnaire were slightly different from the dietary supplements section, nutrient composition data are not available for the prescription medicines and laxatives that were re-coded as dietary supplements.

For this report, the supplements were re-classified into commonly recognized product types using the six broadly defined categories previously described and the nutrient composition information for each supplement. Some examples of these commonly recognized types of supplements are: vitamin C, calcium, iron, multiple vitamins with iron, or multivitamin/multimineral supplements. Single nutrient vitamins or minerals were products that contained only one vitamin or mineral. Multivitamins plus vitamin C had to contain at least thiamin, riboflavin, niacin, and vitamins A, D, and C. Multivitamins plus fluoride had to contain at least thiamin, riboflavin, niacin, vitamins A, B-12, B-6, C and D, and fluoride. The product may or may not have contained iron, but could not contain any other minerals. Multivitamins plus iron had to contain at least thiamin, riboflavin, niacin, vitamins A, B-12, B-6, C and D, and iron, but no other minerals. Multivitamin/multimineral supplements had to contain at least thiamin, riboflavin, niacin, vitamins A, B-12, B-6, C and D, calcium and iron, but not fluoride. As mentioned before, other dietary supplements included herbs, botanical products, amino acids, sport drinks, and other biological extracts. Any of the re-classified supplements that were used by less than 5 percent of a given sex and age group were put in the ''all others'' category.

Statistical analyses

Survey sampling weights were used in all the analyses reported to produce estimates that were representative of the noninstitutionalized civilian U.S. population. SUDAAN was used to calculate the prevalence of supplement use, the percentage of each product type taken and its standard error (23). SUDAAN incorporates the sample weights and adjusts for the surveys' complex sample design in calculating

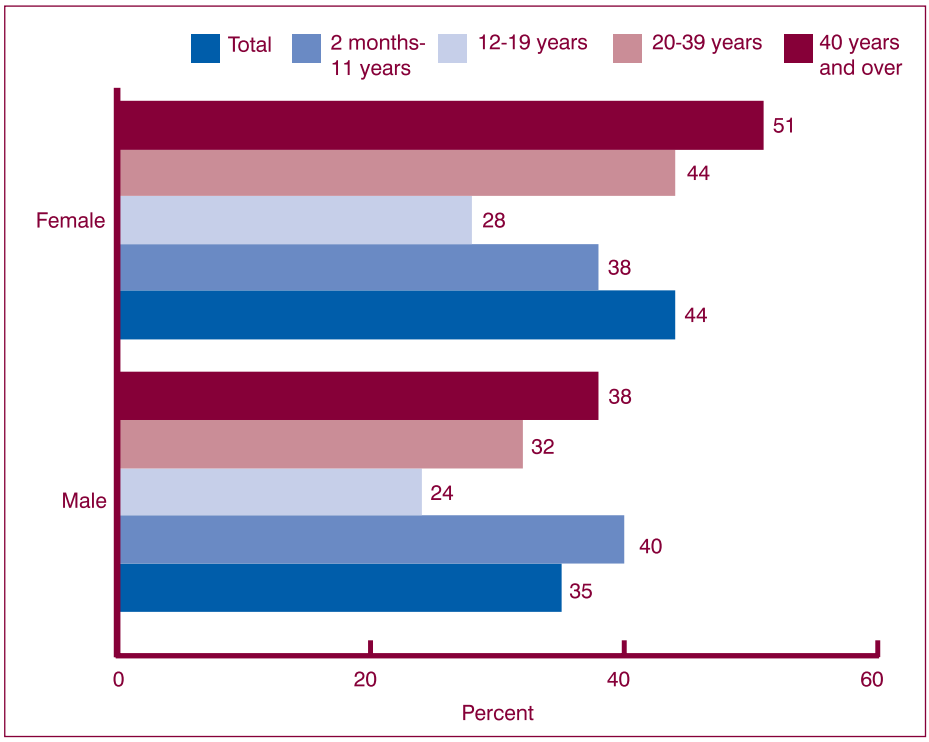

Figure 1. Prevalence of supplement use by sex and age groups

the appropriate standard errors (SEs). Results are reported by sex and age group.

Results

Thirty-five percent of males and 44 percent of females reported taking dietary supplements during the month preceding the household interview (figure 1). For both males and females, supplement use was highest among children and adults and lowest among adolescents. Adult females took more supplements than children and adolescents, but this pattern was not true for males.

The leading supplements taken in NHANES III were multivitamin/multiminerals (22 percent), multivitamins plus vitamin C (15 percent), vitamin C as a single vitamin (13 percent), other dietary supplements (7 percent), and vitamin E as a single vitamin (6 percent) (table 1). Even when the results were partitioned by sex, the same order remained for these supplements. In addition, 6 percent of females took calcium in the form of a single mineral supplement.

After stratifying by sex and age, the leading types of supplements and order changed slightly. The leading supplements reported by children, regardless of sex, were multivitamins plus vitamin C (47 percent), multivitamin/multiminerals (13 percent), multivitamins plus iron (10 percent), vitamin C (7 percent), and multivitamins plus fluoride (6 percent) (table 1). The three leading supplements used by adolescent and adult males and adolescent and young adult females were the same as the total population—multivitamin/multiminerals, multivitamins plus vitamin C, and vitamin C as a single vitamin—although the order varied by sex and age group. Together these supplement types represented 47–62 percent of all supplements taken by these groups. Among middle-aged and elderly females, 18 percent took multivitamin/multiminerals, 11 percent took vitamin C, and 8 percent took multivitamins plus vitamin C.

Other leading vitamins and minerals taken by adolescent and adult males and females included: vitamin E by 5 percent of young adult males and adolescent and young adult females, and 9 percent of middle-aged and elderly males and females; iron by 6 and 7 percent of adolescent and young adult females, respectively; and calcium by 8 percent of middle-aged and elderly females. Five and 6 percent of middle-aged and elderly males and females, respectively, reported taking potassium. Although interviewers did not ask survey participants about their use of other dietary supplements, such as herbal and botanical products, sports drinks, amino acids, or biological extracts, 8 to 11 percent of adolescent and adult males and 6 to 8 percent of adult females reported using supplements that fell in this category.

Discussion

Between 1988 and 1994 about two out of every five people in the U.S. population reported taking a dietary supplement (1), and the leading supplements they took were multivitamin/multiminerals, multivitamins plus vitamin C, vitamins C and E as single vitamins, and other dietary supplements such as herbal and botanical supplements. Nearly two out of every three (63 percent) supplements taken were one of these types of supplements. However, the prevalence of use of each of these types of supplements varied by sex and age group. The most common supplements that children took were multivitamins plus vitamin C followed by multivitamin/multiminerals, multivitamins plus iron, multivitamins plus fluoride, and vitamin C. Use of vitamin E was not as popular among adolescent males as it was among adolescent females and adult males and females. Other leading dietary supplements were: iron for adolescent and young adult females, calcium for middle-aged and elderly females, and potassium for middle-aged and elderly males and females. The high prevalence of use of potassium among middle-aged and elderly adults probably reflects its use as a medication since most of the potassium products were originally coded in the prescription medicines section and later moved to the dietary supplements section.

The leading types of supplements used in the U.S. have not changed much in the past three decades. Other surveys have reported that the most common product types used by adults in the United States were single vitamins, multivitamins, and vitamin and mineral combinations (2–6,24). In the most recent NHANES survey, NHANES 1999–2000, the most commonly reported supplements among adults were multivitamin/multimineral formulas, which included multivitamins with or without minerals, and vitamins E and C (25). In one national survey the most common type of supplement for children was multivitamins (3), and in another it was multivitamins and minerals with or without iron (26). Two recent studies reported adolescent supplement users were most likely to take multivitamins or multivitamins with minerals (27, 28). The leading single nutrient supplements have been vitamins A, C, and E; calcium; and iron (4–6,27,28).

Many survey participants reported using herbal or botanical products, fiber, sports drinks, amino acids, or biological extracts (supplements that fell in the other dietary supplements category) although the survey questions were not designed to collect this type of information. These types of products were grouped together in one category since there were limited counts for each supplement listed individually by the sex and age groups shown in this report. Even though these results probably underestimate true intake of nonvitamin, nonmineral supplements, they were still the fourth most frequently reported supplement for adolescent and adult males and the fifth and sixth most frequently reported supplement for young adult and middle-aged and elderly females, respectively. A more detailed description of the nonvitamin, nonmineral supplements reported in NHANES III is presented elsewhere and will not be repeated here (29). Other research has reported anywhere from 8 to 48 percent of adolescents and adults have reported using herbal and other nonvitamin, nonmineral supplements (24,27,30–33).

The high prevalence of supplement use among children probably should not be surprising. Other researchers have reported a high prevalence of supplement use among young children, and the most commonly consumed supplements were multivitamins with or without iron and multivitamin/multiminerals (3,26). Kleinman (34) noted that many health professionals routinely prescribe supplements for children although there is little evidence to recommend dietary supplementation for healthy children. Pediatricians may prescribe fluoride for children to prevent dental caries when the water supply is not adequately fluoridated (35). Besides advice from medical care providers, other reasons for the high prevalence of supplement use among children may be as a remedy for a child's poor appetite or eating problems, the mother's use of supplements, and marketing strategies directed at mothers and children justifying their need for dietary supplements (26,34,36).

Use of iron among adolescent and young adult females and calcium among middle-aged and elderly adult females, either as multivitamin/multiminerals or as single minerals, may reflect their efforts to compensate for iron losses during menstruation and to prevent osteoporosis. Certainly the Dietary Reference Intakes and the Healthy People 2010 objectives encourage people to consume adequate amounts of calcium in order to achieve peak bone mass and reduce the risk of developing osteoporosis (20,37).

In conclusion, a sizeable proportion of the population takes dietary supplements, and the types taken vary by sex and age group. Collecting information on dietary supplement use is an important part of monitoring the nutritional status of the U.S. population. Not only does it provide a profile of the types of supplements the U.S. population uses, but it is also used to calculate total nutrient intakes. In addition, supplement use data play an important role in developing and evaluating nutrition policies such as the policy establishing fortification of food with folic acid and the Dietary Guidelines for Americans.

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Table 1. Leading dietary supplements taken by sex and age group in NHANES III[1]

All ages				2 months–11 years[2]				12–19 years			
Sex and supplement name[3]	Number[4]	Percent[5]	SE[6]	Supplement name	Number	Percent	SE	Supplement name	Number	Percent	SE
Total population											
Multivitamins/Multiminerals	3,328	22	0.6	Multivitamins + C	1,875	47	2.1	Multivitamins/Multiminerals	225	22	2.5
Multivitamins + C	3,291	15	0.6	Multivitamins/Multiminerals	474	13	1.2	Vitamin C	149	20	2.2
Vitamin C	1,606	13	0.5	Multivitamins + Iron	347	10	1.6	Multivitamins + C	197	19	1.9
Other dietary supplements	1,160	7	0.4	Vitamin C	169	7	1.2	Other dietary supplements	55	6	1.6
Vitamin E	919	6	0.4	Multivitamins + Fluoride	240	6	1.2	All other supplements	323	33	2.2
All other supplements	6,626	36	0.6	All other supplements	979	16	1.1	Total	949	100	
Total	16,930	99		Total	4,084	99					
Male											
Multivitamins/Multiminerals	1,294	22	0.9	Multivitamins + C	923	47	2.1	Vitamin C	72	24	3.4
Multivitamins + C	1,559	18	0.8	Multivitamins/Multiminerals	232	13	1.5	Multivitamins/Multiminerals	77	21	4.0
Vitamin C	728	15	0.8	Multivitamins + Iron	168	11	1.7	Multivitamins + C	86	17	3.3
Other dietary supplements	530	8	0.7	Multivitamins + Fluoride	114	7	1.5	Other dietary supplements	34	8	2.8
Vitamin E	359	6	0.5	Vitamin C	88	7	1.4	All other supplements	110	29	3.4
All other supplements	2,475	32	0.7	All other supplements	512	16	1.1	Total	379	99	
Total	6,945	101		Total	2,037	101					
Female											
Multivitamins/Multiminerals	2,034	22	0.7	Multivitamins + C	952	47	2.9	Multivitamins/Multiminerals	148	23	3.0
Multivitamins + C	1,732	14	0.7	Multivitamins/Multiminerals	242	14	1.4	Multivitamins + C	111	20	2.9
Vitamin C	878	11	0.5	Multivitamins + Iron	179	10	1.8	Vitamin C	77	16	3.6
Other dietary supplements	630	7	0.4	Vitamin C	81	7	1.8	Iron	54	6	1.1
Vitamin E	560	7	0.4	Multivitamins + Fluoride	126	6	1.3	Vitamin E	21	5	1.3
Calcium	464	6	0.4	All other supplements	467	16	1.7	All other supplements	159	30	3.2
All other supplements	3,687	34	0.6	Total	2,047	100		Total	570	100	
Total	9,985	101									

[1]Unidentifiable products were deleted from the analyses.

[2]Age categories: children (2 months–11 years), adolescents (12–19 years), young adults (20–39 years), and middle-aged and elderly adults (40 years and over).

[3]Definitions of supplement types:

Multivitamins + C: Must contain at least thiamin, riboflavin, niacin, and vitamins A, D, and C.

Multivitamins + fluoride: Must contain at least thiamin, riboflavin, niacin, vitamins A, B-12, B-6, C and D, plus fluoride. May or may not contain iron. No other minerals present.

Multivitamins + iron: Must contain at least thiamin, riboflavin, niacin, vitamins A, B-12, B-6, C and D, plus iron. No other minerals present.

Multivitamins/multiminerals: Must contain at least thiamin, riboflavin, niacin, vitamins A, B-12, B-6, C and D, calcium and iron. No fluoride.

Other dietary supplements: Includes herbs, botanical products, amino acids, sport drinks, and other biological extracts.

All other supplements: Supplements included in this category were reported by less than 5 percent of the participants.

[4]Actual count of supplements taken.

[5]Population weighted percent of supplements taken. Percentages may not sum to 100% due to rounding errors.

[6]Standard error.

20–39 years				40 years and over			
Supplement name	Number	Percent	SE	Supplement name	Number	Percent	SE
Multivitamins/Multiminerals	1,041	30	1.1	Multivitamins/Multiminerals	1,588	19	0.7
Multivitamins + C	455	13	0.9	Vitamin C	921	13	0.5
Vitamin C	367	13	0.8	Multivitamins + C	764	9	0.6
Other dietary supplements	311	8	0.7	Other dietary supplements	762	9	0.6
Iron	238	5	0.5	Vitamin E	720	9	0.5
Vitamin E	155	5	0.5	Calcium	452	6	0.4
All other supplements	886	26	1.0	Potassium (all forms)	634	5	0.3
Total	3,453	100		All other supplements	2,603	30	0.8
				Total	8,444	100	
Multivitamins/Multiminerals	352	29	2.3	Multivitamins/Multiminerals	633	20	1.6
Vitamin C	178	17	1.3	Vitamin C	390	15	0.8
Multivitamins + C	204	14	1.2	Multivitamins + C	346	12	1.1
Other dietary supplements	174	11	1.5	Other dietary supplements	305	9	1.0
Vitamin E	63	5	0.7	Vitamin E	280	9	0.9
All other supplements	355	25	2.0	Potassium (all forms)	224	5	0.5
Total	1,326	101		All other supplements	1,025	31	1.2
				Total	3,203	101	
Multivitamins/Multiminerals	689	31	1.4	Multivitamins/Multiminerals	955	18	0.8
Multivitamins + C	251	12	1.1	Vitamin C	531	11	0.5
Vitamin C	189	10	0.8	Vitamin E	440	9	0.5
Iron	210	7	0.7	Calcium	382	8	0.6
Other dietary supplements	137	6	0.8	Multivitamins + C	418	8	0.5
Vitamin E	92	5	0.6	Other dietary supplements	457	8	0.6
All other supplements	559	28	1.1	Potassium (all forms)	410	6	0.4
Total	2,127	99		All other supplements	1,648	31	1.0
				Total	5,241	99	

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