

Dietary Intake of Selected Minerals for the United States Population: 1999–2000

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Abstract

This report presents dietary intake estimates for selected minerals from the National Health and Nutrition Examination Survey, 1999–2000, for the U.S. population. These minerals included: calcium, copper, iron, magnesium, phosphorus, potassium, selenium, sodium, and zinc. Mineral intakes are estimated from one 24-hour dietary recall interview. Population means, medians, and standard errors of the mean are weighted to produce national estimates, and are presented by sex and age groups. Assessment of dietary intakes is an important part of monitoring the nutritional status of the U.S. population.

Keywords: minerals • 24-hour dietary recall • National Health and Nutrition Examination Survey • dietary intake

Introduction

Minerals are involved in a wide range of critical functions in the human body. Calcium, phosphorus, and magnesium are essential in forming and maintaining bones (1). Osteoporosis, a disease affecting more than 28 million Americans over the age of 65, is characterized by a decline in bone mass, reduced bone strength, and increased risk of fractures (2). Regular exercise and a diet with enough calcium help maintain good bone health and reduce the risk of osteoporosis later in life (3). In addition, calcium plays a role in blood clotting (4,5) while phosphorus and magnesium play essential roles in energy metabolism (1,5,6).

The electrolytes sodium and potassium along with calcium, phosphorus, and magnesium play important roles in neural transmission, muscular activity, vascular constriction and dilation, and maintaining normal acid-base balance, osmotic pressure, and normal water balance (1,4,6–8). Increased sodium chloride or salt intake is associated with increased risk for developing hypertension, which is a risk factor for cardiovascular and renal diseases (7). The *Dietary Guidelines for Americans* recommends cutting back on salt and salty foods and seasonings (9).

Phosphorus, magnesium, copper, and zinc act as components of enzyme systems or cofactors in enzymatic reactions (1,5,6,10). In addition,

phosphorus is a component of nucleotides, nucleic acids, and cell membranes (6) and zinc plays a structural role in a number of proteins (10). Iron is a component of hemoglobin and myoglobin, carrying oxygen in the blood and muscles, respectively (5). Anemia may be associated with iron deficiency (5), and impaired immune functioning may be associated with iron and zinc deficiencies (10). Finally, copper and selenium act to defend the body against oxidative damage (10,11). This report contains mean and median dietary intakes for calcium, copper, iron, magnesium, phosphorus, potassium, selenium, sodium, and zinc for the U.S. population during 1999–2000.

The National Health and Nutrition Examination Surveys (NHANES) provide information on the health and nutritional status of the civilian, noninstitutionalized population of the United States residing in the 50 States and the District of Columbia. Beginning in 1999, the NHANES became a continuous survey. Each annual survey is based on a nationally representative sample, but two or more years of data are necessary to provide adequate sample sizes for subgroup analyses. NHANES 1999–2000 is the first of the 2-year data releases planned for the survey.



Methods

Data source

The survey sample covered all ages, but the following subgroups were oversampled to allow for more precise estimates for these groups: adolescents 12–19 years of age, persons 60 years of age and over, Mexican Americans, black or African American persons, low income persons, and pregnant women. More information on the NHANES 1999–2000 survey design and data collection methods, as well as public-use microdata files, can be found at the NHANES website: <http://www.cdc.gov/nchs/nhanes.htm>.

A total of 12,160 persons were eligible for the survey in 1999–2000; nearly 76 percent (n=9,282) of these persons were examined in the mobile exam center. Nearly 93 percent (n=8,604) of the examined persons had complete and reliable dietary recall data and were included in the analyses for these tables. A 20-percent random subsample had their dietary recall interview conducted by telephone as part of a methodologic study to consider the feasibility of conducting the 24-hour recall interview over the telephone. While the means for the telephone recall were sometimes higher than those for the in-person recall, their impact on the estimates for the full sample were minor. Therefore, the estimates in these tables are computed for the full NHANES 1999–2000 sample. There were some extreme mineral intakes but these values were deemed plausible given the types and amounts of foods that the sample persons consumed. All values were included in the final analyses.

The estimates are based on one 24-hour dietary recall. Interviewers conducted the 24-hour recall using an automated data collection system developed by the survey contractor, Westat, Inc, for use in the NHANES 1999–2001. The intake information was coded to USDA's Survey Nutrient Database (versions 1994–96 and 1998) to produce the nutrient intake values.

Statistical analysis

Population means, medians, and standard errors of the means were weighted to produce national estimates and are reported by sex and age groups in the accompanying table. The sample weights incorporate the differential probabilities of selection and include adjustments for oversampling of certain populations, noncoverage, and nonresponse. Standard errors were estimated using SUDAAN by means of the “delete 1 jackknife (JK1) method” in contrast to the Taylor Series Linearization method that was used in previous NHANES to estimate standard errors (12,13). The age categories are those that were recommended in the NHANES 1999–2000 Analytic Guidelines and are based on the survey sample domains (12). The relative standard error (RSE) is the statistical criterion used to determine the reliability of the estimates and is calculated as the ratio of the standard error of the mean to the mean multiplied by 100. The larger the RSE, the less reliable the estimates are. A RSE greater than 25–30 percent is often recommended to define estimates that are not reliable (14). In these tables, all of the RSEs were less than 10 percent. Therefore, all of the estimates are considered to be statistically reliable.

References

1. Committee on Diet and Health. Food and Nutrition Board. National Research Council. Minerals. In: Diet and health: implications for reducing chronic disease risk. 347–66. Washington, DC: National Academy Press. 1989.
2. Layne JE, Nelson ME. Osteoporosis. In: Exercise, nutrition, and the older woman: wellness for women over fifty. (Singh, M.A.F., ed.). 371–94. Washington, DC: CRC Press. 2000.
3. U.S. Department of Health and Human Services. Healthy People 2010. 2nd edition. Objectives for Improving Health (Part B: Focus Areas 15–28). Vol. II. Objective 19–11. Washington, DC: U.S. Government Printing Office. 2000.
4. Krall, E. Calcium and vitamin D. In: Exercise, nutrition, and the older woman: wellness for women over fifty. (Singh, M.A.F., ed.). 173–181. Washington, DC: CRC Press. 2000.
5. Krause MV, Mahan LK. Minerals. In: Food, nutrition, and diet therapy, 7th edition. 144–80. Philadelphia, PA: W. B. Saunders Company. 1984.
6. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. Food and Nutrition Board. Institute of Medicine. Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D, and fluoride. Washington, DC: National Academy Press. 1997.
7. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. Food and Nutrition Board. Institute of Medicine. Dietary reference intakes for water, potassium, sodium, chloride, and sulfate. Washington, DC: National Academy Press. 2004. (<http://www.nap.edu/catalog/10925.html>. Accessed: February 20, 2004).
8. Krause MV, Mahan LK. Water and electrolytes. In: Food, nutrition, and diet therapy, 7th edition. 180–91. Philadelphia, PA: W. B. Saunders Company. 1984.
9. U.S. Department of Agriculture (USDA) and U.S. Department of Health and Human Services (HHS). Dietary Guidelines for Americans. 5th edition. USDA Home and Garden Bulletin No. 232. Washington, DC: U.S. Department of Agriculture. 2000.
10. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. Food and Nutrition Board. Institute of Medicine. Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Washington, DC: National Academy Press; 2001.
11. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. Food and Nutrition Board. Institute of Medicine. Selenium. In: Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids. 284–324. Washington, DC: National Academy Press; 2000.

12. U.S. Department of Health and Human Services. NHANES 1999–2000 Addendum to the NHANES III Analytic Guidelines. August 30, 2002. Available at: <http://www.cdc.gov/nchs/data/nhanes/guidelines1.pdf>.
13. Wolter, KM, Introduction to Variance Estimation, New York: Springer-Verlag, 1990.
14. U.S. Department of Health and Human Services. Analytic and Reporting Guidelines: The Third National Health and Nutrition Examination Survey, NHANES III (1988–94). In: NHANES III reference manuals and reports (CD-ROM). Hyattsville, MD: Centers for Disease Control and Prevention, 1996. Available at: <http://www.cdc.gov/nchs/data/nhanes/nhanes3/nh3gui.pdf>.

Table 1. Dietary intake of selected minerals by sex and age: United States, 1999–2000

Nutrient and age	Both sexes				Male				Female			
	Sample size	Mean	Standard error of the mean	Median	Sample size	Mean	Standard error of the mean	Median	Sample size	Mean	Standard error of the mean	Median
Calcium (mg)												
All ages ¹	8,604	863	12.0	735	4,206	966	15.7	832	4,398	765	16.7	657
Under 6 years ¹	1,195	853	25.6	768	628	916	35.3	809	567	785	27.5	708
6–11 years	962	889	31.2	821	494	915	45.5	843	468	860	41.5	812
12–19 years	2,208	938	24.9	787	1,105	1,081	31.9	956	1,103	793	26.5	661
20–39 years	1,484	909	19.8	762	635	1,025	36.7	856	849	797	32.4	684
40–59 years	1,218	853	24.8	720	577	969	36.5	834	641	744	28.7	621
60 years and over	1,537	721	18.4	619	767	797	27.0	716	770	660	21.3	563
Copper (mg)												
All ages ¹	8,604	1.2	0.02	1.1	4,206	1.4	0.02	1.2	4,398	1.1	0.02	1.0
Under 6 years ¹	1,195	0.8	0.01	0.7	628	0.8	0.02	0.7	567	0.7	0.02	0.7
6–11 years	962	1.0	0.03	0.9	494	1.0	0.05	0.9	468	0.9	0.03	0.8
12–19 years	2,208	1.2	0.02	1.0	1,105	1.3	0.04	1.2	1,103	1.0	0.03	0.9
20–39 years	1,484	1.3	0.03	1.2	635	1.6	0.05	1.3	849	1.1	0.03	1.0
40–59 years	1,218	1.3	0.03	1.2	577	1.5	0.05	1.4	641	1.2	0.03	1.1
60 years and over	1,537	1.2	0.03	1.0	767	1.4	0.05	1.2	770	1.1	0.05	0.9
Iron (mg)												
All ages ¹	8,604	15.2	0.25	13.0	4,206	17.2	0.30	15.1	4,398	13.4	0.28	11.4
Under 6 years ¹	1,195	12.9	0.37	11.0	628	13.6	0.62	12.2	567	12.1	0.41	10.7
6–11 years	962	14.4	0.44	12.5	494	15.3	0.66	13.1	468	13.3	0.50	11.5
12–19 years	2,208	15.9	0.48	13.7	1,105	18.3	0.65	16.4	1,103	13.4	0.44	11.7
20–39 years	1,484	15.8	0.32	13.4	635	17.9	0.45	15.7	849	13.7	0.47	11.6
40–59 years	1,218	15.5	0.45	13.7	577	17.6	0.59	15.9	641	13.6	0.50	11.6
60 years and over	1,537	14.8	0.34	12.2	767	17.3	0.66	14.3	770	12.8	0.41	10.8
Magnesium (mg)												
All ages ¹	8,604	271	3.4	243	4,206	309	3.5	283	4,398	235	4.4	211
Under 6 years ¹	1,195	189	4.0	178	628	201	6.7	192	567	175	4.1	169
6–11 years	962	222	5.7	205	494	233	8.9	214	468	211	7.7	192
12–19 years	2,208	250	5.3	217	1,105	284	8.2	258	1,103	216	5.7	193
20–39 years	1,484	289	4.5	257	635	337	7.0	296	849	242	8.6	215
40–59 years	1,218	302	5.8	281	577	349	7.2	337	641	258	7.3	235
60 years and over	1,537	271	4.7	251	767	316	6.8	298	770	236	6.5	220
Phosphorus (mg)												
All ages ¹	8,604	1,277	12.8	1,159	4,206	1,461	18.0	1,349	4,398	1,100	16.5	1,022
Under 6 years ¹	1,195	968	21.5	913	628	1,036	33.3	997	567	893	21.6	855
6–11 years	962	1,175	30.1	1,078	494	1,216	42.7	1,120	468	1,130	44.1	1,015
12–19 years	2,208	1,314	25.0	1,172	1,105	1,533	37.0	1,393	1,103	1,093	27.3	1,020
20–39 years	1,484	1,398	23.2	1,251	635	1,610	40.3	1,487	849	1,194	33.2	1,084
40–59 years	1,218	1,330	23.8	1,239	577	1,565	35.6	1,474	641	1,111	29.7	1,055
60 years and over	1,537	1,131	16.2	1,055	767	1,305	26.3	1,270	770	990	23.7	946
Potassium (mg)												
All ages ¹	8,604	2,628	30.0	2,422	4,206	2,952	34.4	2,781	4,398	2,319	42.2	2,142
Under 6 years ¹	1,195	1,972	43.7	1,789	628	2,073	67.6	1,888	567	1,861	46.8	1,713
6–11 years	962	2,191	60.5	2,028	494	2,255	98.2	2,061	468	2,122	85.0	1,968
12–19 years	2,208	2,474	53.2	2,182	1,105	2,781	75.8	2,529	1,103	2,162	58.2	1,966
20–39 years	1,484	2,725	39.5	2,466	635	3,114	67.9	2,916	849	2,348	72.6	2,138
40–59 years	1,218	2,914	61.2	2,760	577	3,332	71.1	3,186	641	2,523	80.7	2,387
60 years and over	1,537	2,676	48.0	2,510	767	3,059	78.0	2,904	770	2,367	58.0	2,302
Selenium (mcg)												
All ages ¹	8,604	103.1	1.33	90.1	4,206	120.1	1.78	106.7	4,398	86.9	1.57	78.5
Under 6 years ¹	1,195	60.1	1.19	56.5	628	63.2	1.71	59.9	567	56.7	1.85	53.0
6–11 years	962	88.5	2.93	79.6	494	94.3	4.60	83.8	468	82.2	3.08	74.4
12–19 years	2,208	101.2	2.42	88.8	1,105	117.4	3.79	104.8	1,103	84.9	2.41	76.0
20–39 years	1,484	114.5	2.12	101.3	635	134.6	2.81	119.9	849	95.2	2.91	86.2
40–59 years	1,218	112.9	2.48	99.9	577	137.2	4.25	124.4	641	90.3	2.76	82.1
60 years and over	1,537	95.9	2.25	85.8	767	111.5	3.59	98.1	770	83.4	2.14	76.2

See footnotes at end of table.

Table 1. Dietary intake of selected minerals by sex and age: United States, 1999–2000—Con.

Nutrient and age	Both sexes				Male				Female			
	Sample size	Mean	Standard error of the mean	Median	Sample size	Mean	Standard error of the mean	Median	Sample size	Mean	Standard error of the mean	Median
Sodium (mg)												
All ages ¹	8,604	3,375	37.4	3,017	4,206	3,877	60.5	3,510	4,398	2,896	39.9	2,644
Under 6 years ¹	1,195	2,114	55.3	2,045	628	2,223	71.9	2,206	567	1,995	71.6	1,944
6–11 years	962	3,255	125.3	2,971	494	3,500	217.1	3,141	468	2,993	98.7	2,783
12–19 years	2,208	3,586	76.7	3,120	1,105	4,124	125.8	3,645	1,103	3,041	90.1	2,737
20–39 years	1,484	3,735	63.2	3,385	635	4,329	102.7	4,028	849	3,161	74.8	2,871
40–59 years	1,218	3,535	69.1	3,268	577	4,132	112.0	3,706	641	2,978	86.5	2,809
60 years and over	1,537	2,940	57.7	2,660	767	3,447	97.0	3,250	770	2,532	67.1	2,333
Zinc (mg)												
All ages ¹	8,604	11.4	0.16	9.6	4,206	13.3	0.21	11.5	4,398	9.7	0.21	8.2
Under 6 years ¹	1,195	8.1	0.19	7.3	628	8.4	0.28	7.6	567	7.7	0.26	7.0
6–11 years	962	10.6	0.34	9.1	494	11.0	0.50	9.4	468	10.0	0.45	8.8
12–19 years	2,208	11.9	0.33	10.3	1,105	14.3	0.50	12.3	1,103	9.6	0.29	8.4
20–39 years	1,484	12.4	0.27	10.4	635	14.8	0.49	12.7	849	10.1	0.34	8.5
40–59 years	1,218	11.9	0.28	10.5	577	13.9	0.39	12.8	641	10.1	0.39	8.4
60 years and over	1,537	10.6	0.36	8.6	767	12.2	0.37	10.6	770	9.3	0.59	7.4

¹Excludes nursing infants and children.

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