
Dietary supplements are often implicated in preventable adverse drug events in children and adolescents, yet current data on their use in this population are lacking. We used nationally representative data from the National Health and Nutrition Examination Surveys (NHANES) to estimate the prevalence of dietary supplement use, including the use of both nutritional products and alternative medicines, among children and adolescents in the United States.

Methods | We reviewed 6 recent 2-year cycles (2003-2004 through 2013-2014) of NHANES data and restricted our sample to children and adolescents (aged 0-19 years) who responded to the dietary supplement questionnaire. A parent or caregiver provided information for survey participants who were younger than 16 years and for those who could not answer the questionnaire for themselves. Dietary supplement data were collected during the household interview. Participants were asked whether they had "used or taken any vitamins, minerals, herbs, or other dietary supplements in the past 30 days." Those participants who answered yes were asked to show the interviewer the containers for all the dietary supplements used. Nutritional products were defined as all products that primarily contain vitamins or minerals. Alternative medicines were defined as herbal, nonvitamin, or nonmineral supplements. Each supplement was further classified by its primary use (eg, bodybuilding) or its primary ingredient (eg, ω-3 fatty acids). The study was considered exempt by a University of Illinois at Chicago institutional review board.

We used descriptive statistics to estimate the prevalence of dietary supplement use for each of the 6 cycles of NHANES data examined. All prevalence estimates and CIs use Taylor linearization methods to incorporate sample weights that adjust for the complex sampling methods in NHANES. We used Stata, version 14 (StataCorp) to perform all analyses. All P values reported are 2-sided; P < .05 denotes statistical significance. All analyses were performed from November 1, 2017, to February 28, 2018.

Results | In 2013-2014, of 4404 individuals whose NHANES data were reviewed, 1603 (36.4%) were children aged 0 to 5 years, 1563 (35.5%) were aged 6 to 12 years, and 1238 (28.1%) were adolescents aged 13 to 19 years; 2243 (50.9%) were boys. Similar to 2003-2004, 33.2% (95% CI, 30.4%-36.2%) of children and adolescents used dietary supplements from 2013 through 2014 (Figure, A). While the use of nutritional products did not change between 2003 to 2004 and 2013 to 2014, the use of alternative medicines nearly doubled (3.7%; 95% CI, 2.8%-4.7% vs 6.7%; 95% CI, 4.8%-8.3%; P < .001). The higher rate in the use of alternative medicines was primarily because of increases in the use of ω-3 fatty acid supplements (0.4%; 95% CI, 0.2%-0.9% vs 2.3%; 95% CI, 1.4%-3.5%; P < .001) and melatonin supplements (0% vs 0.9%; 95% CI, 0.5%-1.7%; P < .001). In both boys and girls, the use of any dietary supplements, specifically nutritional products, was lowest and of alternative medicines was highest during adolescence (aged 13-19 years) (Figure, B).

From 2013 to 2014, multivitamins were the most commonly used dietary supplement (25.1%; 95% CI, 22.3%-28.1%) followed by supplements for immunity (3.8%; 95% CI, 2.8%-5.2%), ω-3 fatty acids (2.3%; 95% CI, 1.4%-3.6%), and sleep aids (1.1%; 95% CI, 0.6%-1.9%) (Table). Significant sex differences were only observed during adolescence: iron, calcium, multivitamins, and single vitamins, particularly vitamin B products, were more commonly used among adolescent girls, whereas adolescent boys were more likely to use ω-3 fatty acid supplements and bodybuilding supplements.


Dietary supplements are often implicated in preventable adverse drug events in children and adolescents, yet current data on their use in this population are lacking. We used nationally representative data from the National Health and Nutrition Examination Surveys (NHANES) to estimate the prevalence of dietary supplement use, including the use of both nutritional products and alternative medicines, among children and adolescents in the United States.

Methods | We reviewed 6 recent 2-year cycles (2003-2004 through 2013-2014) of NHANES data and restricted our sample to children and adolescents (aged 0-19 years) who responded to the dietary supplement questionnaire. A parent or caregiver provided information for survey participants who were younger than 16 years and for those who could not answer the questionnaire for themselves. Dietary supplement data were collected during the household interview. Participants were asked whether they had “used or taken any vitamins, minerals, herbs, or other dietary supplements in the past 30 days.” Those participants who answered yes were asked to show the interviewer the containers for all the dietary supplements used. Nutritional products were defined as all products that primarily contain vitamins or minerals. Alternative medicines were defined as herbal, nonvitamin, or nonmineral supplements. Each supplement was further classified by its primary use (eg, bodybuilding) or its primary ingredient (eg, ω-3 fatty acids). The study was considered exempt by a University of Illinois at Chicago institutional review board.

We used descriptive statistics to estimate the prevalence of dietary supplement use for each of the 6 cycles of NHANES data examined. All prevalence estimates and CIs use Taylor linearization methods to incorporate sample weights that adjust for the complex sampling methods in NHANES. We used Stata, version 14 (StataCorp) to perform all analyses. All P values reported are 2-sided; P < .05 denotes statistical significance. All analyses were performed from November 1, 2017, to February 28, 2018.

Results | In 2013-2014, of 4404 individuals whose NHANES data were reviewed, 1603 (36.4%) were children aged 0 to 5 years, 1563 (35.5%) were aged 6 to 12 years, and 1238 (28.1%) were adolescents aged 13 to 19 years; 2243 (50.9%) were boys. Similar to 2003-2004, 33.2% (95% CI, 30.4%-36.2%) of children and adolescents used dietary supplements from 2013 through 2014 (Figure, A). While the use of nutritional products did not change between 2003 to 2004 and 2013 to 2014, the use of alternative medicines nearly doubled (3.7%; 95% CI, 2.8%-4.7% vs 6.7%; 95% CI, 4.8%-8.3%; P < .001). The higher rate in the use of alternative medicines was primarily because of increases in the use of ω-3 fatty acid supplements (0.4%; 95% CI, 0.2%-0.9% vs 2.3%; 95% CI, 1.4%-3.5%; P < .001) and melatonin supplements (0% vs 0.9%; 95% CI, 0.5%-1.7%; P < .001). In both boys and girls, the use of any dietary supplements, specifically nutritional products, was lowest and of alternative medicines was highest during adolescence (aged 13-19 years) (Figure, B).

From 2013 to 2014, multivitamins were the most commonly used dietary supplement (25.1%; 95% CI, 22.3%-28.1%) followed by supplements for immunity (3.8%; 95% CI, 2.8%-5.2%), ω-3 fatty acids (2.3%; 95% CI, 1.4%-3.6%), and sleep aids (1.1%; 95% CI, 0.6%-1.9%) (Table). Significant sex differences were only observed during adolescence: iron, calcium, multivitamins, and single vitamins, particularly vitamin B products, were more commonly used among adolescent girls, whereas adolescent boys were more likely to use ω-3 fatty acid supplements and bodybuilding supplements.
Discussion | Using nationally representative data from NHANES, we found that 33.2% of children and adolescents in the United States use dietary supplements. Many of the most commonly used supplements, including multivitamins, are implicated in preventable adverse drug events among this population. In addition, commonly used nutritional products (eg, iron, calcium, and vitamin D) and alternative medicines (eg, bodybuilding supplements), are also increasingly associated with adverse cardiovascular effects, including arrhythmias, that can lead to sudden cardiac death, a serious yet under-
reported problem in children and adolescents.\(^5\) The growing use of alternative medicines, specifically melatonin and ω-3 fatty acid supplements, which are promoted as having cognitive and sleep benefits for patients with attention-deficit/hyperactivity disorder,\(^6\) is particularly noteworthy given that attention-deficit/hyperactivity disorder drugs, which are frequently used in older children and adolescents, are also associated with serious cardiovascular effects.\(^7\)

Dima M. Qato, PharmD, MPH, PhD
G. Caleb Alexander, MD, MS
Jenny S. Guadamuz, MS
Stacy Tessler Lindau, MD, MAPP

Author Affiliations: Department of Pharmacy Systems, Outcomes, and Policy, College of Pharmacy, University of Illinois at Chicago, Chicago (Qato, Guadamuz); Division of Epidemiology and Biostatistics, University of Illinois at Chicago School of Public Health, Chicago (Qato); Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland (Alexander); Center for Drug Safety and Effectiveness, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland (Alexander); Department of Obstetrics and Gynecology, University of Chicago, Chicago, Illinois (Lindau).

Accepted for Publication: March 13, 2018.

Corresponding Author: Dima M. Qato, PharmD, MPH, PhD, Department of Pharmacy Systems, Outcomes, and Policy, College of Pharmacy, University of Illinois at Chicago, 833 S Wood St, Ste 266, Chicago, IL 60612 (dimaqato@uic.edu).

Published Online: June 18, 2018. doi:10.1001/jamapediatrics.2018.1008

Author Contributions: Dr Qato had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and design: All authors.

Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: Qato, Guadamuz.

Critical revision of the manuscript for important intellectual content: Qato, Alexander, Lindau.

Statistical analysis: Qato, Guadamuz.

Administrative, technical, or material support: Qato.

Conflict of Interest Disclosures: Dr Qato reported serving as a paid consultant for Public Citizen’s Health Research Group; Dr Alexander reported serving as Chair of the Food and Drug Administration’s Peripheral and Central Nervous System Advisory Committee; reported being a paid consultant to IQVIA; reported serving on the Advisory Board of MesarRx Innovations; reported holding equity in Monument Analytics; and reported serving as a paid member of OptumRx’s National Pharmacy & Therapeutics Committee. This arrangement has been reviewed and approved by the Johns Hopkins Bloomberg School of Public Health. Dr Lindau is founder and co-owner of NowPow, LLC. No other disclosures were reported.

Funding/Support: Dr Qato was supported in part by the Robert Wood Johnson Foundation as part of the Clinical Scholars Leadership program. Ms Guadamuz was supported in part by the Robert Wood Johnson Foundation, as part of the Health Policy Research Scholars program.

Role of the Funder/Sponsor: The Robert Wood Johnson Foundation had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.


Trends in Weight Loss Efforts Among US Adolescents With Overweight and Obesity

Snook and colleagues\(^1\) reported recently that, despite the significant increase in the prevalence of obesity over decades, fewer US adults have tried to lose weight. However, the trend among adolescents, the population most susceptible to changes in social norms, is unclear. We assessed the trend in weight loss efforts among adolescents with overweight and obesity aged 16 to 19 years.

Methods | We used data from the National Health and Nutrition Examination Survey for this study. The 1988-1994 survey years were designated as the early period (reference), 1999-2004 as the intermediate period, and 2009-2014 as the recent period. After excluding 449 adolescents who were underweight (body mass index, <fifth percentile) and 619 adolescents who did not respond to questions pertaining to weight loss efforts, race/ethnicity, or family income, 1298 participants aged 16 to 19 years were included for the 1988-1994 period, 2697 participants were included for 1999-2004 period, and 1496 participants were included for 2009-2014 period. The 2000 Centers for Disease Control and Prevention growth charts\(^2\) were used to translate directly measured weight and height into sex- and age-specific body mass index percentiles and categorized adolescents as obese (≥95th percentile), overweight (85th-94th percentile), or healthy weight (5th-84th percentile). The main question of interest, “During the past 12 months, have you tried to lose weight?” was asked in an identical manner for all surveys. Because the percentage of adolescents trying to lose weight, on average, was substantially above 10%, logistic regression may overestimate the response; therefore, modified Poisson regression\(^3\) was used to estimate the percentage ratios of adolescents trying to lose weight between the levels of variables, including survey period, after correcting for body mass index percentile, race/ethnicity, and family income. With appropriate weighting and nesting variables, analyses were conducted using SAS, version 9.4 (SAS Institute). \(P < .05\) (2-sided) was considered statistically significant.

Results | The prevalence of overweight and obesity increased from 22.09% (95% CI, 18.20%-25.98%) in 1988-1994 to 34.03% (95% CI, 30.64%-37.41%) in 2009-2014; during the same period, the overall percentage of adolescents who had tried to lose weight decreased from 33.68% (95% CI, 29.19%-38.17%) to 27.24% (95% CI, 24.17%-30.31%). For adolescents with overweight, the percentage trying to lose weight decreased from 36.36% (95% CI, 58.71%-14.00%) in 1988-1994 to 22.05% (95% CI, 21.31%-15.51%) in 2009-2014 among boys and from 80.24%...