



Concomitant Dietary Supplement and Prescription Medication Use Is Prevalent among US Adults with Doctor-Informed Medical Conditions



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ABSTRACT

Information on patterns of concomitant dietary supplement (DS) and prescription medication (PM) use among US adults is limited. Thus, the prevalence of concomitant DS and PM use as a function of doctor-informed medical conditions (DIMC) was determined in a cross-sectional, observational study of a nationally representative sample of noninstitutionalized, civilian adults aged ≥ 20 years in the United States (N=9,950) from the 2005-2008 National Health and Nutrition Examination Survey (NHANES). Data were weighted for the complex, multistage, probability sampling design. Approximately one third (34.3%) of all US adults reported concomitant DS and PM use (approximately one in three adults). The prevalence of use was significantly higher among those with vs without a DIMC (47.3% vs 17.3%). Adults with a DIMC were more than two and a half times more likely to concomitantly use DS and PM than adults without a DIMC, after adjustment for sex, age, education, and household income. Multivitamin plus other ingredient(s), followed by antacids and multivitamin plus botanical ingredient(s), were the most prevalent DS categories used with a PM among those with and without a DIMC. The most prevalent PM categories used with a DS were cardiovascular agents (among those with a DIMC) and hormones (among those without a DIMC). These findings demonstrate that presence of a DIMC may be a risk factor for concomitant DS and PM use among US adults. Multivitamins containing nonvitamin or mineral ingredients are more commonly used than standard multivitamins with PM by US adults. This may be an emerging trend that warrants further consideration.

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MORE THAN HALF OF US ADULTS REPORT USING at least one dietary supplement (DS) during the previous 30 days.^{1,2} Patients have reported using DS and medications with potential DS-drug interactions in various clinical settings.³⁻⁶ Herbal DS may alter drug pharmacokinetics by inducing or inhibiting cytochrome P450 drug metabolizing enzymes and activity,^{7,8} thereby altering the effectiveness of prescription medications (PM). A review of documented interactions between DS and PM found that DS containing St John's wort, magnesium, calcium, iron, and Ginkgo biloba had the highest number of potential

interactions, whereas DS containing flaxseed, Echinacea, and yohimbe had the highest number of contraindications.⁹ Prior investigations have estimated the prevalence of concomitant DS and PM use as a percentage of PM users.¹⁰⁻¹² However, information to aid health care and dietetics practitioners in identifying populations at risk for experiencing DS and PM interactions remains limited.

In our study, the prevalence proportion (percent) and point prevalence (total number) of concomitant DS and PM use among all US adults, according to doctor-informed medical conditions (DIMC) were determined by analyzing data from the 2005-2008 National Health and Nutrition Examination Survey (NHANES), a nationally representative sample of noninstitutionalized civilian adults and children in the United States. Our analysis included use of the NHANES Dietary Supplement Database (NHANES-DS), which is the largest publicly available national database of DS use. The DS categories most commonly used with a PM, as well as the PM categories most commonly used with DS, are also reported.

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MATERIALS AND METHODS

Subjects

Data were drawn from NHANES, which is administered and managed by the National Center for Health Statistics (NCHS). Comprehensive sample selection and data collection methods are detailed elsewhere.¹³ Briefly, sampling is performed with a complex, multistage, probability sampling design to obtain a nationally representative sample of noninstitutionalized civilian adults and children in the United States. This study used data pooled from the 2005–2006 (N=10,348) and 2007–2008 (N=10,149) data collection series. Of the 19,712 subjects with data from both the household interview and mobile examination center, 10,480 subjects aged ≥ 20 years were eligible for inclusion. Subjects who were pregnant (n=382), and those with missing data for DS use (n=8), PM use (n=5), education (n=8), marital status (n=4), or DIMC (n=123) were excluded. The final sample size was composed of 5,016 men and 4,934 women. NHANES 2005–2006 and 2007–2008 surveys were approved by the NCHS Research Ethics Review Board.

DS Use and Classification

DS use in the past month was assessed by trained interviewers using the computer-assisted personal interviewing (CAPI) system during the household interview. A full description of the DS data collection and CAPI system is provided elsewhere.^{14,15} Antacids and calcium and/or magnesium-containing antacids taken as a DS were included in DS use variables. To minimize subjective classification, DS were classified into 18 mutually exclusive subgroups by a systematic iterative sorting procedure that used the ingredient count variables (vitamin, mineral, amino acid, botanical, and other) and search terms in the DS name variable and ingredient name variable associated with each DS in the NHANES-DSD. A total of 3,106 distinct DS ID numbers derived from the sample were grouped into relevant categories. Multivitamin categories were defined to be consistent with previous NHANES publications,^{14,16} such that multivitamins were identified as containing ≥ 3 vitamins, and may or may not contain minerals. However, standard multivitamins, which were defined as containing no nonvitamin or mineral ingredients, were differentiated from multivitamins containing botanicals and multivitamins containing other non-botanical ingredients. The detailed classification schematic is provided in Figure 1 (available online at www.andjrnl.org).

PM Use

PM use during the past month was assessed using the CAPI system during the household interview. PM was matched to the PM database Lexicon Plus, a proprietary database of Cerner Multum, Inc, used by NCHS. A full description of the database and PM classification scheme is provided elsewhere.¹⁷ Briefly, PMs were classified according to the PM's first-level drug therapeutic category of the 3-level nested category system. Prescription antacids were included in the PM database, not the DS database. Prescription DS, including calcium (except calcium acetate) and fluoride (except topical gel or cream formulations), were included in the DS database. Over-the-counter niacin, niacinamide, and nicotinic acid were included in the DS database, whereas prescription

niacin, potassium, and sodium were included in the PM database.

DIMC and Covariates

Presence of any DIMC and covariates were also assessed using the CAPI system during the household interview. DIMC included asthma, arthritis, congestive heart failure, coronary heart disease, angina, angina pectoris, heart attack, stroke, high blood pressure, high cholesterol, emphysema, chronic bronchitis, any liver condition, thyroid problem, cancer or malignancy, weak/failing kidneys, dialysis during past 12 months, or osteoporosis/brittle bones. Similar conditions were grouped to obtain DIMC categories. Covariates were categorized as follows: sex (male/female), age (20 to 39 years, 40 to 59 years, or ≥ 60 years), marital status (married or living with a partner or single), education (less than high school graduate or high school graduate or some college or college graduate), and family income (unsure, $< \$20,000$, $\$20,000$ to $\$44,999$, $\$45,000$ to $\$74,999$, or $\geq \$75,000$).

Statistical Analysis

SAS statistical analysis software (version 9.1.2, 2004, SAS Institute Inc) was used to perform analyses. All analyses were adjusted for the complex sampling design of NHANES by specifying the stratum and cluster variable, in addition to the 4-year mobile examination center weight, to ensure sampling errors were estimated by the Taylor series (linearization) method, as suggested in the NHANES analytic guidelines.¹⁸ The final sample subpopulation and analyses for subgroups were specified using the domain statement, or by including the domain variable in the surveyfreq procedure, such that variance estimates were based on the full-sample size of subjects with data available from the household interview and the mobile examination center. The surveyfreq and surveylogistic procedure in SAS were used to derive descriptive and logistic regression analysis data (after adjustment for sex, age, education, and household income). A conservative 99% CI was calculated for each prevalence estimate and odds ratio. Significant differences were defined as nonconvergent CIs and odds ratios excluding 1.00 in the CI. The point prevalence (total of US adults) was calculated according to the NHANES analytic guidelines for calculating population counts.¹⁹ Briefly, the total prevalence proportion (percent of all US adults) was multiplied by the population total of US noninstitutionalized civilian adults aged ≥ 20 years for 2005–2008 reported by the Center for Population Statistics²⁰; that is, $\frac{1}{2}$ (2005–2006 population totals) + $\frac{1}{2}$ (2007–2008 population totals) = 210,156,452.

RESULTS AND DISCUSSION

Several demographic characteristics were significantly associated with concomitant DS and PM use (Table 1). Men were less likely than women to use DS and PM. Subjects aged 20 to 39 years and 40 to 59 years were less likely, respectively, than those aged ≥ 60 years to use DS and PM. Subjects with education less than that of college graduates were significantly less likely to use DS and PM. Similarly, subjects with a household income $< \$75,000$ per year were significantly less likely to use DS and PM. Multiple DS users and multiple PM users were more likely than single users to concomitantly use DS and PM. After adjustment for age, married subjects, and

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