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Dietary Supplement Use and Nutrient Intake among Children in South Korea

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ABSTRACT

Background The use of dietary supplements (DS) is common in South Korea and other countries. However, few studies have been conducted in South Korea on their use, especially in early childhood.

Objective The objective of this study was to compare total nutrient intake and nutrient adequacy among DS users and nonusers in Korean children.

Design Cross-sectional study.

Participants/setting Data of participants aged 1 to 8 from the 4th (2007-2009) Korea National Health and Nutrition Examination Survey were used. The participants were divided into two groups based on use of dietary supplements (DS users, n=766; nonusers, n=1,648).

Main outcome measures Dietary intake measured by 24-hour recall and DS information from questionnaires was collected with the assistance of a caregiver. Nutrient intake was adjusted within and between person variations, using C-SIDE (Software for Intake Distribution Estimation, version 1.02, 1996; available from the Center for Survey Statistics and Methodology, Iowa State University) software to estimate usual intake. Total nutrient intake was calculated as the sum of nutrient intake from food and DS.

Statistical analyses performed Nutrient intake between groups was compared by using a multivariate regression model adjusted for demographic characteristics. Adequacy of nutrient intake between the two groups was compared with Dietary Reference Intakes for Koreans by using the Cochran-Mantel-Haenszel test, controlling for demographic characteristics.

Results No significant differences were observed in dietary macronutrients and micronutrients between DS users and nonusers, except for calcium. Total intake (food+DS) of vitamin A, vitamin C, thiamin, riboflavin, niacin, calcium, and iron were higher in DS users compared with nonusers. A lower percentage of DS users had total micronutrient intakes below the estimated average requirement compared with nonusers. DS use was associated with intakes of vitamin A and C that were higher than the tolerable upper intake levels.

Conclusions DS use in children contributes to adequate micronutrient intake. However, concerns exist about excessive intakes of specific nutrients, especially among children who consume more than the suggested dosage.
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IN A RECENT STUDY IN SOUTH KOREA AND OTHER countries, 22% to 47% of children reported taking dietary supplements (DS).[1-3] According to Korea Health Statistics based on the 4th (2007-2009) Korea National Health and Nutrition Examination Survey (KNHANES), 35% of 1- to 2-year-olds, 47% of 3- to 5-year-olds, and 37% of 6- to 11-year-olds take DS.[1] These prevalence data are comparable to those in the United States, where 42% of children aged 2 to 8 years take DS, but higher than those in Taiwan, where 22% of children aged 6 to 12 years take DS.[2,3] In addition, the global DS industry is growing annually. The DS market in the United States increased 7.5% in 2012 compared with 2011, and the annual growth rate of the South Korean DS market was 10.1% during the last 5 years (2009-2013).[4,5]

During childhood, eating behaviors are influenced by the family environment and the overall environment, including economic, social, psychological, and cultural status.[6] Eating behaviors are strongly affected by parental modeling, availability, and food preferences, especially in early childhood.[7] Taking DS during childhood is also affected by the family environment. Previous research among participants younger than 19 years reported that DS use was associated with the age of the child, race or ethnicity, household income, parents' educational status, parents' DS use, and parents' lifestyle.[8-11]

Because the most frequently consumed DS are vitamin–mineral products,[3,8,9,12] intake from DS can contribute significantly to total nutrient intake. In a study of 185 children in Hawaii, the prevalence of nutrient adequacy was

calculated based on the values of the Dietary Reference Intakes; when nutrients from DS were included to estimate the nutrient adequacy, the prevalence improved.[13] For example, vitamin E adequacy increased from 63% to 89% in children aged 6 to 8 years and increased from 33% to 59% in children aged 9 to 13 years. Vitamin A adequacy also increased from 86% to 95% in children aged 6 to 8 years and increased from 74% to 83% in children aged 9 to 13 years. A study using the National Health and Nutrition Examination Survey (NHANES) 2003-2006 showed that the use of DS lowered the prevalence of calcium, iron, magnesium, vitamin A, vitamin C, vitamin D, and vitamin E inadequacy among children aged 2 to 18 years.[2] However, DS use was also associated with the risk of overconsumption of iron, zinc, copper, selenium, folic acid, vitamin A, and vitamin C.[2]

Therefore, research is needed to assess the contribution of DS to total nutrient intake. However, studies evaluating DS use in children are very limited, especially using national survey data. The primary goal of this study was to compare nutrient intake from food and DS among children (between the ages of 1 and 8 years) who are DS users or nonusers, using data from the 4th KNHANES. A secondary goal was to determine the effect of DS on the prevalence of nutrient inadequacy and risks of overconsumption based on the Dietary Reference Intakes (DRIs) for Koreans.

METHODS

Data Source

Data for this study were derived from the 4th KNHANES, a nationally representative, cross-sectional survey conducted by the Korea Centers for Disease Control and Prevention. The 4th KNHANES used a stratified, multiple sampling design. The 4th KNHANES is composed of three component surveys: a health interview, a health examination, and a nutrition survey. The health interview and the health examination were performed by trained medical staff and interviewers at the mobile examination center. The nutrition survey was completed by trained dietitians at the participants' homes and consisted of a 24-hour dietary recall and a dietary behaviors questionnaire.[14] Detailed information on the methods and data of KNHANES is published elsewhere.[14,15] The Korea Centers for Disease Control and Prevention Institutional Review Board approved the survey protocol, and all parents provided written informed consent.

Data from 2,792 children between the ages of 1 and 8 years were used in the analysis. All participants completed the nutrition survey. Proxy responses and proxy-assisted responses were used for the nutrition survey.[15]

Classification of Study Participants

In the 4th KNHANES, dietary supplement data were collected from the dietary behaviors questionnaire in the nutrition survey, using the following questions: "In the past year, has the participating child consumed any vitamin or mineral supplements regularly for at least 2 weeks?" and "In the past year, has the participating child consumed any health functional foods regularly for at least 2 weeks?" Detailed information was collected about product or brand names, types of products, consumption frequency, and doses of DS for up to four different products. If participants answered "no" to both questions, they were classified as "nonusers." If participants answered "yes" to one or more of the two questions and reported the product or brand name, the participants were classified as "dietary supplement (DS) users." Participants who did not provide the product name (n=268) or gave inaccurate product information (n=110) were excluded. Inaccurate product information provided by participants included the following cases: "Generalized product name+no information about manufacturer (n=16)"; "Generalized product name+manufacturer information (n=24)"; and "Product labels did not contain nutrient profile (n=71)." The number of total cases is greater than the number of excluded participants by a value of 1, because two categories were reported by one participant. The final sample included 2,414 participants.

Estimating Usual Nutrient Intakes

Nutrient Intake from Foods. The 4th KNHANES dietary intake data were collected by using a 24-hour dietary recall. Participants' energy and nutrient intakes were calculated from reported intake of food and beverages by the KNHANES survey team, using the 7th edition of the food composition table from the Korea National Rural Resources Development Institute. This database included 2,505 food items. The processed food database from the Korea Health Industry Development Institute was also used to calculate nutrient values in processed foods or imported foods. This processed food database included 1,250 processed food items, 690 imported food items, and 553 fast-food items.[15] The usual nutrient intake from food was estimated as described by Kim and colleagues,[16] using C-SIDE software (Software for Intake Distribution Estimation, version 1.02, 1996; available from the Center for Survey Statistics and Methodology, Iowa State University). The 4th KNHANES collected dietary intake data for only 1 day. Within-person variation was estimated for each nutrient using the 2-day intake data from the KNHANES 2001-2002.[17]

Nutrient Intake from DS. Nutrient intake from DS was calculated by using reported consumption frequency per day, nutrient profiles per standard dose of the DS from the nutrient database, and the ratio of the actual amount taken at one time to the standard serving. The composition of the nutrients per standard serving of each product was collected by searching the product or brand name based on the label information as described elsewhere.[18] DS products were classified based on the categories provided by the Korean Ministry of Food and Drug Safety. A "multivitamin-mineral" was defined as a product containing at least one vitamin and at least one mineral. "Vitamins" were defined as products containing more than one vitamin, and the "minerals" were defined as products containing more than one mineral.

Total Nutrient Intake from Foods and DS. For DS users, total nutrient intake was calculated as the sum of the nutrient intake from food plus that from DS. Nonusers' total nutrient intake was calculated as their nutrient intake from food alone.

Assessment of Nutritional Intake

Adequacy of nutrient intake was evaluated by comparing the intake from food in nonusers and the intake from food and DS in DS users with the reference values of the 2010 Dietary Reference Intakes for Korean[19] for each age group by sex. Percentages of participants with usual nutrient intake below