Levels of the Antioxidant Nutrients, Vitamin C, Vitamin E, and Selenium in the Dietary Supplement Ingredient Database: NHANES Data Applications

Cuwei Zhao1, Janet Roseland2, Karen Andrews3, Matthew Feinberg1, Angela Middleton1, Joanne Holden1, Larry Douglass2, Johanna Dwyer3, Mary Frances Picciano3

1USDA-ARS, BHNRC-NDL, Beltsville, MD 2Consulting Statistician, Longmont, CO 3NIH-ODS, Bethesda, MD

Methods and Materials

Laboratory evidence indicates that antioxidants may slow or possibly prevent the development of certain cancers by protecting cells from damage by free radicals or other mechanisms. Many dietary supplements containing antioxidant nutrients are available to consumers. The Nutrient Data Laboratory (NLD), Beltsville Human Nutrition Research Center (BHNRC), Agricultural Research Service, working with the Office of Dietary Supplements, NIH, and other federal agencies, has developed a Dietary Supplement Ingredient Database (DSID) to estimate levels of ingredients in dietary supplement products. The first release of the DSID (DSID-1) provides data regarding predicted analytical values for 18 nutrients in adult multivitamin/multimineral (MVM) products which are linked with National Health and Nutrition Examination Survey (NHANES) dietary supplement data. DSID-1 data are available at https://dietarysupplementdatabase.usda.nih.gov. The DSID-1 dataset contains multiple lots of more than 100 representative products which were collected from various online and direct sales channels and chemically analyzed for their nutrient content. The analytical values were compared to labeled values and the percentage differences between the two values were calculated for each nutrient. These results were analyzed by regression analysis techniques. The derived prediction equations showed linear relationships for the antioxidant nutrients vitamin C, vitamin E, and selenium over the respective ranges studied. Prediction equations were applied to labeled nutrient levels for adult MVM products reported in the NHANES 2003-06. The predicted mean percent-difference-from-label varied by nutrient and nutrient level. The derived prediction equations showed linear relationships for the antioxidant nutrients vitamin C, vitamin E, and selenium over the respective ranges studied. Prediction equations were applied to labeled nutrient levels for these nutrients were determined by statistical regression analysis and are shown in Figures 1-3 and Table 1, column 7. The predicted amounts per serving were then calculated for each nutrient and are listed in Table 1, columns 3, 5, and 7. The SE for the predicted mean (SEM) is the error associated with the predicted mean for a large precision of supplements labeled at the same level. The SEM percent differences from label for these nutrients are graphed in blue in Figures 1-3. The SE values are calculated based on the SEM percent differences and listed in Table 1, column 5, Predicted Amount per Serving. SEM. The SE for a predicted observation estimates the error associated with the predicted mean for a single observation, which in this case is any individual adult MVM product. The SE percent differences from label for predicted observations for these nutrients are graphed in green in Figures 1-3. The SE (individual) values are calculated based on the SE percent differences and listed in Table 1, column 6, Predicted Amount per Serving (SE individual).

Results

The results for predicted mean percent-difference-from-label varied by nutrient and nutrient level. The derived prediction equations showed linear relationships for the antioxidant nutrients vitamin C, vitamin E, and selenium over the respective ranges studied. Prediction equations were applied to labeled nutrient levels for these nutrients were determined by statistical regression analysis and are shown in Figures 1-3 and Table 1, column 7. The predicted amounts per serving were then calculated for each nutrient and are listed in Table 1, columns 3, 5, and 7. The SE for the predicted mean (SEM) is the error associated with the predicted mean for a large precision of supplements labeled at the same level. The SEM percent differences from label for these nutrients are graphed in blue in Figures 1-3. The SE values are calculated based on the SEM percent differences and listed in Table 1, column 5, Predicted Amount per Serving. SEM. The SE for a predicted observation estimates the error associated with the predicted mean for a single observation, which in this case is any individual adult MVM product. The SE percent differences from label for predicted observations for these nutrients are graphed in green in Figures 1-3. The SE (individual) values are calculated based on the SE percent differences and listed in Table 1, column 6, Predicted Amount per Serving (SE individual).

Conclusions

1. Predicted mean percent-differences from label ranged from 7.7% to 8.8% for vitamin C, -0.12% to 0.5% for vitamin E, and 22% to 26% for selenium. These are representative of adult MVM products reported in the U.S. 2. The predicted equations for these and other nutrients, applied to labeled nutrient levels for adult MVM products reported in NHANES-2003-06, are available at http://dietarysupplementdatabase.usda.nih.gov.

Future Plans

The following studies are underway to analyze representative products based on statistically representative sampling plans and to provide publicly accessible data for researchers’ use in assessing total intake: 1. Children’s MVMs 2. Omega-3 fatty acid products 3. Prenatal MVMs: over-the-counter products

References


Steps to Link DSID-1 Results with NHANES Supplement Ingredient Levels


Figure 1. Predicted Vitamin C Percent Difference From Label in Adult MVMs (327 observations for 96 adult MVM products)