CDC research papers look at sociodemographic and lifestyle variables and their relationship to nutritional biomarkers

Expanding research from CDC's Second National Report on Biochemical Indicators of Diet and Nutrition to better understand potential causes of deficiencies

CDC released its Second Nutrition Report in 2012. The report used NHANES data from 2003–2006 for 58 indicators of diet and nutrition like vitamin D, iodine, and folate.
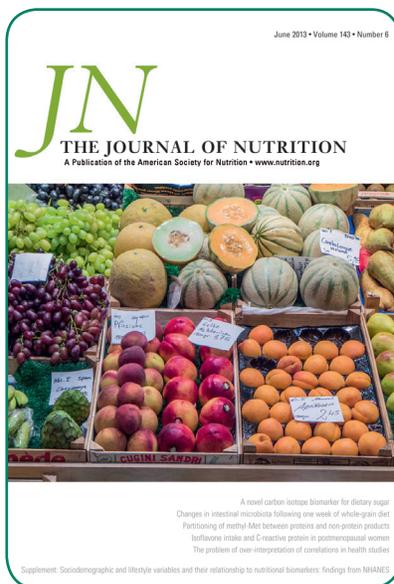
The Second Nutrition Report found that less than 10% of the U.S. population was at risk for selected nutritional deficiencies. However, for most of the nutritional indicators, deficiencies varied by age, sex, or race-ethnicity.

http://www.cdc.gov/nutritionreport/

In the June 2013 issue of The Journal of Nutrition, CDC researchers evaluated sociodemographic, lifestyle, and physiologic variables like education, smoking, fasting, and pregnancy to understand what role they may play in nutritional deficiencies.

What these articles tell us

CDC researchers discovered that the sociodemographic and lifestyle variables provided some insight into the demographic differences found in CDC's Second Nutrition Report, but overall differences in nutritional biomarker levels still depended on age, sex, or race-ethnicity.

June 2013 • Volume 143 • Number 6

JN
THE JOURNAL OF NUTRITION
A Publication of the American Society for Nutrition • www.nutrition.org

A novel carbon isotope biomarker for dietary sugar
Changes in intestinal microbiota following one week of whole-grain diet
Partitioning of methyl-Met between proteins and non-protein products
Isoflavone intake and C-reactive protein in postmenopausal women
The problem of over-interpretation of correlations in health studies

Supplement: Sociodemographic and lifestyle variables and their relationship to nutritional biomarkers: findings from NHANES

The Journal of Nutrition

The June 2013 issue of The Journal of Nutrition contains eight articles from CDC's environmental health laboratory (http://jn.nutrition.org/content/143/6.toc).

Each article addresses a different category of nutritional biomarkers evaluated in CDC's Second Nutrition Report: water-soluble vitamins, fat-soluble nutrients, trace elements (iron and iodine), phytoestrogens (isoflavones and lignans), and acrylamide hemoglobin adducts.

Variables used in the CDC data analysis

Lifestyle
- Alcohol consumption
- Body mass index
- Dietary supplement use
- Physical activity
- Smoking

Sociodemographic
- Age
- Education
- Income
- Race-ethnicity
- Sex

Physiologic
- Fasting
- Inflammation
- Pregnancy
- Renal function

Key findings on the association of sociodemographic and lifestyle variables with biomarkers of nutritional status in U.S. adults

For many nutritional biomarkers, higher levels occurred with every 10 year increase in age

For instance, iodine, folate, and vitamin E levels were 11%, 5-7%, and 5% higher, respectively. Differences were smaller for vitamin C (roughly 4%), vitamin A (2%), and vitamin B12 (1%).

Women had lower nutritional biomarker levels compared to men for some nutrients such as vitamin A (10%), vitamin B6 (21%), and vitamin B12 (4%)

But women had higher folate (4-6%) and vitamin C (roughly 10%) levels.

Non-Hispanic blacks had generally lower levels of nutrients compared to non-Hispanic whites

Non-Hispanic blacks had higher vitamin B12 (20%) levels, but lower levels for vitamin D (roughly 40%), iodine (34%), folate (13-20%), vitamin A (9%), vitamin B6 (8%), and vitamin E (7%) compared to non-Hispanic whites.

Smokers generally had lower levels of several nutrients

Tobacco smokers who had elevated serum cotinine levels, a marker of tobacco smoke exposure, had lower levels of several nutrients such as vitamin B6 (28%), vitamin C (roughly 20%), folate (12-15%), vitamin B12 (6%), and vitamin E (5%) compared to nonsmokers.

Persons who reported consuming dietary supplements had higher levels of most nutrients

For instance, vitamin B6 (79%), vitamin C (roughly 30%), folate (24-38%), iodine (22%), vitamin B12 (21%), vitamin E (21%), vitamin D (roughly 9%), and vitamin A (5%) levels were higher compared to nonusers.

Overweight persons generally had lower nutrient levels

Based on body mass index, overweight persons had lower vitamin B6 (13%), vitamin C (roughly 10%), vitamin D (roughly 8%), vitamin B12 (4%), serum folate (4%), and vitamins A and E (1%) levels compared to normal weight persons.

Key findings on the association of physiologic variables with biomarkers of nutritional status in U.S. adults

CDC also evaluated how much nutritional biomarkers varied as a result of physiologic variables. CDC found the following:

- Persons who ate a meal less than 3 hours before providing a blood sample (non-fasted), had slightly higher serum folate (10%), vitamin B6 (9%), and vitamin E (4%) levels compared to persons who fasted for 8 hours or more.

- Persons with signs of inflammation or infection (elevated serum C-reactive protein levels) had lower levels of several vitamins compared to persons without inflammation including serum vitamin B6 (29%), vitamin C (roughly 16%), vitamin A (9%), vitamin D (roughly 8%), and folate (5%). Levels of serum ferritin (25%), a marker of iron deficiency, were higher in persons with inflammation, thereby complicating ferritin's interpretation.

- Persons with chronic kidney disease had higher levels of several vitamins compared to persons with normal kidney function: serum vitamin A (20%), folate (7-9%), and vitamin B12 (5%).

- Pregnant women had higher folate, vitamin E, and vitamin D levels compared to nonpregnant women, but lower vitamin B12 and vitamin A levels, and lower iron status.

How will these findings help investigators?

The information in the eight articles from CDC's analyses will help investigators better interpret available data on biomarker levels and provide them a foundation to plan future nutrition studies and develop predictive models to study the association of nutritional status with health outcomes.

Because NHANES uses a cross sectional design, causal relationships between the biomarkers and variables in the CDC study cannot be drawn. Furthermore, the results could be confounded by other variables that were not considered in this analysis, such as biological, genetic, or health factors.

Journal of Nutrition June 2013 Supplement
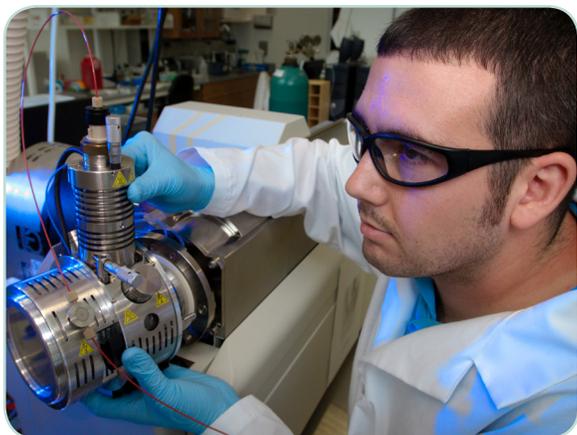
FEATURED ARTICLES

1. Pfeiffer CM, Sternberg MR, Schleicher RL, Haynes BM, Rybak ME, Pirkle JL. *The CDC's Second National Report on Biochemical Indicators of Diet and Nutrition in the U.S. Population is a valuable tool for researchers and policy makers. J Nutr. 2013 Jun;143(6):938S-47S.*

2. Sternberg MR, Schleicher RL, Pfeiffer CM. *Regression modeling plan for 29 biochemical indicators of diet and nutrition measured in NHANES 2003-2006. J Nutr. 2013 Jun;143(6):948S-56S.*

3. Pfeiffer CM, Sternberg MR, Schleicher RL, Rybak ME. *Dietary supplement use and smoking are important correlates of biomarkers of water-soluble vitamin status after adjusting for sociodemographic and lifestyle variables in a representative sample of U.S. adults. J Nutr. 2013 Jun;143(6):957S-65S.*

4. Schleicher RL, Sternberg MR, Pfeiffer CM. *Race-ethnicity is a strong correlate of circulating fat-soluble nutrient concentrations in a representative sample of the U.S. population. J Nutr. 2013 Jun;143(6):966S-76S.*

5. Pfeiffer CM, Sternberg MR, Caldwell KL, Pan Y. *Race-ethnicity is related to biomarkers of iron and iodine status after adjusting for sociodemographic and lifestyle variables in NHANES 2003-2006. J Nutr. 2013 Jun;143(6):977S-85S.*

6. Rybak ME, Sternberg MR, Pfeiffer CM. *Sociodemographic and lifestyle variables are compound- and class-specific correlates of urine phytoestrogen concentrations in the U.S. population. J Nutr. 2013 Jun;143(6):986S-94S.*

7. Vesper HW, Sternberg MR, Frame T, Pfeiffer CM. *Among 10 sociodemographic and lifestyle variables, smoking is strongly associated with biomarkers of acrylamide exposure in a representative sample of the U.S. Population. J Nutr. 2013 Jun;143(6):995S-1000S.*

8. Haynes BM, Pfeiffer CM, Sternberg MR, Schleicher RL. *Selected physiologic variables are weakly to moderately associated with 29 biomarkers of diet and nutrition, NHANES 2003-2006. J Nutr. 2013 Jun;143(6):1001S-10S.*

*Articles available online at http://jn.nutrition.org/content/143/6.toc