

New study finds toenails help trace arsenic exposure from foods

By John Cramer and Joe Balintfy

Diet alone can be a significant source of arsenic exposure, regardless of arsenic concentrations in drinking and cooking water, according to a [study](http://www.ncbi.nlm.nih.gov/pubmed/24237880) (<http://www.ncbi.nlm.nih.gov/pubmed/24237880>) led by Dartmouth College, funded in part by NIEHS, and published in Nutrition Journal. The study also confirms that toenail clippings are a good biomarker, or indicator, of long-term exposure to arsenic from consuming alcohol, Brussels sprouts, and dark meat fish.

Listen as Cottingham describes the study findings and their public health significance (01:52)

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Previous studies have shown that diet can be an important source of total arsenic exposure, but this new study also took into account arsenic in drinking and cooking water. Household water is thought to be the most significant source of arsenic exposure in regions where water arsenic concentrations are elevated. Exposure to arsenic has been linked to a variety of health problems.

"It is obviously a known carcinogen and has effects on the cardiovascular system and lung functioning," said [William Suk, Ph.D.](#), head of the NIEHS Hazardous Substances Research Branch. "Because there is no known mechanism, it is hard to determine how low a dose can be tolerated."

Foods found to contain arsenic

Researchers asked 852 study participants about their average consumption, over the previous year, of 120 different foods, including dairy, fruits, vegetables, eggs, meat, breads, beverages, and baked goods. They found arsenic in toenail clippings is most strongly linked with consumption of Brussels sprouts and alcohol, especially beer for men and white wine for women. Those who drank more alcohol and ate more Brussels sprouts had more arsenic in their toenail clippings, which makes sense because alcoholic beverages can have higher arsenic content and are known to interfere with the metabolic pathways that detoxify arsenic.

"With Brussels sprouts, there is some emerging evidence that shows vegetables in this particular group contain sulfur molecules that help the plants detoxify arsenic," explained Dartmouth Professor [Kathryn Cottingham, Ph.D.](#), (<http://www.dartmouth.edu/~cottingh/>) the study's lead author. "We think that Brussels sprouts are high in arsenic because the compounds that give them their characteristic smell also cause them to have potentially higher arsenic concentrations."

Researchers also found increased toenail arsenic in people who eat dark meat fish, which includes tuna steaks, mackerel, salmon, sardines, bluefish, and swordfish. Fish generally contain a form of arsenic that is thought to safely pass through the human body without being metabolized, but dark meat fish also contains arsenic compounds that can be metabolized.

Water is still a main source

Both Cottingham and Suk emphasized that it is important to limit arsenic exposure, in particular inorganic arsenic, which is found in water. "Filtering water that is contaminated does work," said Suk. Cottingham encouraged everyone who has a private well to get it tested, because, as she noted, everyone drinks water every day.

The study included researchers from Dartmouth College, Stony Brook University, University of North Carolina at Chapel Hill, Geisel School of Medicine at Dartmouth, and University of Missouri. The research was conducted by the [Children's Environmental Health and Disease Prevention Research Center at Dartmouth](#), one of 14 centers whose aim is to develop strategies to prevent, detect, and treat environmentally related health conditions and communicate these strategies to families, health professionals, and policymakers. The centers are funded by NIEHS and EPA. This study also received support from the National Cancer Institute.

"We continue to see new emerging science on other sources of arsenic in our food supply," said [Kimberly Gray, Ph.D.](#), NIEHS



Cottingham said some high-arsenic foods are important as part of a healthy diet - they just shouldn't be consumed every day or multiple times a day. (Photo courtesy of Kathryn Cottingham, Ph.D.)

program lead for the centers. "This validates the need for continued monitoring." She added that more research is needed to fully understand the health impacts, and that it is time to consider safety standards for arsenic in food.

Citation: [Cottingham KL, Karimi R, Gruber JF, Zens MS, Sayarath V, Folt CL, Punshon T, Morris JS, Karagas MR.](#)

(<http://www.ncbi.nlm.nih.gov/pubmed/24237880>)

2013. Diet and toenail arsenic concentrations in a New Hampshire population with arsenic-containing water. *Nutr J* 12(1):149.

(This story was adapted from an article by John Cramer, associate director for media relations at Dartmouth College. Joe Balintfy is a public affairs specialist in the NIEHS Office of Communications and Public Liaison.)

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