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Rice is a staple crop for much of the world, but for some people it may also be a source of arsenic exposure.

## Research raises concerns about arsenic in rice

Both rice and well water are significant sources of arsenic exposure for pregnant women, according to a recent study by a team of Geisel School of Medicine and Dartmouth College researchers.

Arsenic is a chemical that occurs naturally in the environment at low levels. Chronic exposure to arsenic is associated with a higher risk of skin, lung, and bladder cancers. Prenatal exposure to arsenic has been linked to an increased risk of infant mortality, reduced birth weight, hampered immune function, and an increased risk of death from lung cancer later in life.

The study, published in the *Proceedings of the National Academy of Sciences*, looked at arsenic levels in the urine of 229 pregnant women and at their consumption of rice in the three days before the sample was taken. Researchers also tested the women's tap water for arsenic to adjust for exposure that might occur through water.

"We found that rice consumption was associated with a significantly higher concentration of arsenic in urine, a biomarker that shows recent exposure to arsenic," says Diane Gilbert-Diamond, Ph.D., DC '98, a research associate and a coauthor of the study. The median level of arsenic in the women who had eaten rice was 56% higher than in those who had not eaten rice. The study also showed increased arsenic concentrations in women who ate cold rice cereals or other rice-based products, not just in those who ate plain rice.

Gilbert-Diamond adds that many women were exposed to arsenic in drinking water at levels higher than the 10-parts-per-billion safety standard set by the Environmental Protection Agency (EPA). "One of the most striking findings was that about 15% of the women had well water above this limit," she says. "We really want to get out the message that people in New Hampshire should test their well water for arsenic."

Public water supplies have to be tested and monitored for the chemical regularly, but many people in New England drink from a private well. "The high level of arsenic in the bedrock in New Hampshire and the relatively large percentage of individuals who are not on municipal water sources is one of the reasons we were looking at arsenic in this population," explains Carolyn Murray, M.D., a Dartmouth physician trained in occupational and environmental health.

Compared to other plants, rice is particularly efficient at extracting arsenic from the environment. But concentrations of arsenic in rice can vary widely by region. For example, rice grown in California generally contains less arsenic than rice grown in the south-central U.S. Another complicating factor is the mix of organic and inorganic arsenic in rice. Organic arsenic is not as clearly linked to health risks as the inorganic form. Rice contains both organic and inor-

ganic forms of arsenic, whereas well water contains mostly inorganic arsenic.

The researchers are focusing on pregnant women, infants, and children because they may be more vulnerable to the effects of the toxin. "Children are not just little adults," says Murray. "The way they are exposed to any contaminant is different because of their size, and because they may metabolize them differently."

But this doesn't necessarily mean that pregnant women should avoid rice. "We're not saying rice can't be part of a healthy diet, but that there should be guidelines about arsenic levels in foods to minimize exposure," says Gilbert-Diamond. "Right now, [the United States] doesn't have a statutory limit on the level of arsenic in foods like rice," says Margaret Karagas, a professor of community and family medicine and a coauthor of the study. "We should be regulating the amount of arsenic in our foods—not just rice, but also rice products."

Brian Jackson, Ph.D., the director of the Trace Metal Analysis Core Facility at Dartmouth, who performed the analysis of the samples used in the study, is now studying arsenic concentrations in other foods that

contain rice, such as infant formula and baby food. Jackson says it's hard to correlate the concentration of arsenic in food to the limits set for drinking water. "It's harder to quantify the cumulative expo-

sure people are getting through food," he says. "It's not like water, where you can predict how much someone will consume over time. At the same time, if the calculations of the safe limit for arsenic are based on water as the only source of arsenic, we're missing a potential exposure through foods. The significance of this is only beginning to be appreciated." — Lauren Ware

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