

Nitrate in Drinking Water Increases Risk for Bladder Cancer

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IOWA CITY, Iowa – Nitrate in drinking water is associated with an increased risk for bladder cancer, according to a University of Iowa study that looked at cancer incidence among nearly 22,000 Iowa women.

The study results suggest that even low level exposures to nitrate over many years could be problematic in terms of certain types of cancer, said Peter Weyer, Ph.D., associate director of the UI Center for Health Effects of Environmental Contamination (CHEEC) and one of the study's lead authors. The study will be published in the May issue of the journal *Epidemiology*.

"The positive association we found between nitrate contamination in drinking water and bladder cancer is consistent with some previous data. However, this is something that warrants follow-up research," said Weyer, who co-authored the article with James R. Cerhan, M.D., Ph.D., an investigator with the Department of Health Sciences Research at the Mayo Clinic in Rochester, Minn.

The researchers assessed nitrate exposure from drinking water for 21,977 women who were participants in the Iowa Women's Health Study. The women, who were between 55 and 69 years of age in 1986 (at the start of the study) resided in a total of 400 Iowa communities and had used the same drinking water supply for more than 10 years. Approximately 16,500 of the women received their water from municipal water supplies; the remaining women used private wells.

Since no individual water consumption data were available, the researchers assigned each woman an average level of exposure to nitrate based on data collected between 1955 to 1988 on nitrate levels in her community's water supply. No nitrate data were available for women using private wells.

Using cancer incidence data from the Iowa Cancer Registry for 1986 to 1998, and after adjusting for factors such as smoking and nitrate in the diet, the researchers found a greater risk for bladder cancer as the nitrate levels in the communities' water supplies increased. Women whose average drinking water nitrate exposure level was greater than 2.46 milligrams (mg) per liter (nitrate-nitrogen) were 2.83 times more likely to develop bladder cancer than women in the lowest nitrate exposure level (less than 0.36 mg per liter).

While nitrate is produced naturally within the body, environmental sources include food (including many vegetables), contaminated drinking water, cigarette smoking and certain medications. Drinking water can account for a substantial proportion of the total nitrate intake. Up to 20 percent of ingested nitrate is transformed in the body to nitrite, which can then undergo transformation in the stomach, colon and bladder to form N-nitroso compounds. These compounds are known to cause cancer in a variety of organs in more than 40 animal species, including higher primates.

"The U.S. Environmental Protection Agency drinking water standard is 10 mg per liter nitrate-nitrogen. Our study suggests that nitrate levels much less than that could be a serious health concern" Weyer said.

Weyer emphasized that additional studies are needed to look at possible links between nitrate levels in drinking water and cancer, particularly with respect to refining exposure assessments.

"From a public health perspective, source water protection is a main concern. Sources of nitrate which can impact water supplies include fertilizers, human waste and animal waste," he said. "All of us, rural and urban residents alike, need to be more aware of how what we do as individuals can impact our water sources and potentially our health."

The study was funded by CHEEC and by the National Institute of Environmental Health Sciences. Additional study authors include: Burton Kross, Ph.D., UI adjunct associate professor of epidemiology; George Hallberg, Ph.D., of the Cadmus Group in Waltham, Mass; Jiji Kantamneni, a senior systems analyst at CHEEC; George Breuer, Ph.D., associate director of the UI Hygienic Laboratory; Michael Jones, Ph.D., UI professor of biostatistics; Wei Zheng, Ph.D., of Vanderbilt University; and Charles Lynch, M.D., Ph.D., UI professor of epidemiology.

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