

Fluoridated Water

Key Points

- Fluoride in water helps to prevent and can even reverse tooth decay.
- More than 60 percent of the U.S. population has access to fluoridated water through public water supply systems.
- The optimal level of fluoride to prevent tooth decay is 0.7 milligrams per liter of water.
- Many studies, in both humans and animals, have shown no association between fluoridated water and cancer risk.

1. What is fluoride, and where is it found?

Fluoride is the name given to a group of compounds that are composed of the naturally occurring element fluorine and one or more other elements. Fluorides are present naturally in water and soil at varying levels.

In the 1940s, scientists discovered that people who lived where drinking water supplies had naturally occurring fluoride levels of approximately 1 part fluoride per million parts water or greater (≥ 1.0 ppm) had fewer dental caries (cavities) than people who lived where fluoride levels in drinking water were lower. Many more recent studies have supported this finding (1).

It was subsequently found that fluoride can prevent and even reverse tooth decay by inhibiting bacteria that produce acid in the mouth and by enhancing remineralization, the process through which tooth enamel is “rebuilt” after it begins to decay (1, 2).

In addition to building up in teeth, ingested fluoride accumulates in bones.

2. What is water fluoridation?

Water fluoridation is the process of adding fluoride to the water supply so the level reaches approximately 0.7 ppm, or 0.7 milligrams of fluoride per liter of water; this is the optimal level for preventing tooth decay (1).

3. When did water fluoridation begin in the United States?

In 1945, Grand Rapids, Michigan, adjusted the fluoride content of its water supply to 1.0 ppm and thus became the first city to implement community water fluoridation. By 2008, more than 72 percent of the U.S. population served by public water systems had access to fluoridated water (3).

The Centers for Disease Control and Prevention (CDC) considers fluoridation of water one of the greatest achievements in public health in the 20th century.

4. Can fluoridated water cause cancer?

A possible relationship between fluoridated water and cancer risk has been debated for years. The debate resurfaced in 1990 when a study by the National Toxicology Program, part of the National Institute of Environmental Health Sciences, showed an increased number of osteosarcomas (bone tumors) in male rats given water high in fluoride for 2 years (4). However, other studies in humans and in animals have not shown an association between fluoridated water and cancer (5–7).



X 3 0 1 5

In a February 1991 Public Health Service (PHS) report, the agency said it found no evidence of an association between fluoride and cancer in humans. The report, based on a review of more than 50 human epidemiological (population) studies produced over the past 40 years, concluded that optimal fluoridation of drinking water “does not pose a detectable cancer risk to humans” as evidenced by extensive human epidemiological data reported to date (5).

In one of the studies reviewed for the PHS report, scientists at NCI evaluated the relationship between the fluoridation of drinking water and the number of deaths due to cancer in the United States during a 36-year period, and the relationship between water fluoridation and number of new cases of cancer during a 15-year period. After examining more than 2.2 million cancer death records and 125,000 cancer case records in counties using fluoridated water, the researchers found no indication of increased cancer risk associated with fluoridated drinking water (6).

In 1993, the Subcommittee on Health Effects of Ingested Fluoride of the National Research Council, part of the National Academy of Sciences, conducted an extensive literature review concerning the association between fluoridated drinking water and increased cancer risk. The review included data from more than 50 human epidemiological studies and six animal studies. The Subcommittee concluded that none of the data demonstrated an association between fluoridated drinking water and cancer (6). A 1999 report by the CDC supported these findings. The CDC report concluded that studies to date have produced “no credible evidence” of an association between fluoridated drinking water and an increased risk for cancer (2). Subsequent interview studies of patients with osteosarcoma and their parents produced conflicting results, but with none showing clear evidence of a causal relationship between fluoride intake and risk of this tumor.

Recently, researchers examined the possible relationship between fluoride exposure and osteosarcoma in a new way: they measured fluoride concentration in samples of normal bone that were adjacent to a person’s tumor. Because fluoride naturally accumulates in bone, this method provides a more accurate measure of cumulative fluoride exposure than relying on the memory of study participants or municipal water treatment records. The analysis showed no difference in bone fluoride levels between people with osteosarcoma and people in a control group who had other malignant bone tumors (7).

5. Where can people find additional information on fluoridated water?

The CDC has information at <http://www.cdc.gov/fluoridation> on standards for and surveillance of current fluoridated water supplies in the United States.

The Environmental Protection Agency has more information about drinking water and health at <http://water.epa.gov/drink/index.cfm>. The information on this page includes details about drinking water quality and safety standards.

Selected References

1. Centers for Disease Control and Prevention. Public Health Service report on fluoride benefits and risks. *JAMA* 1991; 266(8):1061–1067. [[PubMed Abstract](#)]
2. Centers for Disease Control and Prevention. Achievements in public health, 1900–1999: fluoridation of drinking water to prevent dental caries. *Morbidity and Mortality Weekly Report* 1999; 48(41):933–940.
3. Centers for Disease Control and Prevention (August 2010). *2008 Water Fluoridation Statistics*. Retrieved August 10, 2011, from <http://www.cdc.gov/fluoridation/statistics/2008stats.htm>.
4. Bucher JR, Hejtmancik MR, Toft JD, et al. Results and conclusions of the National Toxicology Program’s rodent carcinogenicity studies with sodium fluoride. *International Journal of Cancer* 1991; 48(5):733–737. [[PubMed Abstract](#)]
5. Committee to Coordinate Environmental Health and Related Programs, Ad Hoc Subcommittee on Fluoride (February 1991). *Review of Fluoride: Benefits and Risks*. Public Health Service, Department of Health and Human Services. Retrieved August 10, 2011, from <http://health.gov/environment/ReviewofFluoride>.
6. National Research Council, Subcommittee on Health Effects of Ingested Fluoride. Carcinogenicity of fluoride. In: *Health Effects of Ingested Fluoride*. Washington, DC: National Academy Press, 1993.

7. Kim FM, Hayes C, Williams PL, et al. An assessment of bone fluoride and osteosarcoma. *Journal of Dental Research* 2011; 90(10):1171–1176. [[PubMed Abstract](#)]

Related Resources

- *Cancer and the Environment: What You Need To Know, What You Can Do* (<http://www.cancer.gov/newscenter/cancer-and-the-environment>)
- *What You Need To Know About™ Cancer* (<http://www.cancer.gov/cancertopics/wyntk/cancer>)

How can we help?

We offer comprehensive research-based information for patients and their families, health professionals, cancer researchers, advocates, and the public.

- **Call** NCI's Cancer Information Service at 1–800–4–CANCER (1–800–422–6237)
- **Visit** us at <http://www.cancer.gov> or <http://www.cancer.gov/espanol>
- **Chat** using LiveHelp, NCI's instant messaging service, at <http://www.cancer.gov/livehelp>
- **E-mail** us at cancergovstaff@mail.nih.gov
- **Order** publications at <http://www.cancer.gov/publications> or by calling 1–800–4–CANCER
- **Get help** with quitting smoking at 1–877–44U–QUIT (1–877–448–7848)