

10 Fluoride Facts You Should Know

by Kate Kershner



The fictional character General Jack D. Ripper -- not a fluoride fan.
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"Have you ever seen a commie with a glass of water?"

In the 1964 Stanley Kubrick film "Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb," it's a question that leads to a conspiratorial rant about the dangers of water fluoridation.

Almost fifty years later, [water fluoridation](#) is still a heated topic of debate. But what do you -- and for that matter, the experts who have been tasked to research it -- know about the actual [dangers and benefits of fluoride](#)? The medical and dental establishments by and large play the part of the beleaguered professor, begging people to educate themselves about the benefits fluoridation provides. But that doesn't stop vocal groups from claiming that even if fluoride does have useful properties, the dangers of fluoridation (or over-fluoridation) are far too risky to outweigh the benefits of a pretty smile.

In the following pages, we'll debunk common misperceptions about fluoride -- or lack of fluoride - and also take a look at the debate that surrounds community water fluoridation, so you can decide for yourself how fluoride affects your body and region. But first, let's look at the things that fluoride is not.

DOES FLUORIDE CAUSE CANCER?

Depends on who you ask. The CDC says that most of the studies of areas with fluoridated or naturally high levels of fluoride didn't find a link between cancer and fluoride, and American Cancer Society reiterates no strong link has been found. Opponents cite a study in 1990 that found "equivocal" evidence that male rats with fluoridated water had a higher incidence of a type of bone cancer [source: [ACS](#)]. In 1987, the World Health Organization labeled the carcinogenicity of fluorides as "non-classifiable."

10: Fluoride is not fluorine.

If you're scanning your handy chemical table for [fluoride](#), don't bother. Fluorides are actually compounds of fluorine -- that's F, on your periodic table -- combined with a metal. When we refer to the fluoride in our drinking water, [toothpaste](#), or food additives in this article, we're mostly referring to sodium fluoride, although we'll see later on that for large-scale water distribution, other forms of fluororide are sometimes used.

Fluorine is a naturally occurring gas that is quite irritating to the eyes, skin, and respiratory system. When it is combined with sodium, however, it's easily dissolvable in water, making it an ideal way to add fluorides to drinking water, toothpaste, mouthwashes, and a variety of other dental products.

Fluoride does accumulate in plants and animals. Animals (and that includes you, mammal!) see fluoride accumulation in their bones or soft shell. That means that with a high level of fluoride accumulation, bones can become brittle and be at risk for skeletal damage. In extremely high doses, reproductive organs and fertility can be affected [source: [ATSDR](#)].

We'll explore some of the risks of over-exposure to fluoride later, but first we'll explore how poisonous fluoride really is.



Any substance can be toxic in excess quantities, including plain old water.
Andrew Unangst/Photographer's Choice/Getty Images

9: Fluoride is a poison ... and so is your Pabst.

[Fluoride](#) may not be on the periodic table, but that doesn't mean it's not a naturally occurring substance. Fluoride is a mineral that is in the air we breathe, the food we eat, and--yes--occurs quite naturally in the water we drink. That being said, the natural fluoride level in all these things can vary wildly, and thus the debate about adding or subtracting fluoride in water supplies occurs.

Like any chemical or mineral, the dose makes the poison. Thus, if ingested or accumulated at levels too high, over-toxicity will occur. But don't panic quite yet--by this definition, nearly anything could be considered poisonous. For instance, drinking copious amounts of [water can be deadly](#). However, in small amounts, fluoride has been proven to prevent cavities and tooth decay in humans [source: [ATSDR](#)].

If you're still not sure how something poisonous can possibly be beneficial, think of the body's relationship with alcohol. In moderation, it's been shown to have health (and psychological) benefits, but if you're taking nine shots of "Tequila Sunrises" within nineteen minutes, you'll find that it's pretty toxic stuff.

So indeed, fluoride is not completely without its risks, which we'll see when we discuss fluorosis. But first, let's explore why it was deemed beneficial in small amounts, and how community water fluoridation amped up the debate about fluoride--and made Colonel Jack D. Ripper in "Dr. Strangelove" so leery of its origins.



8: Some Communities Add Fluoride to Water

You'd think that the benefits of [fluoride](#) would be discovered on people with either a high exposure to fluoride with perfect teeth, or a low exposure with troubled teeth. Turns out that in 1901 in Colorado, a dentist noticed his patients had mottled brown teeth . . . and very few cavities [source: [CDC](#)].

After a few more investigations into water sources, it was determined that high fluoride concentration in water could cause fluorosis (the mottling or corrosion of teeth) and that lower levels of fluoride could prevent [cavities](#) (sometimes referred to as "caries"). In 1945, a full-scale, long-term study took place in three U.S. and one Canadian city, where fluoride was added at a 1.0-1.2 parts per million (ppm) ratio. Over the course of 13-15 years, cavities were reduced by



Early (1965) water fluoridation process in Watford, England.
Hulton Archive/Getty Images

50%-70% in children in these communities, and fluorosis was seen at levels comparable to places with a natural 1.0 ppm fluoride source [source: [CDC](#)].

Community water fluoridation quickly spread, and the results were pretty stunning: from 1966 to 1994, the percentage of 12 year-olds in the United States with decayed, missing (due to cavities) or filled teeth declined 68% [source: [CDC](#)].

Cavities have declined in communities both with and without water fluoridation, which is ascribed to a prevalence of fluoride toothpaste. Also worth considering: many of our foods and beverages are processed in places with fluoridated water [source: [CDC](#)]. But with this trend of fluoridation, are we actually over-exposing ourselves to fluoride? Find out more by sinking those pearly whites into the next section.



Early on, there were opponents of fluoride in public water supplies. This man from Birmingham, England, collects water from his friends in Warwickshire in 1964.
Keystone/Hulton Archive/Getty Images

7: There's such a thing as too much fluoride

As we've discussed, [fluoride](#), like many other minerals or naturally occurring substances, can be harmful in high doses. Over-exposure to fluoride can lead to dental or skeletal fluorosis.

Dental fluorosis is caused by moderate amounts of excessive fluoride in early childhood. According to the [World Health Organization](#), ingesting fluoride after the age of six will not cause dental (sometimes called enamel) fluorosis, which is marked by a staining or pitting of the teeth.

However, long-term exposure to high levels of fluoride can cause skeletal fluorosis to develop in later years. Skeletal fluorosis can cause a change in the actual structure of the bones, and a bending of the limbs. Ligaments can calcify, resulting in painful muscle impairment and stiffening.

This kind of change to the body is seen mostly in places with an extremely high level of naturally-occurring fluoride in drinking water. While developed countries like the United States and Japan (which both have so-called "fluoride belts") can adjust the fluoride in the water to prevent harm, many of these belts are in impoverished regions like Sudan, Kenya, India, and Afghanistan.

We'll come back to how fluorosis and fluoride treatment is addressed globally in an upcoming section. But first, let's take a look at why fluoride has become such a hot-button issue both politically and socially.



Young children are most susceptible to a fluoride overdose and should be monitored when using fluoridated toothpaste.
Peter Cade/Iconica/Getty Images

6: Fluoride is no longer just a health issue

In many ways, [fluoride](#) has become a political and social cause. While the traditional medical and dental establishment sees the benefits of adding fluoride to water, those on the other side of the fluoride debate see a government entity exposing their bodies to a potentially toxic substance.

There's also the argument that good [dental hygiene](#) is not necessarily available or affordable in all communities. While fluoride toothpaste or other fluoridated oral products are effective cavity-fighters, some see fluoridating water as a free public health service that could save parents from spending money on dental treatment for [cavities](#).

Like every issue surrounding fluoride, there is an equal and entirely opposite side to the economic and social argument. Those who are wary of fluoridation argue that over-exposure to fluoride is actually more harmful to low-income groups, as fluorosis is costly to treat: bleaching, micro-abrasion and veneers cost a pretty penny.

Beyond social and economic inequality, many opponents of fluoridation simply see it as government intrusion in their most basic right to choose how to take care of their own body. More than personal choice, it also becomes a way of forcing parents to cede control of their children's bodies.

As we'll see in the next page, we'll check out why each side is begging the other to "think of the children."



Most doctors and dentists give fluoride a big thumbs up.
Thomas Northcut/Photodisc/Thinkstock

5: Fluoride has the most effect on developing teeth

You know the warning on the toothpaste package that says only a "pea-sized" amount of toothpaste is appropriate for children under six? And that children under two should avoid toothpaste altogether? And that you should squeeze the tube from the bottom up to get every little bit of paste out?

All of those things are useful to know, but only the first two might prevent a serious oral health problem. Dental (sometimes called enamel) fluorosis occurs in the early years of tooth development. That means only a pea-sized amount of toothpaste from the ages of two to six. The American Academy of Pediatric Dentistry also recommends that you ask your dentist (or water treatment plant) about the amount of [fluoride](#) in your water. Based on that, you can decide if fluoride supplements are necessary.

Most important, the AAPD recommends monitoring your child's use of [fluoride toothpaste](#). Although most of us don't jones for the taste of toothpaste, children might take a liking to the minty freshness, or simply swallow too much when brushing. Make sure they're brushing thoroughly, but also spitting the toothpaste out.

One thing the AAPD doesn't recommend is avoiding fluoride completely. As we've gone over, the right amount of fluoride is going to prevent cavities. Just be aware that at an early age, the line between too much and enough is a little finer. Next, we're going to see who is on what side in the fluoride debate.



4: Established medical groups fight for fluoride



The EPA and the Department of HHS revised their water fluoridation standards in early 2011.
Thinkstock/Comstock Images/Getty Images

Four out of five [dentists](#) might recommend sugarless gum, but virtually every dental and medical association recommends [fluoride](#). The groups that recommend fluoridation at optimal levels reads like a child's confused attempt at the alphabet:

- ADA (American Dental Association)
- AMA (American Medical Association)
- CDC (Centers for Disease Control)
- EPA (Environmental Protection Agency)
- WHO (World Health Organization)
- NRC (National Research Council)
- CDA (Canadian Dental Association)
- EAPD (European Academy of Pediatric Dentists)

Although all the groups recommend fluoride, that doesn't mean all of them are gung-ho about community water fluoridation. The EAPD states, "for the majority of European communities, the EAPD recommends the use of an appropriate fluoride toothpaste [à€](#) to be the basic fluoride method," but still "reaffirms its support for the use of water fluoridation, as recommended by WHO,

and in those cases where this is possible" [source: [Oulis](#)].

Many groups that oppose fluoridation are grass-roots led, and though many have individual endorsements from scientists, dentists, doctors, and educators, they don't have a broad nod from organized medical or dental associations.

It also must be kept in mind that fluoride is a pollutant, and thus has an influence on the environment. While the effect of fluoride contamination from industry (and naturally occurring fluoride contamination, which might occur when a volcano erupts) is not entirely known, the effect of fluoride-treated water on the environment has been studied and has not been deemed a risk [source: [Pollick](#)].

Now let's take a look at our larger global environment, and how fluoride and the fluoride debate is seen much differently from one region to the next.

SAHA'S SENSOR

Excessive natural fluoride in drinking water presents a challenge to those in developing nations. Researcher Sourav Saha at Florida State University hopes to make monitoring fluoride levels less difficult by creating a molecular sensor that changes color when fluoride is added. More importantly, the color changes yet again at a dose considered above optimal levels.

3: Fluoride presents different challenges around the world.

In the United States, the questions about [fluoride](#) generally center around the safety of adding fluoride to water. Globally, the debate about fluoride often must focus on how to remove high levels of naturally-occurring fluoride from a drinking supply.

As we saw in an earlier section, it's excessive fluoride that often can lead to debilitating skeletal fluorosis in certain regions of the world. Fluoride belts--those regions with high levels of natural fluoride--are often found at the foot of high mountains, or where the sea makes mineral deposits. The [World Health Organization](#) acknowledges the larger risks of over-fluoridation and skeletal fluorosis on populations, and focuses its efforts

on controlling excessive fluoride in water sanitation and safety programs.

Over half the United States adds fluoride to their water supplies to reach an optimal level. New Zealand, Australia, and Ireland (and ten percent of the water supply in Britain) is fluoridated. Most European nations do not fluoridate water, along with Japan and China, among others. However, don't assume that they're anti-fluoride; several countries add fluoride to their table salt (much like you can buy iodized salt in the United States), or even add fluoride to milk.

So adding fluoride to water is by no means globally accepted. But if you're entirely certain that fluoride should be dumped into drinking water with pleasure, read on -- because even the United States government recently had a change of heart about their long-established fluoride stance.



A regular water filter like this one might get rid of impurities, but it won't do much about fluoride in your water.
Creative Crop/Digital Vision/Getty Images

2: Fluoride Levels in U.S. Drinking Water have been Lowered

Sure, the United States has had a bit of an adjustment when it comes to fluoridated drinking water. But don't get too excited if you're a fluoridation foe, because it's more of a teeny shift of weight than a full about-face.

In January 2011, the United States Department of Health and Human Services (HHS), along with the Environmental Protection Agency (EPA), announced the range of [fluoride](#) in water should move from 0.7 to 1.2 milligrams per liter of water to .7 milligrams per liter. The EPA decided to review their evaluation of fluoride after the National Academies of Science did a comprehensive review of the effects of fluoride on dental and skeletal structure, which also addressed the wider range and use of fluoridated products in the United States.

Now here's where things get a little tricky: while HHS recommends .7 mg per liter, the EPA has an "enforceable" standard of 4.0 mg per liter, and a "secondary standard" of 2.0 mg per liter. Why the confusion? The EPA is in charge of making sure that no one is exposed to excessive fluoride, while HHS is tasked with providing optimal public health recommendations that give the most benefit with the least harm [source: [EPA](#)].

So while HHS recommends the lower .7 mg standard, the EPA is still reviewing whether they need to lower their enforceable or secondary (ie: recommended but not required) standards. In the next section, we'll see how exactly we can add or remove fluoride should we need to.

1: Fluoride is easily added to drinking water and tough to remove

So by now, you may have decided where you stand on [fluoride](#), and the debate that surrounds fluoridating community water supplies. But how, exactly, is fluoride added or removed from the water?

First of all, adding fluoride is much easier than removing it. Essentially, a water district will add fluoride (usually in the form of fluorosilicic acid, sodium fluorosilicate, or sodium fluoride) to a large drum of water called a saturator tank. When the water is saturated with fluoride, it is distributed into the water supply at the levels deemed fit.

Removing fluoride is a bit trickier. Most standard water filters will not impact the fluoride concentration in water, because they are charcoal-based (which don't trap any and all chemicals). And don't bother with the old boiling trick; fluoride will cheerfully stay in the hot tub. Reverse osmosis and distillation filters will remove fluoride, and the CDC recommends you purchase a American National Standards Institute (ANSI) certified unit that's been tested for effective fluoride removal.

Unfortunately, cost of reverse osmosis and distillation techniques can be prohibitive to individuals, and is not necessarily effective for an entire community water supply. As the [World Health Organization](#) puts it, "the preferred option is to find a supply of safe drinking-water with safe fluoride levels" [source: [WHO](#)].

If you can't get enough of fluoride--or are concerned you're getting too much--read on to discover lots more information about fluoride and the debate that surrounds it.

Lots More Information

Related Articles

- [Pros and Cons of Fluoride](#)
- [Is fluoride considered a poison in most European countries?](#)
- [How Cavities and Fillings Work](#)
- [The Ultimate Fluoride Facts Quiz](#)

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