

## Fluoride

**DISCLAIMER: the following is not meant to treat anyone with advice or tell you what you should do, such as relative to use of medication, exercise, or changing your diet. The information in this handout is merely offering what has been published in the research literature, as well as based on my professional experience. Talk to a doctor or other appropriate professionals as to what is best for your own specific needs.**

**It should also be appreciated that everyone has their own perspective on how to improve health. Nutritionists do it through food. Physicians do it through medicine. Psychologists do it through changing thoughts, feelings, and behaviors. Consequently, what is offered here is a reflection of my own bias and perspective.**

### What it does

The one fact that probably everyone knows about fluoride is that it is often added to public water supplies and toothpaste to prevent cavities. National studies (NHANES, 1999-2004, and 2011-2014) found that for counties in which 75% or more of the drinking water contained 0.7 mg/liter of fluoride resulted in a 30% reduction in cavities in baby teeth, and a 12% lower rate of cavities for permanent teeth.

About 60% of the fluoride consumed in the U.S. is through fluoridated water. According to the CDC as of 2020 about 73% of people in the US receive fluoridated water. There is research (International Journal of Occupational & Environmental Health, "A new perspective on metals and other contaminants in fluoridation chemicals" Phyllis Mullenix, April 2014) that metal contaminants occur in fluoride added to water (through sodium fluoride or hydrofluorosilicic acid, HFS), and these can include

- ❖ aluminum
- ❖ arsenic
- ❖ barium
- ❖ calcium
- ❖ iron
- ❖ lead
- ❖ magnesium
- ❖ potassium
- ❖ zinc

with arsenic being found most consistently. How much of these metals is in such fluoride is batch dependent with as much a 10-fold variation between batches for arsenic, lead, and barium. Arsenic ranged from 4.9-56 ppm in HFS batches. HFS may leach lead from pipes which can then cross the blood-brain barrier easier than other types of fluoride. There is some research (Neurotoxicology, "Association of silicofluoride treated water with elevated blood lead" R.D. Masters et al, Dec. 2000) that there was a significant association between such treated water and elevated blood lead levels. HFS is said to be more dangerous than sodium fluoride as to

increasing the risk of lead toxicity and especially for kids living in older homes such as those with lead paint. A 2006 study by the National Research Council ("Fluoride in drinking water: a scientific review of EPA's standards") found that fluoridated water can put some groups of people at higher risk including:

- ❖ infants
- ❖ children
- ❖ outdoor workers
- ❖ athletes
- ❖ people with poor kidney function
- ❖ diabetics, and other health conditions

with impacts including on the central nervous and endocrine systems.

Foods and beverages prepared with such water, along with toothpaste and other dental products are other potential sources of intake. Fluoride toothpaste typically has about 1.3 mg in a single application (a ¼ teaspoon or so). The amount swallowed in the process of brushing one's teeth obviously varies by the person and their control over swallowing. Kids up to the age of 5 are estimated to ingest 0.1 - 0.25 mg/day. Kids ages 6-12 years are estimated to ingest 0.2 - 0.3 mg/day, and 0.1 is estimated for adults. Fluoride gels applied by a dentist can lead to ingestion of anywhere from 1.3 - 31.2 mg per visit.

Fluoride comes with risks. They include:

- ❖ it concentrates in the cardiovascular system which can lead to elevated blood pressure, arterial calcification, arteriosclerosis, and heart damage.
- ❖ dental fluorosis can result, which are little white streaks or specks on the tooth enamel. The tooth's health is not affected, but the discoloration may be noticeable. Two national studies (NHANES, 2001-2002 and 2011-2012) found dental fluorosis increased from about 30% to 61% during those ten years. Kids with dental fluorosis have been shown to have altered EKG's including a prolonged Q-T interval which is a marker for arrhythmias and a risk factor for sudden death ("Effects of fluorosis on QT dispersion, heart rate variability and echocardiographic parameters in children" S. Karademir, March 2011)
- ❖ Another study (Neurotoxicological Toxicity, "Association of lifetime exposure to fluoride and cognitive functions in Chinese children: a pilot study" Anna Choi et al, Jan-Feb. 2015) found that dental fluorosis was the strongest indicator for cognitive deficits in kids due to fluoride exposure.
- ❖ fluoride accumulates in the pineal gland more than anywhere else in the body. The gland's main job is to make melatonin which maintains the circadian rhythm. Impacts on circadian rhythm may include falling asleep later, waking up earlier, developing sleep apnea, and reducing sleep duration and quality in older adolescents and adults (Environmental Health, "Fluoride exposure and duration and quality of sleep in a Canadian population-based sample" Jasmyn Cunningham et al, Feb. 2021). They found that for every 0.5 mg/L

higher water fluoride concentration there was a 34% increased relative risk of sleeping less than recommended amount. The pineal also regulates the beginning of puberty in girls, and helps protect the body from damage caused by free radicals. It is outside of the blood brain barrier and so subject to fluoride in the blood stream getting into it. The gland has a lot of blood flowing to it. Plus, it has the highest calcium concentration of any normal tissue in the body. Fluoride loves to react to calcium which can then lead to the gland's calcification. What results: poor sleep, early puberty, increased risk for breast cancer, more oxidation, and increased risk of Alzheimer's. Reducing fluoride exposure (e.g. fluoride toothpaste & mouthwash; fluoridated tap water) can help limit exposure. Apple cider vinegar and iodine can also help. Chlorine, which is chemically similar to fluoride can take a toll too (e.g. from chlorinated tap water, along with calcium carbonate supplements).

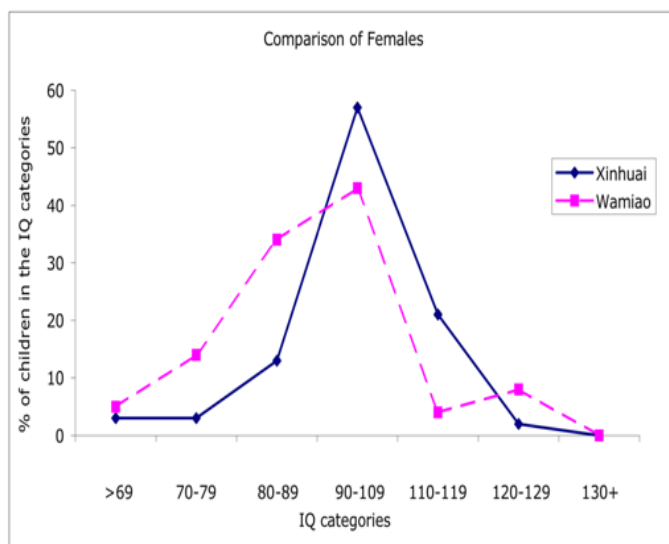


FIGURE 7-1 Distribution of IQ scores from females in Wamiao and Xinhuai (data from Xiang et al. 2003a).

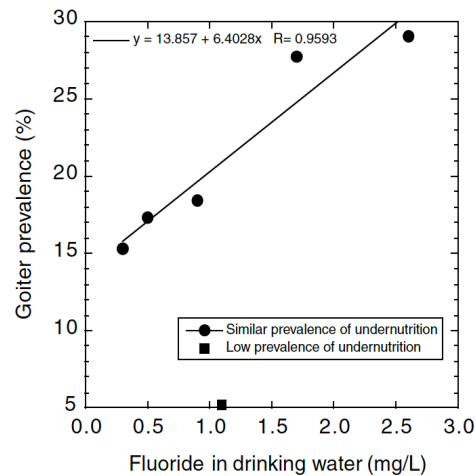
This graph reflects findings from a study in two areas of China involving 512 kids ages 8-13. One area had fluoride concentrations in the water of about 2.47 mg/l and the other was around 0.36 mg/l. The populations had similar qualities such as family income, education and iodine levels. Average IQ scores in the high fluoride area (in pink) were significantly lower (~92 vs. 100). IQs for both boys and girls declined with increasing fluoride exposure. Boys had a roughly similar graph result as that shown for girls.

(Fluoride, "Effect of fluoride in drinking water on children's intelligence" Q. Xiang et al, 2003).

- ❖ Another study in China looking at low- vs. high fluoride concentrations in water found almost 22% of kids in the high fluoride area had IQs of 70 or lower vs. 3.4% in the low fluoride region. IQ tests are designed so that approximately 2% are expected to have a score of 70 or lower. Urinary fluoride concentrations were inversely correlated with IQ.
- ❖ skeletal fluorosis is another issue that can arise. It is a bone disease with increased risk of fractures. Increased arterial calcification has often found in those who have skeletal fluorosis. The aorta accumulates more fluoride than possibly any other soft tissue.
- ❖ damage to the parathyroid gland can occur. This can lead to hyperparathyroidism which can cause loss of calcium from bones leading to more potential fractures, along with more

calcium in the blood which can lead to arterial calcification ('hardening of the arteries'), heart damage, and heart failure.

- ❖ problems with the thyroid gland leading to Hashimoto's or Grave's disease.
- ❖ joint problems can develop such as osteoarthritis
- ❖ possible reduction of testosterone in men. One study done in China on men between the ages of 18-50 looked at people in different villages. One group was exposed to high levels of fluoride and the other was not. Results were that prolonged exposure could greatly reduce testosterone in otherwise healthy males. Another study done by researchers in Canada and China found that fluoride causes decreased sperm count, reduced fertility, and disturbed levels of sex hormones in men. (Wei Sheng Yan Jiu, "Influence of water fluoride exposure on sex hormone binding globulin and testosterone in adult male," Tong Zhou et al, March 2013).
- ❖ an 18 yearlong study done by the National Center for Toxicological Research on females ages 10-49 looked at different counties with varying levels of fluoridation in public water systems across nine states. They found that total fertility in women in towns with higher fluoride exposure was significantly lower compared to those with lower exposure. (Journal of Toxicological Environmental Health, "Exposure to high fluoride concentrations in drinking water is associated with decreased birth rates", SC Freni, May 1994).
- ❖ fluoride also has an impact on iodine levels in the human body. It can reduce T3 and T4 and increase TSH. Fluoride can displace iodine. Use of fluoride to treat an overactive thyroid was first done back in the 1930s so the effect on iodine has been known for a long time. One study in 1994 funded by UNICEF found that fluoride levels of 0.9 ppm (which is less than added by some water systems) were sufficient to worsen iodine deficiency. Kids in areas with low fluoride compared to those with iodine deficiency in the 0.9 ppm area had higher TSH levels, reduced T3, reduced intelligence, retarded bone development, and reduced hearing. They concluded "high fluoride intake exacerbates the central nervous lesions and the somatic developmental disturbance of iodine deficiency." (Endemic Disease Bulletin, "The relationship of a low-iodine and high-fluoride environment to subclinical cretinism in Xinjiang", 6(2),62-67.)
- ❖ observational studies suggest decreased cortisol secretion. It may have adverse effects on insulin levels, impair pancreatic function and result in abnormal glucose tolerance.



Taken from: "Fluoride in drinking water: a scientific review of EPA's standards" 2006

This suggests that there's an association between higher fluoride and lower iodine levels leading to goiters.

**FIGURE 8-2** Goiter prevalence versus drinking water fluoride concentrations in six South African towns with adequate iodine concentrations. One town had a significantly lower prevalence of undernutrition than the other five towns and is not included in the line fitting. SOURCE: Jooste et al. 1999.

- ❖ The same EPA paper cited above discusses research on fluoride and blood sugar levels relative to diabetes. "The conclusion from the available studies is that sufficient fluoride exposure appears to bring about increases in blood glucose or impaired glucose tolerance in some individuals and to increase the severity of diabetes."
- ❖ there is some research that has found an association between fluoride exposure and elevated blood pressure, especially for women and those over age 60.
- ❖ prenatal exposure may lead to lower cognition in kids such as IQ scores, although some say such research was methodologically flawed
- ❖ The Harvard School of Public Health and China Medical University in Shenyang did a review of 27 studies (Environmental Health Perspectives, "Developmental fluoride neurotoxicity: a systematic review and meta-analysis", Anna Choi et al, Oct. 2012). They found evidence that fluoride may adversely impact the intellectual development of kids. The average loss of IQ was 7 points. (As to the significance of that: an average IQ is 100, and 50% of kids are above or below that level. An IQ of 93 is at approximately the 32<sup>nd</sup> percentile, meaning that about 68% of people are above that level of intelligence.) One of the authors, Phillippe Grandjean, wrote "Fluoride seems to fit in with lead, mercury and other poisons that cause chemical brain drain. The effect of each toxicant may seem small, but the combined damage on a population scale can be serious."
- ❖ The EPA source cited above also discusses the risk of cancer resulting from fluoride exposure. "Fluoride appears to have the potential to initiate or promote cancers, particularly of the bone, but the evidence to date is tentative and mixed. Osteosarcoma is of particular concern" because fluoride gets deposited in bone.

- ❖ high doses ingested in a single instance can result in nausea, vomiting, abdominal pain, diarrhea, and on rare occasions death. Such toxicity is estimated at 5 mg/kg (e.g. a 165 pound/75 kg person ingesting 375 mg), but such a level is virtually impossible to obtain from something like water or toothpaste.
- ❖ aluminum and fluoride can be found together in drinking water and the two minerals together are synergistic as to fluoride increasing the absorption of aluminum. The most common way aluminum gets into drinking water is through surface runoff and soil seepage, as to water flowing over rocks that high concentrations of the mineral, and traces dissolve into it. Acid rain is another common cause of high aluminum concentrations in surface water. Moreover, some public drinking water treatment facilities add aluminum to water to remove organic matter, turbidity, and microorganisms. The only accurate way to know if your drinking water contains aluminum is to test it. Fluoride has been added to water supplies for decades against tooth decay.
- ❖ there is also some concern about fluoride leading to kidney and liver damage. At relatively low levels, according to animal research, it may be toxic to them. There is less research about this on humans, but there are hints that it is toxic to these human organs too. e.g. There was a NHANES study on nearly 2000 adolescents with their fluoride levels measured in their blood with over 1700 having their fluoride level in tap water measured too. Those with the highest fluoride level had lower kidney function. A similar association was found between tap water fluoride levels and kidney function. (Environment International, “Fluoride exposure and kidney and liver function among adolescents in the U.S.: NHANES 2013-2016” Ashley Malin et al, Nov. 2019). They noted that reverse causality cannot be ruled out, meaning that those with impaired kidney and/or liver function may have an effect on fluoride absorption.
- ❖ hypothyroidism may be increased from fluoridated water in a non-linear manner as to increasing TSH and the risk of some thyroid diseases. (Environmental Research, “Does fluoride exposure affect thyroid function? A systematic review and dose-response meta-analysis” Inga Iamandii et al, 2024).
- ❖ there is also a question about fluoride speeding up puberty in females while delaying it in males. It may damage ovarian function, the prostate gland, lower testosterone and progesterone, and cause estrogen imbalances. (Environmental Pollution, “Association of fluoride exposure with sex steroid hormones among U.S. children and adolescents, NHANES 2013-2016” Rongan Bai et al, May 2020).

A Scottish study found that higher levels of the two minerals together were related to increased risk of dementia with a dose-response pattern. Dementia risk more than doubled in the highest quartile vs. the lowest. Such dementia risk was found in people who consumed relatively small drinking-water levels of both.

As to how to protect against the effects of fluoride, a study done on mice in India found that the spice curcumin “significantly reduces the toxic effect of fluoride to near normal level by augmenting the antioxidant defense through its scavenging property and provide an evidence of

having therapeutic role against oxidative stress mediated neurodegeneration.” Chlorella may help bind it it up too.

#### Symptoms of deficiency

Fluoride deficiency may lead to tooth decay, and possibly osteoporosis.

#### Who is at risk

Fluoride deficiency is usually rare. High amounts of calcium, magnesium or aluminum can lead to it.

#### Sources (including the top 10 highest in it)

- ❖ raisins (2.34 ppm)
- ❖ blue crab (2.10 ppm)
- ❖ shrimp (2.01 ppm)
- ❖ fries (1.15 ppm)
- ❖ potato chips (1.06 ppm)
- ❖ gravy (1.06 ppm)
- ❖ popsicles (0.77 ppm)
- ❖ oatmeal (0.72 ppm)
- ❖ broth (0.70 ppm)
- ❖ raisin bran (0.65 ppm)
- ❖ beef
- ❖ black tea
- ❖ coffee
- ❖ corn
- ❖ cottage cheese
- ❖ grapes
- ❖ grapefruit juice
- ❖ lamb chop
- ❖ milk
- ❖ nuts
- ❖ potatoes
- ❖ rice
- ❖ salmon
- ❖ spinach

	Adequate Intake	Pregnancy/Lactating	Daily Tolerable Upper Intake Level	Pregnancy/Lactating
0-6 months	0.01 mg		0.7 mg	
7-12 months	0.5 mg		0.9 mg	
1-3 years	0.7 mg		1.3 mg	
4-8 years	1 mg		2.2 mg	
9-13 years	2 mg		10 mg	
14-18 years	3 mg	3/3 mg	10 mg	10/10 mg
19+ years	4 mg	3/3 mg	10 mg	10/10 mg

The World Health Organization (WHO) guideline limit is 1.5 ppm. The EPA has the maximum allowable level at 4 ppm and asks people to inform them at levels above 2 ppm. Levels about 4 ppm could be hazardous.

### Interactions

Fluoride is not known to interact with drugs.

However, fluoride is in a lot of meds. One way to know it is in a drug is that it often has flu- or fluo- as part of the name. Some of them include:

### Anesthetics

Desflurane  
Droperidol  
Enflurane  
Flumazenil  
Halophane  
Isoflurane  
Methoxyflurane  
Midazolam  
Sevoflurane

### Antacids

Lansoprazole

### Antianxiety

Flurazepam  
Halazepam  
Hydroflumethiazide

### Antibiotics

Fluconazole  
Flucytosine



Voriconazole  
Ciprofloxacin  
Enoxacin  
Flucloxacillin  
Gatifloxacin  
Gemifloxacin mesylate  
Levofloxacin  
Linezolid  
Lomefloxacin  
Moxifloxacin  
Norfloxacin  
Ofloxacin  
Sparfloxacin  
Trovafoxacin mesylate

Antidepressants

Citalopram  
Escitalopram  
Fluoxetine HCL  
Fluvoxamine  
Paroxetine  
Progabide

Antifungals

Fluconazole  
Flucytosine  
Voriconazole

Antihistamine

Levocabastine

Anti-inflammatory/steroids

Amcinonide  
Betamethosone dipropionate  
Clobetasol  
Clocortolone  
Dexamethasone  
Diflorasone  
Dustasteride  
Flumethasone pivalate  
Flunisolide  
Fluocinolone acetonide  
Flucinonide  
Fluorometholone

Fluticasone propionate  
Flurandrenolide  
Hydroflumethiazide

Antimalarial

Mefloquine

Antipsychotics

Fluphenazine HCl  
Haloperidol  
Trifluoperazine HCl

Arthritis

Celecoxib  
Diflunisal  
Flurbiprofen  
Leflunomide  
Sulindac

Chemo

Fluorouracil

Cholesterol lowering

Atorvastatin  
Ezetimibe  
Fluvastatin