Cadmium

Cadmium is known for its toxicity and being carcinogenic. It is in the top 10 chemicals of major public health concern according to WHO (along with arsenic, lead and mercury). The CDC ranks cadmium at #7 out of 275 most hazardous substances in the environment.

Cadmium harms the kidneys, thyroid, and bones. It has been associated with lung cancer, and possibly prostate, testicular and breast cancers. One estimate has been made that as many as a third of breast cancer cases in the U.S. may be associated with elevated cadmium levels (Aging, "Environmental cadmium and breast cancer risk" Carolyn Gallagher et al, Nov. 2010).

It can cause damage to the immune system, hormonal imbalances, fetal malformations, and lead to brain damage. It may also contribute to heart disease and diabetes. There is some research between cadmium levels and neurocognitive tests based on the NHANES 3 survey done between 1988-1994 on people 20-59 years old (Environmental Health, "Associations between cadmium exposure and neurocognitive test scores in a cross-sectional study of US adults" Timothy Ciesielski et al, 2/5/2013). Subtle impairments on such cognitive performance were found with cadmium exposure that had been thought to be safe.

Cadmium gets into the environment through a number of means. These include smelting, metal plating, producing pigments, in production of NiCd batteries, as a neutron absorber in nuclear reactors, and as stabilizers in plastics.

Once it gets into the air it can fall back to earth with rain or simply by falling out of the air. It is then picked up by plants such as leafy greens, root crops (e.g. potatoes), tobacco, rice, cereals and grains. Cadmium in drinking water is typically under 1 mcg/liter (1 ppb), and it typically is not contaminated other than by mining or industrial wastewater. It can also be found in liver and kidney meats, and in some areas shellfish and mushrooms. Other sources of potential exposure include cigarette smoke which for heavy smokers can be as much as they absorb from food (which might be 0.5 - 2 mcg/cigarette, with smokers ending up with twice as much cadmium in their bodies as nonsmokers). Ceramics and glass glazing, jewelry making, and fabric dyes are other potential sources of it.

Cadmium can also be found in kids' jewelry. Lead had been used by countries like China but when they were barred from using that heavy metal some switched to using cadmium which can be more dangerous. One piece of jewelry that was tested contained 91% cadmium by weight. Other trinkets purchased at national and regional chains or franchises found 84-89% of cadmium by weight. Kids can ingest the cadmium by sucking or biting into such jewelry. One study done by the Associated Press found 12% of the jewelry tested containing at least 10% cadmium. How is this possible? There are no federal laws restricting it, although some states (e.g. California, New York, Illinois, Maryland, Minnesota, Washington) are now limiting it in children's jewelry items. There are some voluntary industry standards for cadmium in toys.

Other potential sources of cadmium that is in food includes:

	mcg/100 g of food (or 100 ml of liquid)
Mussels	53.1
Oyster	42
Lamb kidney	19
Crabmeat	18
Potato chips	13.5
Prawn, king size	12.8
Lamb liver	12.7
Sesame seed	7.7
Peanut	3.9
Tahini	3.1
Strawberry	3.1
Beetroot	2.1
Tuna	2.0
Peanut butter	1.9
Celery	1.5
Avocado	1.5

A more complete list can be found at http://dietgrail.com/cadmium-in-food/

Cadmium also accumulates in snails, scallops, lobster, shrimp, fish, and dried seaweed.

Another common source of cadmium intake through food is chocolate and cocoa. Below is a table showing lead and cadmium levels of various chocolate products.

	Lead mcg/serving	Cadmium mcg/serving
NOW healthy foods certified organic cocoa powder 100 pure	7.5	10.8
Whole Foods 365 Everyday value organic dark chocolate coconut 56 cacao	6.0	16.3
Theo organic fair trade almond coconut 65 dark chocolate limited edition spring collection	4.5	10.7
Trader Joe's passport Tanzania 73	4.4	6.8
Endangered species chocolate natural dark chocolate with 88 cocoa	3.4	2.1
Godiva chocolatier 85 cacao extra dark Santo Domingo chocolate	3.0	6.8
Lindt Excellence 85 cocoa extra dark chocolate bar	2.8	5.2
Whole Foods 365 Everyday value organic dark chocolate 56 cacao	1.8	10.3
Newman's Own organics the second generation super dark chocolate premium organic chocolate 70 cocoa	1.8	33.1
Cadbury Royal Dark Chocolate Indulgent Semisweet	1.0	0.9
Godiva chocolatier 50 cacao dark chocolate sea salt	1.0	2.1
Hershey's Special Dark Mildly Sweet chocolate bar	1.0	3.8
Equal Exchange chocolate organic fairly traded dark chocolate very dark 71 cacao	1.0	8.1
M&M's dark chocolate	0.9	Not available
Toblerone of Switzerland dark chocolate with honey and almond nugat	0.9	1.1
Swiss Miss premium cocoa dark chocolate hot cocoa mix	0.7	0.7
Ghirardelli chocolate premium baking cocoa 100 unsweetened cocoa	0.7	0.6
Whole Foods 365 Everyday value organic hot cocoa rich chocolate flavor mix	0.7	4.5
Dove silky smooth dark chocolate bar	0.7	5.5
Nestle rich milk chocolate flavor hot cocoa mix	0.6	0.3

Baker's unsweetened baking chocolate bar	0.6	4.6
Hershey's kisses milk chocolate	0.5	0.6
Whitman's sampler solid milk chocolate rabbit	0.5	0.6
Hershey's cocoa 100 cacao natural unsweetened	0.4	4.0
Reeses milk chocolate peanut butter cups	0.1	0.6
Snickers bar	None detected	0.6

A more complete listing can be found at https://www.asyousow.org/environmental-health/toxic-enforcement/toxic-chocolate

Protein powders also can contain cadmium (along with other heavy metals like lead, arsenic, and mercury). One study found a serving of protein powder contained on average 1.6 mcg of cadmium, but ten samples had 4.6 – 10.7 mcg/serving. Elevated levels in such powders tend to be from chocolate flavoring from cocoa powder.

However, there is a difference between what is eaten and what is absorbed. What research found is that the bioavailability of cadmium was greater in animal-based foods than vegetable-based. Research also has found that the uptake of heavy metals like lead and cadmium are inhibited by dietary fiber and phytate that are found in plant foods.

Acute effects of cadmium toxicity can include

- irritating the respiratory system
- headaches
- chills,
- muscle aches
- nausea
- vomiting
- diarrhea

Chronic toxicity primarily affects the kidneys, with less accumulating in the liver and muscles. It can also impact the lungs leading to decreased functioning and emphysema. Osteoporosis and osteomalacia can occur from it too. Occupational exposure to cadmium has been implicated in lung and prostate cancer. It can also affect the reproductive and cardiovascular systems.

Some of the damage cadmium does is by the fact that it is similar to zinc in structure and function, and the zinc/cadmium ratio influences its toxicity and storage. Being deficient in zinc can increase the cadmium toxicity, while having appropriate levels of zinc can reduce cadmium's damage. Zinc deficiency and cadmium toxicity are more likely in diets that are high in refined grains and flours because the ratio gets altered when the grains are refined.

Kids who do not get enough iron, calcium, zinc or protein may absorb more cadmium through their diet. Pregnant women low in calcium, iron or zinc may absorb more cadmium. It can also get into breast milk, and levels in such milk are at 5-10% of the maternal blood levels. Effects of cadmium in fetuses is not well studied. It may have an impact on birth weight, neurobehavior, and the immune system.

A 2012 study from Harvard (Environmental Health Perspectives, "Cadmium exposure and neurodevelopmental outcomes in U.S. children" May 2012, Timothy Ciesielski et al) took over 2,000 kids ages 6-15 years old from the NHANES data collected between 1999-2004. It found that kids with higher cadmium levels were three times more likely to have learning disabilities and be in special ed. The adverse health effects were with cadmium levels that are commonly found in American children and which were previously thought to be without adverse effects.

What is a safe level of cadmium?

The World Health Organization (WHO) offered that the "tolerable intake" of cadmium through food is 25 mcg/kg of body weight per month. The EPA has mandated that the maximum cadmium level in bottled drinking water is 0.005 mg/liter. California's Prop. 65 safe limit is 4.1 mcg/day.

Detoxing from cadmium

There are two half-life's for cadmium, meaning how fast does it leave the body. A half-life of 1 month would mean that it would be cut in half by then, and would be at a quarter after 2 months, etc. One half-life is of a few months and is how fast red blood cells are being turned over. The other half-life is years to decades long and reflects cadmium that is stored in the liver, kidneys, and muscle.

There are chemical chelation agents but there are concerns about their safety and efficacy. Talk to a medical doctor if you want to know more about them.

One approach to removing mercury, as well as lead and cadmium, from the human body, is through use of a lactovegetarian diet. One study found that mercury levels dropped by 25%, lead by 47%, and cadmium by 24% after three months on the diet. When the subjects went off the diet, their levels of these poisons returned to about their baseline although lead was actually 13% higher after a three year period.

Another approach to consider is what already has been mentioned as to zinc, calcium and iron offering a protective effect. Zinc is one of the more well studied metals for detoxing from heavy metals. Mice research suggests that selenium may be helpful against lead and cadmium poisoning. Iron competes with cadmium for intestinal uptake meaning that iron supplementation may limit cadmium absorption. Calcium and magnesium may also compete with lead and cadmium for intestinal absorption. Copper, sulfur, and manganese also have a two-way relationship to cadmium (meaning that each is an antagonist to the other). None of this is to say that you should start gulping down handfuls of such minerals. Nutrients need to stay in balance to each other such as maintaining a proper ratio between calcium and magnesium. The human body likes everything to be at the 'Goldilocks' level, not too much, not too little, but just right. Determining where your levels are at relative to cadmium and then discussing it with an appropriate professional who can give you guidance on supplementation or changes to your diet is advised.

There is also some research, mostly based on rats, that garlic, ginger and onion can be helpful with lead and cadmium toxicity. Other research, again rat based, has found some benefit from green tea, tomatoes, curry, grapes, and ginseng.

Still other mice and rat research has found various probiotic strains to be helpful including l. plantarum CCFM8661, l. rhamnosus Rosell-11, l. acidophilus Rosell-52 and b. longum Rosell-175.

Other animal research suggests that spirulina and chlorella can help with cadmium or lead poisoning. How well such research into animals translates to humans, and with what doses is largely unknown. Taking excessive amounts of such foods, spices or other supplements can cause problems too. Some experts voice concern that if you try to flush out toxic elements like cadmium too fast, what might happen is that it goes from being locked up in your body to suddenly flushed into your blood stream and hits with you a more serious and acute poisoning. Consequently, they recommend that you first strengthen yourself nutritionally such as by looking at mineral and vitamin levels and getting them up to snuff, before you flush anything out of your system.