Fact or Fiction?

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Mercury

"*If you've read a newspaper lately, chances are you've seen an ad claiming that millions of women who eat tuna and other fish with mercury are poisoning their children. That sure sounds bad. Only problem is, it's a whole lot abalone. About the only thing the ads do prove is that trusting 'environmentalists' in a political debate is harmful to your health and the national well being*." - The Wall Street Journal[1]

Mercury is everywhere and we cannot avoid it. The average adult contains around 6 milligrams of mercury, assuming they have no mercury and amalgam fillings in their teeth. The human body can tolerate quite large amounts of mercury, although if the total exceeds 4 grams there is serious risk of death. About one person in ten has a mercury level greater than 0.05 ppm in their body. This makes them unsuitable as food for any cannibals who followed the nutritional guidelines regarding excess mercury levels in meat.[2]

A very small percentage of deposited elemental mercury is converted to methylmercury by microorganisms in bodies of water. This is the compound of primary public health concern since it is more readily absorbed by tissues and cells than other mercury compounds and is therefore more likely to harm humans. It can enter the aquatic food chain and accumulate in fish and other marine animals.[3]

About 70% of the mercury deposition in the US comes from natural sources and non-US anthropogenic (man-released) emissions. Natural sources include surface volcanic eruptions; deep sea vents and volcanic activity; hot springs such as the geyser basins in Yellowstone National Park or those at the bottom of Clear Lake in California; evaporation from the ocean basins, other water bodies and soils; and erosion. The oceans alone contain millions of tons of naturally occurring mercury. Forest fires and the burning of other types of vegetation also contribute to the world mercury budget. The non-US anthropogenic emissions mostly originate from China and the rest of Asia. China alone emits almost 500 tons of mercury annually from power plants and other sources, and is expected to increase emissions over the next two to five years by 20-30 tons annually.[4]

Natural fossil fuels like coal and oil contain trace levels of mercury. Burning these fuels results in the release of mercury into the air, where it either remains or may be deposited at distances ranging from nearby to thousands of miles away from the original emissions source. This makes determining where the mercury in a given location comes from a difficult task. One study indicates that 70% of the mercury deposited in the US comes from non-US sources. Another study estimates this value to be somewhere between 20 and 80%, depending on location.[3]

In general the majority of the mercury released from power plants which use a lot of fossil fuel is in the non-water soluble elemental form which enters the global mercury pool and is therefore, not available for conversion to methylmercury. Emissions from medical, municipal and hazardous waste incineration plants on the other hand release a higher proportion as oxidized (water soluble) mercury into the environment which tends to deposit locally.[5]

US power plant emissions, which continue to drop (38% decrease between 1995 and 1999), are presently 40-50 tons per year, equal to the amount that China will increase in just the next two years.[6] Global emissions - manmade and natural - are 5,000 tons annually, so emissions from US power plants are 1% per year. China's emissions are 10% per year and growing.[7]

Other industrial processes such as cement manufacturing, burning of municipal and hazardous waste, medical waste incineration, pulp and paper milling and mining activities also release mercury into the environment. These human activities combined with power plant emissions in the US, make up 2% of the total world mercury emissions.[4]

Humans are exposed to methylmercury primarily by eating fish and other seafood. Because mercury is an abundant and naturally occurring element, we can never expect methylmercury levels in fish to be zero. Larger, predatory fish contain more methylmercury than smaller fish due to accumulation effects at increasingly higher levels of the food chain. Studies designed to determine the origin of methylmercury contamination in ocean fish suggest that the accumulation is due primarily to natural processes, not human activity. Studies involving freshwater fish have yielded conflicting data.[3]

Two heavily contaminated areas, in Japan and Iraq, provide most of the known information on deaths and injury from mercury contamination of food. In Japan, the cause was fish from heavily contaminated waters. In Iraq, it was grain treated with mercurous fungicide. In the United States, sickness from mercury pollution is very rare.

In Japan, women who consumed fish heavily contaminated with methylmercury due to enormous industrial discharges into Minimata Bay gave birth to children with severely impaired speech, movement and mental activity. Some adults were also affected. The average methylmercury concentrations in fish ranged from 9,000 to 24,000 parts per billion, over 1,000 times the upper levels of exposure in the US. In addition, the amount of fish consumed was 20 times greater than the amount consumed by US sport fishermen, who are the highest consumers of fish in the US.[8]

Children and adults in Iraq experienced poisoning, including neurological damage, after eating seed grains, mistakenly distributed as food instead of for planting.

This had been treated with a methylmercury-based antifungal agent. Over 6,500 people were hospitalized and 459 died. Those exhibiting symptoms of methylmercury poisoning were estimated to have consumed 2 to 33 milligrams of mercury a day. In comparison, the typical consumption level in the US is 0.00008 milligrams a day (an average of 22,000 times less). These cases in Japan and Iraq resulted from extremely high doses of methylmercury and are difficult to compare with the far lower methylmercury exposure levels associated with US fish consumption.[8]

EPAs standards and other studies

EPAs reference dose is based on a study of Faroe Island children.[9] The Faroe mothers consumed enormous amounts of mercury though from seafood (such as whale) most Americans don't eat. When their children were given 17 neuropsychological tests, some scored slightly below average on three. Scientists have since disputed whether there was ever a statistical correlation and note that even if there was, it's impossible to know it was caused by mercury (the mothers were consuming high levels of such other toxins as PCBs and DOT). Either way, the kids who scored marginally below peers on a few tests didn't remotely have "learning disabilities" or "brain damage."[1]

Yet from this study, EPA developed a reference dose value of 5.8 ppb, an ultra-precautionary value that was derived by taking the Benchmark Dose Limit value of 598 ppb and dividing by a safety factor of 10. A FDA official has pointed out that even women who are over the US limit still have an eight-fold margin of safety.[1]

Other studies, such as some of the following, didn't show so-called "bad effects." These represent "the rest of the story" you typically don't hear about.

- For the past 15 years, scientists have been following 700 children on the tiny island nation of Seychelles, Africa. Their mothers ate tremendous amounts of high-mercury fish while pregnant (12-14 meals per week). The blood mercury levels of the mothers were six times higher than those of US women. Instead of negative results, benefits such as better eyesight and less hyperactivity were noted in the children.[10]
- A Princeton University study, funded by the EPA, compared mercury analysis of recently caught Pacific tuna with similar tuna that had been caught in the 1970s. Results showed that mercury levels in the tuna had not changed over time. The concluding statement in the paper reads as follows: "The bare fact that the concentrations of Hg [methylmercury] in tuna were identical in 1971 and 1998 either reflects a remarkable coincidence or indicates that, regardless of mechanisms, these concentrations are not responding to atmospheric pollution."[11]
- Comparison of mercury levels in deep sea fish (blue hake) from the 1880s with fish from the 1970s showed no differences in mercury content. This result supports the idea that the relatively high concentrations of mercury found in marine fish that inhabit the surface and deep waters of the open ocean result from natural processes, not 20th century industrial pollution.[12]
- Hair samples from eight 550-year old Alaskan mummies had concentrations of methylmercury higher than Alaska's modern population (*i.e.*, a group of pregnant women). The methylmercury concentrations in hair collected from the mummies ranged for 1.2 ppm to 4.6 ppm. The mean methylmercury concentration in today's Alaska population is 0.6 ppm.[13]
- Analyses of lakebed sediments deposited over the past 11,000 years in Minnesota's Elk Lake show that anthropogenic emissions have not been significant or exceptional. Average mercury levels in the lakebed sediments today are 140 parts per billion. Mercury levels in the sediment have been higher on seven different occasions due to natural causes with the highest being 350 ppb about 8,000 years ago.[14]

The findings of these studies bring into question several claims made by environmental organizations. Most importantly, the claim that atmospheric deposition of mercury from power plants or other anthropogenic sources is directly related to methylmercury levels in fish.

When I compare all of these studies with the EPA benchmark study I have to agree with University of Georgia Professor Emeritus Harold Brown who observes, "We wouldn't base our air quality standards on studies done in Mexico City or Tegucigalpa. What have they done to us?"[15]

Summary

Environmental organizations have shamelessly used fish advisories to further their political agenda and have created the false impression that US anthropogenic mercury emissions are increasing. Their ads are filled with misleading information and have contributed to a sharp decline in domestic fish consumption.

Scaring people away from consuming fish is creating a public health crisis in its own right. Fish is an important part of a healthy diet. Research has demonstrated that a diet rich in omega-3 polyunsaturated fatty acid through fish consumption has beneficial health effects for people with heart disease and various types of cancer, including breast, prostate and endometrial. In addition, fish consumption has beneficial impacts on people suffering from Alzheimer's disease and type-2 diabetes.[16] *P&SF*

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