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REPORT

Are Fish Oil Supplements Safer Than Eating Fish?

By Debra Fulghum Bruce, PhD



Americans are eating more fish than ever before. While the benefits of fish and fish oil are well substantiated, consumers are growing concerned about contaminants. Mercury, PCBs, and dioxins are toxins found in fish and have been shown to cause cancer, atherosclerosis, and brain damage.

This article reveals how much of what type of fish you can safely eat, and how to ensure that your fish oil supplements are free of toxins.

A recent *Wall Street Journal* article reported on the FDA's failure to provide adequate warning about pollutant levels in fish.¹ The article described a 10-year-old boy who suffered severe mercury poisoning because his parents believed that eating tuna fish was healthy. In attempting to identify the cause of the boy's newly acquired learning difficulties, a neurologist ordered tests that showed the boy's blood levels of mercury were nearly double what the United States Environmental Protection Agency (EPA) deems safe.

The boy's parents were alarmed to learn that the government had failed to warn the public despite its awareness of the potential dangers of eating tuna and other fish. Not until March 2004 did the FDA and EPA issue a mercury advisory urging limits on tuna consumption for children and pregnant and nursing women. However, the limits set forth in this advisory may in fact exceed safe levels for some people, according to a mercury risk assessment produced by the EPA several years earlier. Even if the joint advisory had been available in 2003 and the boy's parents had followed its recommendations, their son still would have consumed 60% more mercury than the EPA can confidently assure is safe.

GROWING CONCERNS ABOUT FISH SAFETY

While fish has long been considered a staple of a healthy diet, recent health alerts concerning the widespread contamination of fish by mercury, PCBs, and dioxins leave health-conscious consumers in a quandary: how can we obtain the health-boosting benefits of marine omega-3 fatty acids without risking a buildup of potentially harmful toxins in the body?²

In the past decade, millions of Americans have turned to fish oil supplements to augment the body's supply of the omega-3 fatty acids EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid). According to the *Nutrition Business Journal*, sales of fish oil supplements have more than tripled since 1998, reaching \$190 million in 2003.³ Fish oil's growing popularity is easily explained—EPA and DHA from fish oil are the most bioavailable forms of omega-3 fatty acids. For example, just one 1000-mg capsule of fish oil provides about the same amount of valuable marine fatty acids as four ounces of salmon.

Across the globe, toxic chemicals continue to proliferate in the environment, and traces of man-made pollutants have been found in nearly all tests of human and animal tissues.^{4,5} With all the negative clinical findings concerning mercury, PCBs, and dioxins—the three main pollutants highlighted in advisories for fish caught in the US—many consumers have also expressed concern about the safety of fish oil supplements.

These concerns were magnified last year when the United States Pharmacopeia warned that fish oil supplements may contain some of the same high levels of PCBs, arsenic, and other toxins that accumulate in wild fish. A flurry of debate ensued following the publication last year of a United Kingdom study targeting cod liver oil supplements as having high levels of PCBs, chlorinated pesticides (DDT), and other toxic chemicals.^{6,7} In response to growing consumer concerns, international standards and quality-assurance programs have been created to ensure the safety and quality of fish oil supplements. Before examining these programs, let us examine the primary pollutants found in fish and their associated health effects in humans.

MYRIAD HEALTH DANGERS OF METHYLMERCURY

Mercury Levels in Common Fish

A review of the scientific literature produces far-reaching evidence of the accumulation of organic pollutants in the marine environment. Nearly all fish and shellfish contain traces of mercury, making it the major contaminant found in fish.

A naturally occurring element in the environment, mercury is also released into the air through emissions from coal-burning power plants and solid-waste incinerators. In water, mercury is converted into methylmercury, a powerful neurotoxin that destroys nerve tissue. Predatory fish ingest methylmercury as they feed, with large fish taking in more of this neurotoxin than smaller fish. When humans eat fish (particularly the larger species), methylmercury accumulates in the bloodstream. In fact, the World Health Organization (WHO) has reported severe health epidemics in several countries that were caused by the consumption of methylmercury-polluted fish.⁸ While methylmercury is removed naturally from the body over time, it takes more than one year for levels to drop significantly.

Marine mercury contamination should be of serious concern to health-conscious adults, particularly those at higher risk for cardiovascular disease. New findings indicate that mercury is linked to cholesterol oxidation and may increase heart attack risk.⁹ A study from Finland published earlier this year suggests that mercury adversely affects cardiovascular health and may attenuate the cardioprotective effects of certain fish.¹⁰

Eating fish or shellfish tainted with mercury is of greatest concern to women of childbearing age, particularly those who are pregnant, planning to become pregnant, or nursing a young child. This risk is significant even for women who have yet to become pregnant, since toxic levels of mercury may be present at conception. Because mercury is bioaccumulative, it can be passed from the pregnant woman to the fetus and may contribute to learning disabilities and other neurobehavioral disorders in newborns. Dartmouth College researchers found that children exposed prenatally to even low levels of methylmercury (as evidenced in maternal hair samples) perform more poorly in cognitive tests.¹¹ Recent findings from the US Centers for Disease Control and Prevention show that 8% of US women of childbearing age have unsafe mercury levels. This translates into more than 300,000 babies born each year who are at risk for impairments in language, memory, and attention span, as well as delayed physical development.^{12,13}

View table: [Mercury Levels in Commercial Fish and Shellfish](#) (pdf)

The following chart shows some interesting data. Note that albacore tuna, which is more expensive than regular tuna, contains almost three times more mercury. Also note that salmon contains the least amount of mercury.

Fish/Shellfish	Average Mercury Concentration (parts per million)
Albacore tuna	0.35
Chunk light tuna	0.12
Swordfish	0.97
Pollock	0.06
Cod	0.11
Catfish	0.05
American lobster	0.31
Salmon	0.01

Source:
Northeast States for Coordinated Air Use Management; Food and Drug Administration.



DIOXINS, PCBS, AND OTHER MARINE TOXINS

In addition to mercury, dioxins—environmentally persistent by-products of industrial chemicals—readily accumulate in the fatty tissues of fish. About 90% of human exposure to dioxins results from consuming contaminated food.¹⁴ In animal studies, dioxins have been found to cause nerve damage, birth defects, increased incidence of miscarriages, and significant changes in immunity. The EPA has classified dioxins as a probable human carcinogen.¹⁵ Depending on where and at what time of year fish are caught, their dioxin levels may be below, equal to, or even greatly above the maximum level recommended. Like mercury, dioxins build up in the body when fish are consumed regularly over extended periods, and pose the greatest risks for women of childbearing age and young children.^{16,17}

PCBs, once used as insulating tools in electrical transformers, are persistent, fat-soluble contaminants that also accumulate in the fatty tissues of marine and animal species. While banned in the US in 1977, these ubiquitous pollutants are still found in America's soil, lakes, rivers, and atmosphere, as well as in fish and fish oil. PCB exposure has been linked to certain cancers and other ill health effects.¹⁸ Prenatal exposure to PCBs is associated with impaired memory and learning problems that can persist for years. In a study of 212 children born to women who had eaten PCB-contaminated fish from Lake Michigan, researchers found that children who had been exposed to PCBs prenatally were three times more likely to have lower average IQ scores and twice as likely to be at least two years behind in reading comprehension than children in the control group. The study authors concluded that in-utero exposure to PCB concentrations even just slightly higher than those found in the general population can greatly and adversely affect intellectual function.¹⁹

DDT (dichlorodiphenyltrichloro- ethane) is yet another contaminant found in fatty fish species such as salmon and herring. DDT was once considered a "miracle pesticide" in the fight against malaria, typhus, and other insect-borne human diseases. However, chemicals such as DDT are considered to be hormonally active agents and have been associated with adverse reproductive and developmental effects in fish and wildlife. Eating food contaminated with PCBs or DDT may produce adverse health effects in

humans. These chemical compounds may play a role in the mysterious declines in sperm counts seen in some areas of the US and other nations, as well as in increased rates of testicular and prostate cancer, and other male reproductive disorders.^{20,21}

Other contaminants that have been identified in fish include arsenic, cadmium, copper, and lead, all of which can be found in both farm-raised and wild fish. While farm-raised salmon was once thought to be far safer to eat than wild salmon, groundbreaking findings have detected a wide range of PCBs, organochlorine pesticides, and PBDEs (polybrominated diphenyl ethers) in both farmed and wild salmon, aquaculture feeds, and fish oils used to supplement the feeds.²² In a 2004 survey published in the journal *Science*, researchers compared the level of organochlorine contaminants such as PCBs and dioxins in farmed versus wild salmon collected from around the world. Most of the organochlorine contaminants evaluated in the study were found in dramatically higher levels in farmed rather than in wild salmon.²³

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ENSURING THE SAFETY OF FISH OIL SUPPLEMENTS

While there is no guarantee that the fish you eat is free of contaminants, the tide has turned when it comes to guaranteeing the safety of omega-3 fish oil supplements. In fact, recent studies substantiate that some supplements are safer than eating fish. For example, analyzing five brands of fish oil supplements, researchers from Brigham and Women's Hospital and Harvard Medical School in Boston found that levels of PCBs and organochlorine pesticides were below the detectable limit in all five brands tested. The study authors concluded that if a person were to eat fish from the Great Lakes at the optimal recommended amount of about 400 grams per week, he would consume at least 70 times more PCBs and 120 times more organochlorine pesticides than if he were to supplement with the average daily dose of fish oil (1.5 grams) for one week.²⁴



With growing concerns about contamination and recent journal studies warning of the health effects of mercury and PCBs from marine sources, health-conscious consumers are demanding more information about the safety of the fish oil products they consume. Reputable fish oil products now undergo rigorous testing for purity and concentration by independent quality-assurance programs such as the International Fish Oil Standards (IFOS) program. Under the direction of Canada's Nutrasource Diagnostics Inc., a world leader in omega-3 diagnostic testing and product analysis, the IFOS program measures the quality of omega-3 products in the context of global standards developed by the WHO and the Council for Responsible Nutrition (CRN), a trade association for supplement suppliers and manufacturers. Oddly, FDA standards for allowable contaminants in fish oil are the least stringent of all of these organizations.

When a third-party laboratory performs an assay of fish oil products to determine whether the active agents meet the label claim, the technicians review the presence of contaminants in the product and check the rate of dissolution (how fast the product releases within a specific time), among other tests for purity and quality.

In testing for PCB, dioxin, and furan levels, the IFOS testing service uses the highly specialized technique of gas chromatography mass spectrometry.²⁵ The fish oil's omega-3 content is also tested as a percentage of weight using advanced gas chromatography techniques.²⁶

The IFOS service tests mercury using cold water vapor atomic absorption spectroscopy. Heavy metals such as arsenic, nickel, cadmium, and lead are analyzed by microwave-assisted digestion in nitric acid.

After submitting fish oil to the most rigorous assay laboratory, the IFOS program compares the product to far more stringent standards than those established by the WHO or CRN. Testing fish oil at these far lower levels of detection affords consumers a much greater margin of safety. For example, the Council for Responsible Nutrition Voluntary Monograph allows a maximum mercury content in fish oil supplements of one-tenth of one (0.10) parts per million. The IFOS program tests the product at a far greater detection limit of 10 parts per billion to demonstrate to consumers a premium level of product purity and safety. While the CRN Voluntary Monograph allows a maximum PCB content of 0.09 of one part per million, the IFOS program tests product levels at an even greater detection limit in parts per trillion to provide for a much greater margin of safety.

LIFE EXTENSION PRODUCTS ATTAIN HIGHEST RATING

Life Extension's fish oil supplements exceed the IFOS's testing assay for EPA and DHA potency and purity, earning the highest possible rating, signifying an "exceptional product batch."

Ratings are based on the CRN Voluntary Monograph standard or the WHO standard in each of the four categories shown below.

- *Category 1: Omega-3 Concentration* tests the product's omega-3 levels and compares the results to the label claim on a per-gram basis.
- *Category 2: Contaminants* tests for mercury, PCBs, dioxins, and furans, and lists the totals for each testing type with the detection limit used and the product's contaminant compliance.
- *Category 3: Oxidation* tests peroxide and total oxidation to assess the product's stability.

- *Category 4: Heavy Metals* tests for arsenic, cadmium, nickel and lead.

The IFOS report states that levels of PCBs, PCDDs (poly-chlorinated dibenzo-dioxins), and PCDFs (polychlorinated dibenzofurans) in Life Extension's fish oil supplements were well below the maximum allowed by the CRN and WHO. Moreover, Life Extension's fish oil had no mercury, arsenic, lead, nickel, or cadmium content evident, and was under the CRN's maximum allowable score for peroxide and oxidation, demonstrating the highest premium level of purity and safety.

CONCLUSION

Today, high levels of contaminants such as mercury, PCBs, and dioxins in our environment and waters make eating certain fish regularly a potentially risky dietary choice. This does not mean that fish meals should be avoided. Published studies clearly show health benefits for those who eat fish. The problem is that some people are overdoing it and eating too much of the wrong kinds of fish. Fortunately, the wealth of health benefits associated with fish consumption can be safely and readily obtained from premium fish oil supplements. Rigorous testing standards and unparalleled attention to quality help create safe, effective fish oil products for you and your family.

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