Fish Oils and Mercury

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Summaries of the latest research concerning fish oils and mercury

Net benefit of fish consumption
HARTFORD, CONNECTICUT. An adequate daily intake of fish oils, particularly EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid), is associated with a wealth of health benefits including decreased risk of heart disease, lower blood pressure, improvement in rheumatoid arthritis, prevention of macular degeneration, and reduced risk of type 2 diabetes. There is also evidence that fish oil consumption is beneficial for patients with depression, schizophrenia, and Parkinson's disease. Finally, several studies have confirmed that fish oils, especially DHA, are essential for optimum development of an infant's brain and visual acuity.

Thus, it is not surprising that health authorities promote the frequent consumption of fish with the American Heart Association (AHA) specifically recommending that healthy people eat fish at least twice a week. The AHA also recommends that patients with heart disease consume at least 1000 mg of EPA + DHA every day.

Unfortunately, it is becoming more and more apparent that fish consumption is not always beneficial. Gary Ginsberg and Brian Toal from the Connecticut Department of Public Health point out that many fish are now heavily contaminated with methylmercury, a highly toxic compound with profound deleterious effects on both the cardiovascular and nervous system. Many researchers have studied these adverse effects and a consensus has been arrived at as to just what amounts of methylmercury are likely to produce serious consequences. Similarly, many studies have been done to determine the minimum daily intakes of EPA + DHA needed to obtain significant benefits. The two Connecticut researchers have combined these findings into two models aimed at predicting the net health benefits of consuming particular fish and seafood. One model is concerned with determining the net benefit for adult men and women (in regard to heart disease), the other with determining the net benefits for pregnant women and infants.

The researchers looked at 13 fish and seafood specimens available fresh in Connecticut and 3 varieties of canned tuna. They found that it was safe for adults to consume unlimited amounts of tilapia, pollack, flounder, cod, shrimp, trout, herring, canned light tuna, and Atlantic salmon, although they warn that farmed salmon may not be desirable due to concerns about its possible content of carcinogens. Swordfish and shark should be totally avoided and tuna steak should be eaten no more than once a week. Canned white tuna (Albacore), halibut, sea bass, and lobster can safely be eaten twice a week. Their recommendations for pregnant women and infants are somewhat more restrictive in that consumption of canned light tuna and cod should be limited to twice a week and consumption of canned white tuna, tuna steak, halibut, sea bass and lobster should be limited to once a week.
Ginsberg, GL and Toal, BF. Quantitative approach for incorporating methylmercury risks and omega-3 fatty acid benefits in developing species-specific fish consumption advice. Environmental Health Perspectives, Vol. 117, February 2009, pp. 267- 75

Recommendations for fish oil intake
SIOUX FALLS, SOUTH DAKOTA. It is now well established that fish and fish oil are protective against coronary heart disease (CHD) and reduces the risk of dying from CHD by about 40%. The American Heart Association (AHA) recommends that patients with existing CHD consume

1000 mg/day of EPA (eicosapentaenoic acid) plus DHA (docosahexaenoic acid), the main components of fish oils. AHA also recommends that healthy adults consume at least two servings a week of fish (preferably oily). Considering that oily fish, such as sardines, mackerel, salmon and tuna contain anywhere between 800 and 1500 mg of EPA + DHA per 3-oz (85 grams) serving means that people eating two oily fish meals a week would obtain between 230 and 430 mg/day of EPA + DHA.

Researchers at the University of South Dakota believe it is time to issue an official recommendation for a minimum daily intake of EPA + DHA in the USA. They suggest that the minimum intake should be 400 – 500 mg/day of EPA + DHA. They point out that several other countries already have such recommendations with France specifying an intake of 500 mg/day of EPA + DHA (minimum 120 mg/day of DHA), the UK 450 mg/day, Australia and New Zealand 442 mg/day of EPA + DHA for men and 318 mg/day for women. Both the American and Canadian Dietetic Association recommend 500 mg/day with a minimum of 120 mg/day of DHA. The US FDA has set an upper limit of safe EPA + DHA intake at 3000 mg/day, so the 500 mg/day recommendation is well within generally accepted safe limits.

The researchers point out that some fish are very contaminated with methylmercury and should be consumed only rarely if at all. Among the worst offenders are tile fish, king mackerel, shark and swordfish, but the FDA also warns that albacore (white) tuna should be consumed no more than once a week by pregnant women. Finally, they suggest that if the recommended EPA + DHA intake cannot be achieved by fish consumption, then fish oil supplements may be used instead to achieve the recommended minimum target of 500 mg/day of EPA + DHA.
Harris, WS, et al. Intakes of long-chain omega-3 fatty acid associated with reduced risk for death from coronary heart disease in healthy adults. Current Atherosclerosis Report, Vol. 10, 2008, pp. 503-09

Fish oils are safe!
LOUISVILLE, KENTUCKY. Harold Bays, MD at the Louisville Metabolic and Atherosclerosis Research Center has addressed the question, “Does therapy with fish oils rich in omega-3 fatty acids increase the risk of bleeding, and are they contraindicated in patients treated with antiplatelet and anticoagulant therapies?” Dr. Bays concludes that clinical trial evidence does not support the idea that fish oils (EPA [eicosapentaenoic acid] and DHA [docosahexaenoic acid]) increase bleeding, even when given in combination with aspirin or warfarin. He also makes two other interesting observations:

- Fish oils inhibit thrombosis and may thus decrease the risk of ischemic stroke. However, one needs to take at least 1000 mg of EPA + DHA (not just 1000 mg of fish oil) a day to achieve significant cardiovascular benefits.
- It may be wise to stop fish oil supplementation 4-7 days prior to major surgery, except in the case of coronary artery bypass surgery where continued supplementation may help prevent post-procedure atrial fibrillation.

Dr. Bays also addressed the question, “Do prescription and/or supplement omega-3 fatty acid products contain excessive vitamin or toxins, such as mercury, polychlorinated biphenyls, dioxin, or other contaminants, in sufficient concentrations to pose a potential health risk?” Again, his answer is negative. This conclusion is largely based on a 2006 ConsumerLab evaluation of 42 commercially available fish oil supplements. All but two were found to contain the amount of EPA and DHA stated on the label, were free of mercury, PCBs and dioxins, and were not oxidized (rancid). Among the brands that passed the ConsumerLab evaluation were Carlson, Coromega, Metagenics, Nordic Naturals, Kirkland and Puritan Pride.

Dr. Bays cautions that a high fish oil intake through the consumption of large amounts of fish

may present a risk for environmental toxin exposure, especially methylmercury, PCBs, organochlorine pesticides and dioxins. He points out that oxidized mercury is insoluble in oil, so would not be expected to represent a significant toxicity risk in fish oil supplements.

In an accompanying editorial Dr. William Harris of the University of South Dakota emphatically endorses Dr. Bays' conclusion that fish oils do not increase bleeding risk even if taken in combination with aspirin or warfarin.
Bays, HE. Safety considerations with omega-3 fatty acid therapy. American Journal of Cardiology, Vol. 99, No. 6A, March 19, 2007, pp. 35C-43C
Harris, WS. Omega-3 fatty acids and bleeding – Cause for concern? American Journal of Cardiology, Vol. 99, No. 6A, March 19, 2007, pp. 44C-46C

Fish intake—Risks and benefits
BOSTON, MASSACHUSETTS. The benefits of eating fish are related to the content of the long-chain omega-3 fatty acids EPA and DHA. The risk is associated with a whole host of contaminants such as mercury, PCBs etc. Thus the question—do the benefits outweigh the risks? A detailed examination of this question appeared in the October 18th issue of the *Journal of the American Medical Association*. Mozaffarian and Rimm from Harvard Medical School first review the cardiovascular and neurological developmental benefits of fish and in particular the fatty acids EPA and DHA for which fish provide a significant dietary source. Numerous studies relating to the cardiovascular benefits of EPA and DHA are presented in tables and impressive graphs. DHA is also critical in the neurological development during gestation and the first 2 years of infancy. A number of studies are quoted to support the importance of maternal intake of DHA during pregnancy and while nursing. The other aspect of the question, i.e. the risks associated with contaminants, is much more difficult to address. Medical scientists obviously do not conduct experiments on humans where the dose dependence of toxicity from the contaminants in question is investigated by giving the participants toxic chemicals and observing the results. Thus data for high doses must come from accidental or occupational exposure but these levels are irrelevant in terms of the levels found in most fish. At the other end of the dose spectrum, making an association between the intake of traces of toxic materials and adverse health outcomes is very difficult and fraught with uncertainty and confounding.

This paper quotes a number of studies that relate to undesirable intakes of organic mercury for women of childbearing age, nursing mothers, and young children, but it is hard to believe that the limits are more than a rough estimate. The situation with regard to health effects of trace amounts of mercury on adults is even less clear-cut. There are reports of adverse effects of mercury on cardiovascular and neurologic health. As regards the former, the authors simply pose the question as to whether the expected benefits from fish consumption would merely be greater if mercury were not present. As regards the neurologic aspect, the evidence as to adverse effects is unclear but there is a growing body of evidence that fish consumption may favorably influence clinical neurologic outcomes in adults, including benefits associated with ischemic stroke, cognitive decline and dementia, depression and other neuropsychiatric disorders. Translated into a useful guideline, the end result is advice not to eat shark, swordfish, golden bass and king mackerel since they typically contain more than 50 micrograms of organic mercury (methylmercury) per serving. Levels of dioxins and PCBs are low in fish and the authors take the position, based on what evidence is available, that any adverse effects from these contaminants are outweighed by the benefits of eating fish. Fish are also a rich dietary source of selenium and the authors mention evidence that some of the adverse effects of organic mercury may be mitigated by adequate intake of selenium, which incidentally is an essential dietary trace element. The bottom line is that the following fish pass muster as being good sources of EPA and DHA and are on average low in mercury: anchovies, Atlantic herring, wild and farmed salmon, sardines, and trout. These fish provide between 600 and 4500 mg per serving of EPA + DHA and contain on average 0.7 or less parts

per million of mercury.

The authors also discuss plant sources of EPA and DHA. These two long-chain omega-3 fatty acids in fact do not occur in plants, but must be made in the body from alpha-linolenic acid which is present in flaxseed, canola, soybeans and walnuts. Only small amounts are converted to EPA and further conversion to DHA limited. Thus fish represent by far the best source, and the authors raise no objections to getting these fatty acids from fish oil capsules, which typically contain 20% DHA and 80% EPA with little or no mercury, and taking even 1-3 grams of fish oil, according to the authors, results in low intake of PCB and dioxins.
Mozzaffarian, D and Rimm, E. B. Fish Intake, Contaminants, and Human Health. Evaluating the Risks and Benefits. Journal of the American Medical Association, 2006, Vol 296, No. 15, pp. 1885-99

Fish, mercury, and heart disease
BALTIMORE, MARYLAND. Several studies have shown that regular fish consumption protects against cardiovascular disease. Other studies have shown that consuming mercury-contaminated fish increases the risk of coronary heart disease. The beneficial effect of fish consumption is believed to be due to the presence of the omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in the tissue of fish and shellfish. Two recent studies have attempted to answer the question "Are the beneficial effects of fish oils (EPA and DHA) outweighed by the negative effects of mercury"?

The first study, carried out by a team of researchers from eight European countries, Israel and the United States, involved 684 men who had suffered a first non-fatal heart attack and 724 matched controls. All participants had their mercury level measured in toenail clippings and their level of DHA measured in a fat tissue sample taken from the buttock. Participants with a mercury level of 0.66 mcg/gram were found to have twice (odds ratio of 2.16) the risk of having a first heart attack when compared with participants having a mercury level of 0.11 mcg/gram. This risk assessment was arrived at after adjusting for age, DHA level in adipose tissue, body-mass index, waist:hip ratio, smoking status, alcohol intake, HDL cholesterol level, diabetes, history of hypertension, family history of heart attack, blood levels of vitamin E and beta-carotene, and toenail level of selenium.

The research team also found that participants with a high (0.44% of total fatty acids) fat tissue content of DHA had a 41% lower risk of having a first heart attack than did those with a low (0.10% of total fatty acids) fat tissue level of DHA. This risk assessment was arrived after adjusting for all other known risk factors including toenail mercury level.

The researchers point out that the main sources of mercury are occupational exposure (dentists), exposure to silver-mercury amalgam in dental fillings, and fish consumption. They conclude that the health benefit of fish consumption is significantly diminished if the fish is high in mercury. They also confirm the cardioprotective effect of fish oils (DHA).

The second study was part of the Health Professionals Follow-Up Study begun in 1986 as a cooperative venture between the Harvard School of Public Health, the Brigham and Women's Hospital, and Harvard Medical School. The study involved 33,737 male health professionals who had toenail clippings analyzed for mercury in 1987. After 5 years of follow-up 470 participants had been diagnosed with coronary heart disease. The researchers observed that dentists, who are habitually exposed to mercury, had toenail mercury levels (0.91 mcg/gram) that were twice as high as the levels found in non-dentists (0.45 mcg/gram). They also found a direct relationship between fish consumption and mercury level with participants consuming an average of 357 grams (3/4 lb) of fish per week having a level of 0.75 mcg/gram while those who consuming 145 grams (1/3 lb) per week had a level of 0.29 mcg/gram. After adjusting for age, smoking and other risk factors for heart disease the researchers conclude that there is no

clear association between total mercury exposure and the risk of coronary heart disease, but that a weak relation cannot be ruled out.
Guallar, E, et al. Mercury, fish oils, and the risk of myocardial infarction. New England Journal of Medicine, Vol. 347, November 28, 2002, pp. 1747-54
Yoshizawa, K, et al. Mercury and the risk of coronary heart disease in men. New England Journal of Medicine, Vol. 347, November 28, 2002, pp. 1755-60
Bolger, PM and Schwetz, BA. Mercury and health. New England Journal of Medicine, Vol. 347, November 28, 2002, pp. 1735-36

Editor's comment: The two studies clearly do not agree as to whether high mercury levels are associated with an increased risk of coronary heart disease. I am inclined to believe that they are. Furthermore, there is compelling evidence of significant associations between high mercury levels and Alzheimer's disease, Parkinson's disease, congestive heart failure, kidney damage, hearing loss, and high blood pressure. So definitely, mercury, from whatever source, is a very bad actor and should be avoided. The joint European/Israeli/US study clearly confirms that DHA (fish oil) is protective against a first heart attack, so regular consumption of low-mercury-level fish is still a healthy option. An alternative approach to obtaining DHA (and EPA) on a regular basis is to supplement with 1 gram/day of a high quality, molecular distilled, non-rancid fish oil containing a minimum of 220 mg EPA and 220 mg DHA. Reliable sources of such fish oils can be found at

www.coromega.com

and at

www.consumerlab.com/results/omega3.asp

To be on the safe side it is best to eat fish and shellfish with an average mercury content of less than 0.10 ppm. Unfortunately, there are not too many species left that fulfill this requirement. King crab, scallops, catfish, salmon (fresh, frozen and canned), oysters, shrimp, clams, saltwater perch, flounder, and sole are all good choices. Salmon is my favourite because of its combination of a low mercury content with a high level of beneficial EPA and DHA. The following fish species should be avoided: tilefish, swordfish, king mackerel, shark, grouper, tuna, American lobster, halibut, pollock, sablefish, and Dungeness and blue crab. Limited sampling of the following also indicated high mercury levels: red snapper, marlin, orange roughy, saltwater bass. Atlantic cod, haddock, mahi mahi, and ocean perch have mercury levels around 0.18 ppm, so should be eaten in moderation. For more on mercury content of fish see

www.cfsan.fda.gov/~frf/sea-mehg.html