



# Fish Consumption: Risks versus Benefits with Respect to Developmental Methyl Mercury Exposure: Is there a Bottom Line?

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## Editorial

Fish is an excellent nutrition source but mercury contamination is a concern. Risks associated with toxicants found in food sources can be controlled by reducing contamination or by reducing consumption of contaminated food. Since it appears to be impossible to reduce mercury contamination of fish, at least in the short term, this leads many to wonder whether they should limit their fish consumption [1]. Benefits need to be weighed against the risks with respect to limiting consumption of fish.

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Mercury contamination is found worldwide and methyl mercury is the most important form of mercury contamination with respect to human food sources. Bacteria found in both fresh and salt water transform elemental mercury into methyl mercury [2,3], which, due to its high lipid solubility, is readily absorbed across the gut mucosa and into muscles and organs, including the brain [4]. Methyl mercury becomes bio concentrated in the food chain and can reach relatively high concentrations in large, predatory fish. High-risk fish include swordfish, tuna, mackerel, tilefish and shark [5], which are all prime human food sources. Both farm-raised and wild caught fish seem to have similar levels of contaminants (6).

Fish contain high quality protein, are low in saturated fats, and are high in iron, and omega-3 fatty acids (n-3 polyunsaturated fatty acids) including, Docosahexaenoic Acid (DHA) and Eicosapentaenoic Acid (EPA) [7]. Humans are unable to synthesize n-3 polyunsaturated fatty acids except in very limited capacities, so they must acquire this nutrient from their diet [8]. Seafood is a primary source of DHA and EPA for humans and these nutrients are especially important to be included in the diet of pregnant and lactating women due to the high nutritional need of the developing fetus and infants [9]. Two studies have reported supplementation of infant formula with fish oil improved visual acuity at four months [10,11].

Methyl mercury is known to adversely affect nervous system development [12-14] and it accumulates at higher concentrations in the fetus compared to the mother [15,16]. Starting in 2004 the US Department of Health and Human Services and the US Environmental Protection Agency began to jointly advise women of child-bearing age and those pregnant or breast-feeding to modify their fish consumption

to avoid eating too much fish contaminated with high levels of methyl mercury [17]. In 2010 The US Department of Agriculture and US Department of Health and Human Services published the Dietary Guidelines for Americans (DGA) in which it is recommended that pregnant or breast-feeding women should try to consume 8-12 ounces of seafood per week from a variety of seafood types [7]. In that same advisory it also was stipulated that women should limit consumption of white (Albacore) tuna to 6 ounces per week and shark, swordfish, king mackerel, or tilefish should not be consumed at all by that segment of the human population [7]. The overall goal is for pregnant and lactating women to consume seafood that is higher in DHA and EPA, but lower in contaminants.

Does the scientific community agree that this is sound advice? And what about public opinion? Concern about mercury exposure and a rise in developmental disabilities are still very much public concerns [18,19]. Over the past 10 years a number of studies have been done worldwide, including France [20-22], the United Kingdom [23,24], Israel [25], several Asian countries [26], Nordic-Baltic countries [26,27] and the United States and Canada [6,8,9,28-35] that examined consumption of fish by women while pregnant and assessed various outcomes in their children. A number of questions were asked in these studies, but a common theme was that of the risk of methyl mercury exposure versus nutritional benefits that might be experienced by the developing fetus. As might be expected, results reported thus far are cautious and most studies conclude that additional research is warranted. A 2010 by Del Gobbo et al. in Canada [31] went so far as to say that women of childbearing age could consume daily, nine of 18 fish species, and remain below the recommended limits for mercury. However, it should be noted that the 2013 study by Zellmaker et al. [24] in the United Kingdom reported that for most fish species, the adverse effects of methyl mercury exposure exceeded the beneficial effects of DHA on the IQ score of children exposed in utero.

What then, is the bottom line? Taken together, the majority of studies report that benefits from consuming fish to achieve recommended DHA levels were measurable and outweighed the risk of methyl mercury exposure as long as women were careful to only consume fish that were low in mercury contamination.

This then brings up the question of the role of official advisories that are provided to the public concerning fish consumption. We will not reduce fish contamination by mercury at any time in the foreseeable future. Therefore, advising the population on which fish to eat or not eat is important. Do advisories work? The answer appears to be – sometimes. In 2007, the French study by Verger et al. [20] concluded that consumer advisories concerning how individuals might be able to limit exposure to mercury in fish had minimal effect on actually reducing exposure risk. In 2010 Groth concluded that substantial improvement in risk communication on this topic was needed [32]. On

the bright side, the recent 2013 study by Engelberth et al. [35] indicates that a well-designed advisory could successfully increase knowledge of women concerning both benefits and risks of consuming fish while pregnant and that such advisories could increase their ability to recognize fish that were low (i.e. safe to eat) and high (i.e. to be avoided) with respect to mercury contamination. Therefore the majority of studied carried out in the last 10 years and highlighted by Engelberth et al. [35] and the study by Zellmaker et al. [24] suggest that official recommendations should target beneficial effects of fish consumption and focus on fish species with high DHA content but clearly provide instruction on how to avoid fish species with high methyl mercury contamination.

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