

# U.S. Food and Drug Administration

CENTER FOR FOOD SAFETY AND APPLIED NUTRITION

## **Draft Risk and Benefit Assessment Report Report of Quantitative Risk and Benefit Assessment of Consumption of Commercial Fish, Focusing on Fetal Neurodevelopmental Effects (Measured by Verbal Development in Children) and on Coronary Heart Disease and Stroke in the General Population**

For full text: <http://www.cfsan.fda.gov/~dms/mehgrb.html>

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### **Executive Summary**

Fish provides protein, is low in saturated fat, and is rich in many micronutrients; it also can be a source of certain omega-3 fatty acids. As the Institute of Medicine of the National Academies of Science (IOM) noted in a recent report, "[i]n the past several years, research has implicated seafood, particularly its contribution of EPA and DHA [two omega-3 fatty acids], in various health benefits identified for the developing fetus and infants, and also for adults, including those at risk for cardiovascular disease" (IOM 2006 at 1). However, as a result of natural processes and human activity, aquatic food sources, including fish, can contain methylmercury, which has been linked to adverse health consequences. Because of the presence of methylmercury in fish, FDA and the United States Environmental Protection Agency (EPA) issued an advisory to consumers, "What You Need to Know About Mercury in Fish and Shellfish" (<http://www.cfsan.fda.gov/~dms/admehg3.html> ). The advisory, which was most recently revised in 2004, recommends that women who may become pregnant, pregnant women, nursing mothers, and young children avoid some types of fish and eat fish and shellfish that are lower in methylmercury, as specified in more detail in the advisory.

Researchers in the United States and elsewhere have attempted in recent years to develop approaches to better evaluate the net health impacts of fish consumption; in other words, to understand the relationship between the risk of not eating fish and the risk of eating fish that contain methylmercury at the levels currently found in the commercial fish available to consumers. As the IOM noted in its 2006 report, "A better way is needed to characterize the risks combined with the benefits analysis." (IOM 2006 at 6). The draft summary of published research and benefit and risk assessment report were developed by FDA to provide further scientific information to help address this question for consumers of commercial seafood in the United States (i.e., fish shipped or sold interstate, as opposed to fish caught recreationally or for subsistence).

The risk and benefit assessment described in the risk benefit assessment report reflects an effort by FDA to quantify the impact of eating commercial fish on three human health endpoints: (1) neurodevelopment, as measured by verbal development, to assess effect from prenatal exposure to methylmercury as passed from the mother to the developing fetus; (2) risk of fatal coronary heart disease; and (3) risk of fatal stroke. Each of these health endpoints has been associated in the scientific literature both with adverse effects of methylmercury exposure (including through fish consumption) and beneficial effects of regular fish consumption. The risk and benefit assessment provides further scientific information about the likelihood and magnitude of both a beneficial net effect and an adverse net effect at current levels of commercial fish consumption and exposure to methylmercury through fish consumption in the United States. The risk and benefit assessment should not be construed as altering the existing fish advisory. Moreover, because this assessment does not distinguish among types of fish in terms of their beneficial constituents, it is not possible to translate the results of this analysis into fish-specific advice to consumers about maximizing benefits.

The methodology used for this quantitative assessment is novel for FDA in that, rather than attempting to quantify the risk resulting from the presence of a particular hazard in a food, it seeks to balance that risk and the benefit from consumption of the food in the same quantitative analysis. For fetal neurodevelopment, the assessment estimates this net effect by separately estimating: (1) the likelihood and size of an adverse contribution from methylmercury to the net effect; (2) the likelihood and size of a beneficial contribution to the net effect from fish; and (3) the likelihood, size, and direction of the net effect. For the methylmercury contribution, the assessment uses data on the association between methylmercury and early age verbal skills (as an indicator of neurodevelopment) and then compares the results against results developed elsewhere on methylmercury's effect on other aspects of neurodevelopment, including IQ. For the fish contribution, the assessment uses data on the association between fish consumption during pregnancy and early age verbal skills. For the net effect, the assessment combines the results from the methylmercury and fish contributions. This assessment builds on published work performed previously by FDA scientists on the estimation of a methylmercury effect as well as on recent articles by other investigators that quantitatively assessed this effect.

For fatal coronary heart disease and stroke, the assessment estimates the net effect on risk from fish consumption without separately modeling a methylmercury contribution and a fish contribution. Most data on this subject come from studies that measured an association between fish consumption and these health endpoints without measuring a methylmercury contribution. The modeling builds in part on dose-response functions for these endpoints that have been published in the scientific literature.

The risk and benefit assessment identifies and discusses assumptions made for the scientific models and analyses and sources of uncertainty with respect to each endpoint analyzed. Subject to the limitations and assumptions set forth in the analysis, the assessment estimated the net impact of consumption of different amounts of fish. The results indicate that consumption of fish species that are low in methylmercury has a significantly greater probability of resulting in a net benefit, as measured by verbal development. The highest net benefit modeled in our risk and benefit analysis was modest. When we modeled actual baseline consumption for the range of methylmercury concentrations (low to high) the assessment indicated a significant probability of a net adverse effect for one-tenth of one percent of children for the central estimate. The highest estimated net adverse effect was also modest.

For fatal coronary heart disease and stroke, commercial fish baseline consumption is averting a central estimate of over 30,000 deaths per year from coronary heart disease and over 20,000 deaths per year from stroke.

The results of our quantitative risk and benefit assessment are generally consistent with research reported in recent years in the scientific literature.

A second document that is being made available along with this report is entitled "Summary of Published Research on the Beneficial Effects of Fish Consumption and Omega-3 Fatty Acides for Certain Neurodevelopmental and Cardiovascular Endpoints." This summary of published research primarily identifies secondary analyses of the large body of scientific research on the impact of fish and omega-3 fatty acids on cardiovascular and neurologic endpoints, including research on both prenatal and post-natal exposures. In addition to the IOM report, these secondary analyses include reports by the American Heart Association, the European Food Safety Authority, the International Society for the Study of Fatty Acids and Lipids, the World Health Organization and a previous investigation by the FDA. This compendium of research was developed by FDA for use in developing its quantitative risk benefit assessment.

The summary of published research provides background for the risk benefit assessment report. It identifies and delineates the lines of scientific evidence that indicate the association of fish and omega-3 fatty acid consumption with cardiovascular and neurodevelopmental health outcomes. When available, the compendium of research also identifies reports of quantitative dose-response relationships which may be relevant for risk and benefit assessment modeling. The summary of research describes the context of the overall body of scientific evidence currently available for potential application to the risk and benefit assessment modeling and the risk benefit assessment report.

