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Flawed risk assessment of contaminants in salmon

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Old data yields misleading conculsions

An article in the *Journal of Nutrition* used outdated data and made inappropriate comparisons.

In “Quantative Analysis of the Benefits and Risks of Consuming Farmed and Wild Salmon,” a recent article by Jeffrey Foran and coauthors published in the *Journal of Nutrition*, risks were associated with the content of organic contaminants, and benefits with content of highly unsaturated fatty acids. Using

data drawn from their controversial paper “Global Assessment of Organic Contaminants in Farmed Salmon,” published in *Science* in 2004, the authors concluded that the risks of farmed salmon consumption outweigh the benefits for sensitive groups such as pregnant women, nursing mothers, and young children.

The newer article contains no new data beyond that of the original, which has been widely criticized as inaccurate and alarmist by scientific and public health communities worldwide. The 2005 paper is seriously flawed in several ways.

First, the salmon tested were sampled five years ago in 2001, so the data on levels of polychlorinated biphenyls (PCBs) in salmon is no longer relevant. Second, different species of salmon with different feeding habits that affect exposure to contaminants were compared.

Third, the assumption that all the contaminants monitored posed an additive toxicity risk was incorrect. And fourth, the risk assessment, based on U.S. Environmental Protection Agency (EPA) data, is controversial. The U.S. Food and Drug Administration (FDA) and European food standards agencies do not consider EPA data appropriate.

Sampling date

After the original samples were collected in 2001, the European Union set limits for dioxin in feeds that have reduced levels in farmed salmon dramatically. Fish oils from sources that formerly had higher levels are now processed to remove dioxins and PCBs.

Generally, levels for all the contaminants considered by Foran are falling. The organochloride pesticides, of which residues were reported in the original *Science* paper, have long since been banned in the E.U. and many other parts of the world, reducing environmental levels as a result.

And again, the data used for this risk analysis was from fish sampled five years ago. This is hardly acceptable for any public health conclusions or statements. Common sense would dictate that data used for this type of “warning” needs to be current.

More current PCB data is available, but was not used. The new information shows that farmed salmon produced in the Americas, which supply 95 percent of the United States and Canadian markets, now contain PCBs at about 11 parts per billion (ppb) – about one-fourth of the PCB levels in the 2004 study, that used fish sampled in 2001. If used, this new data would have changed the conclusions of the current paper significantly.

Also, a study by the Alaska Department of Environmental Conservation (ADEC) that examined PCBs in wild salmon sampled in 2004 showed levels about twice that of the original *Science* article – averaging 10 ppb, which is about that of farmed salmon. Again, this newer data would have changed the risk assessment’s recommendation as to the relative merits of wild and farmed salmon, since both types have similar PCB levels.

Different species compared

The 2004 study determined contaminants in farmed Atlantic salmon and wild Pacific pink and coho or chum salmon. A comparison between wild and farmed Atlantic salmon would have been more appropriate and relevant.

In addition, the ADEC PCB levels for wild salmon are twice that reported by the authors of the risk assessment because ADEC included only those species of salmon widely sold in the fresh and frozen markets in the U.S. The authors' numbers included data for salmon species rarely, if ever, seen in the market, which pulled the average PCB value for wild salmon down. These salmon always have lower contaminant levels because they feed differently and have less fat.

Toxicity risk not additive

Foran et al. incorrectly assumed that for all the contaminants monitored, the risk of noncarcinogenic toxicity was additive. For example, the dioxins and dioxin-like PCBs are primarily immunotoxic and cause endocrine alterations and congenital malformations. They bind to a specific cellular receptor, the Ah, to induce the dioxin-specific biochemical and toxic responses.

The strength of the binding of the contaminant to this receptor is considered a measure of its toxic potency. Toxins with weak or no Ah receptor binding cannot simply be added to dioxins plus dioxin-like PCBs as a measure of toxicity, as was discussed by the U.S. Environmental Protection Agency in its 2000 health assessment of dioxin and related compounds.

Assuming that the wide range of persistent contaminants whose toxicity is mainly noncarcinogenic have additive toxicity yields a likely overestimation of overall toxicity at the very low levels detected. The procedure adopted by the Committee on Toxicity of Chemicals in Food, Consumer Products, and the Environment, which works with the U.K. Food Standards Agency, is to take the toxicity of the most toxic component only for assessing the toxicity of low levels of mixtures of contaminants. This approach identifies a much lower risk than Foran et al. determined.

Risk assessment questioned

Risk assessment based on EPA data is controversial. It is based on hypothetical calculations, whereas the benefits of salmon in the human diet are based on quantifiable data. Referring to the measurable amounts of organ-ochloride compounds reported in the *Science* article, W.C. Willett of the Harvard School of Public Health commented last year in "Fish – Balancing Health Risks and Benefits" in the *American Journal of Preventive Medicine.*

"That publication was particularly troublesome, perhaps even irresponsible, because the implied health consequences were based on hypothetical calculations and very small (lifetime risk of less than or equal to 1:10,000). In contrast, the benefits of eating salmon are based on human data at the doses actually consumed. As pointed out by Cohen et al., they are likely to be at least 100-fold greater than the estimates of harm, which may not exist at all.

"Although the monitoring of contaminant levels in foods is an important function, reporting the findings in places where widespread publicity is likely should be accompanied by at least a qualitative balancing of likely risks and benefits of changing consumption of the food being considered."

It should be noted that the USFDA, Health Canada, USEPA (whose formulas were used as the basis of the current risk assessment), and many other organizations responsible for protecting public health worldwide disagree with the basic foundation on which Foran's risk assessment was made. Thus, as in the original study that generated the now-outdated PCB numbers used in the calculations, the "risk" conclusions are those of the authors and not the public health community at large.

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