

**Review of – “Global Assessment of Organic Contaminants in Farmed Salmon”, Science 2004. by Charles R. Santerre, PhD; Associate Professor, Foods and Nutrition, Purdue University; santerre@purdue.edu; 765/496-3443.**

1. Exciting new study by researchers at Indiana University, University of Michigan, State University of New York at Albany, Cornell University and a private company.
  - a. Tested 700 samples of farmed and wild salmon collected from around the world for pesticides and environmental contaminants.
  - b. Largest published study of its kind involving these products.
  - c. Researchers are from respected academic institutions.
  - d. Manuscript published in a respected journal.
  - e. Results are comparable to past reports for PCBs and dioxin-like compounds in farmed salmon.
2. Salmon is safe to eat since contaminants were well below limits established by the Food and Drug Administration (FDA), the World Health Organization (WHO), and the Environmental Protection Agency (EPA).
  - a. Concentrations of Mirex, DDT, dieldrin, chlordane and heptachlor epoxide were well below FDA Action Limits (i.e., 0.1, 5.0, 0.3, 0.3, 0.3 ppm, respectively)
  - b. Concentrations of endrin, lindane, hexachlorobenzene and toxaphene were very low (< 0.005 ppm).
  - c. Concentrations of mercury (although not reported in manuscript) were much lower than the FDA Action Level (i.e., 1 ppm).
  - d. Polychlorinated biphenyls (PCB) in farmed salmon (0.06 ppm) were only ~ 3% of the FDA tolerance (i.e., 2 ppm). PCB levels in farmed salmon allow consumption of 8 oz/wk based upon an EPA non-cancer endpoint (i.e., 0.096 ppm if a 50% cooking loss factor is applied) for at-risk populations (i.e., pregnant or nursing women and young children) to reduce the risks for developmental delays. PCB levels in salmon allow consumption of 2-8 oz/wk based upon EPA cancer-endpoint (i.e., 0.024 ppm if a 50% cooking loss factor is applied) for exposure over a 70-year lifespan. PCBs consumed at the Reference Dose (RfD) over 70 years are predicted to increase the risk of cancer by 1 in 100,000.
  - e. Assuming an 8 ounce per week consumption of salmon, the Toxicity Equivalency Quotient (TEQ) for farmed salmon ranged from 0.9 to 5 pg/kg body weight per day which would provide a 60 kg person a daily Tolerable Daily Intake (TDI) of between 0.48 (10<sup>th</sup> percentile residue rate) and 2.7 pg TEQ/day (90<sup>th</sup> percentile residue rate). This range is well within the WHO recommended limits (i.e., 1-4 pg/d). For U.S. consumers, the exposure to PCB would be even lower since the farmed salmon that is consumed in the U.S. is lower in dioxin-like compounds and comes from Chile (56%), Canada (31%), US (6%). Only 7% comes from Europe which had higher PCB levels.
3. Farmed and wild salmon are nutritious
  - a. Source of protein (25%)
  - b. Source of vitamin D (3.5 oz provides 90% DV)
  - c. Source of healthy fats (i.e., long-chain omega-3 fatty acids incl. eicosapentaenoic acid (EPA, C20:5, n-3)) and docosahexaenoic acid (DHA, C22:6, n-3)

- i. 8 oz /wk provides 5 times the Adequate Intake (i.e., 0.13-0.14 g/d) for pregnant or nursing women as established by the National Academy of Sciences.
  - ii. 8 oz/wk provides 70% of the amount recommended by the American Heart Association (AHA) for cardiovascular disease patients. AHA estimates that 250,000 Americans die each year from sudden cardiac death. AHA recommends an intake of EPA and DHA of 1 g/d to reduce the number of these deaths.
4. Farmed salmon is affordable and available year round
  - a. Third most popular fish in U.S. (behind shrimp and tuna). Per capita consumption of farmed salmon is 2 pounds per year or 0.6 oz per week.
  - b. Affordable by limited income families (\$4-6/pound). A current study at Purdue University has found that over 40% of women that are in their childbearing years and are from limited resource families did not eat fish in the past year.
  - c. Wild salmon is available only during certain months (i.e., from June to October) and is about three times more expensive than farmed salmon
5. Avoiding salmon or eliminating salmon from the diet will increase health risk
  - a. By reducing the intake of healthy fats that are needed for brain development in the very young
  - b. By increasing the risk of sudden cardiac death in seniors
  - c. By reducing the intake of protein and vitamin D (which is limited during winter months in the northern U.S. due to reduced sun exposure)
  - d. By increasing exposure to mercury if salmon is replaced by tuna, swordfish, shark, king mackerel or tilefish.
    - i. The Centers for Disease Control and Prevention estimates that 1 in 12 women have levels of mercury in their bodies that exceed safe limits. Mercury is a developmental toxin that can be passed from the mother to the fetus or nursing infant.
  - e. By reducing fish consumption due to an increased cost for alternative fish species
6. Comparative risks for seniors – Suppose that consumption of 8 oz of farmed salmon per week could reduce the annual mortality from sudden cardiac death by 20-40% and save 50,000-100,000 lives (note: an estimate would require more research). In contrast, if our population of 300 million consumed 8 oz of farmed salmon per week for 70 years, the number of cancer deaths would increase by 6,000 (i.e., 1 in 50,000). However, new technologies will reduce exposure to PCBs, so it is likely that the number of cancer deaths would be so low that it could not even be estimated. So, the net benefit from consuming farmed salmon far outweighs the estimated risk. Conversely, the net risk for those that do not eat farmed salmon is greater than for those that do eat farmed salmon.
7. Future Developments – In the near future, we will replace some or all of the fish oil and fish meal in the farmed salmon’s diet with transgenic crops that have enhanced levels of long-chain omega-3 fatty acids. Even though salmon can synthesize EPA and DHA, fish oil and fish meal must be fed to salmon to increase their levels of omega-3 fatty acids. Currently, there is a canola that is being developed that has higher levels of stearidonic acid (C18:4, n-3) which can be converted to EPA more efficiently than alpha-linolenic acid (C18:3, n-3)

**Conclusions** – Farmed salmon is an affordable and available food that should be encouraged in the American diet. The Science study supports the concept that farmed salmon is low in contaminants and therefore, safe to consume. The impact from reducing or eliminating farmed salmon from the American diet is significantly greater than the minimal risk that occurs for consuming this food.

**Media Talking Points –**

1. This is a significant study by respected researchers at major institutions.
2. The study demonstrates that farmed salmon is very low in contaminants and meets or exceeds standards established by the FDA and the WHO. At the current per capita consumption rate (0.6 oz/wk), the risk from cancer based upon the EPA reference dose is extremely small.
3. Other studies have demonstrated that consuming fatty fish, like farmed salmon, saves lives and improves the health of very young children. Farmed salmon is also affordable by limited income families.
4. So, American consumers should be encouraged to increase their intake of fish, including farmed salmon.