Fish Consumption Advice and Guidelines for Vulnerable Subgroups

Related to Mercury exposure

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Acknowledgements

LGLDHU = Leeds, Grenville, and Lanark District Health Unit

LGLDHU would like to acknowledge Toronto Public Health as the originator of the report titled "Fish Consumption: Benefits and Risks for Women in Childbearing Years and Young Children."

NOTE:
Current work by public health professionals in Ontario with Health Canada may lead to a change in guidelines in the coming months. LGLDHU will revisit at a time when additional information and direction is available.

Fish Consumption Advice and Guidelines for Vulnerable Subgroups

LGLDHU Guidelines on Fish Consumption related to Mercury exposure

Vulnerable subgroups refers to women who could become pregnant, pregnant and/or breastfeeding women, and young children aged 0-4 years. Vulnerable subgroups can eat **up to a total of two fish meals (2 x 170 grams) per week** but should choose fish species carefully, with emphasis on low mercury species, while avoiding or eating only rarely, high mercury species, such as fresh or frozen tuna, shark, King Mackerel, marlin or swordfish among others. Pregnant or breastfeeding women, in particular, should choose primarily from low mercury fish and should eat no more than two fish meals total per week.

Low mercury (i.e., < 0.05 ppm Mercury) fish include:

- Salmon
- Herring
- Sardines
- Oyster
- Shrimp
- Pollock
- Clams
- Tilapia
- Haddock

Medium mercury (i.e., ≥ 0.05 but ≤ 0.2 ppm Mercury) fish include:

- Smelt
- Scallops
- Mackerel (Atlantic)
- Catfish (farmed)
- Snapper (mixed species)
- Tuna (light, canned)
- Trout (mixed species, freshwater)

High mercury (> 0.2 ppm Mercury) fish include:

- Shark
- Swordfish
- Orange roughy
- Mackerel (King)
- Halibut (pacific)
- Grouper (mixed species)
- Tuna (white albacore, canned)

Data source for mercury levels:
USDHHS/EPA – US Department of Health and Human Services and U.S. Environmental Protection Agency (2006). Mercury Levels in commercial Fish and Shellfish. Updated February 2006. Retrieved March 8, 2006 from www.cfsan.fda.gov/~frf/sea-mehg.html by Toronto Public Health.

Other types of fish may also have low levels of mercury, depending on the waters from which they are caught. The public should consult the Ministry of the Environment publication titled “Guide to Eating Ontario Sport Fish”, which is published annually.

Based on the findings in the attached report, LGLDHU advises that **women who may become pregnant** can eat a total of two fish meals (2 x 170 gram serving size) per week and keep mercury intake below “tolerable” levels by:

- choosing among fish with low to medium mercury levels (i.e., ≤ 0.2 ppm Mercury)
- avoiding (preferably) or eating only rarely (that is, less than once a month) fish that are high in mercury (i.e., > 0.2 ppm Mercury)

To protect the fetus and nursing infant however, **pregnant women or women who are breastfeeding** should take care to eat *no more than* two fish meals (2 x 170 gram serving size) per week and:

- choose fish primarily from the low mercury category (i.e., < 0.05 ppm Mercury)
- avoiding most medium and high mercury fish (i.e., ≥ 0.05 ppm Mercury) except canned light tuna (see below)

Young children (0-4 years of age) can safely eat two fish meals (half-portion sizes) per week by:

- choosing primarily fish low in mercury (i.e., < 0.05 ppm Mercury)
- avoiding or eating only rarely (that is, less than once a month) most medium and high mercury fish (i.e., ≥ 0.05 ppm Mercury) except canned light tuna (see below)

Canned tuna requires separate advice because mercury content is different depending on the type of canned tuna and because it is affordable, widely available and commonly consumed.

Light canned tuna (skipjack species) is a **medium mercury content** fish, therefore:

- Women who may become pregnant can eat 2 cans (2 x 170 grams) per week
- Young children and pregnant or breastfeeding women can eat about one can (or ~2 half-can portions) per week (and should ensure they keep other fish meals in the low mercury category)

Canned **white** or **albacore** tuna, is **high in mercury** therefore:

- Women who may become pregnant should eat no more than one can per month
- Young children and pregnant or breastfeeding women should avoid or eat only rarely (that is, less than once per month)

Background

Recent local public health initiatives have explored ways to inform people about the contaminants that may be found in store-bought fish. Debate over the risks and benefits of fish consumption for the general population and for the identified vulnerable subpopulations, has broadened and intensified. There has been new information on contaminants other than mercury in commercial fish. There has also been increasing study of the health benefits of the omega 3 long chain polyunsaturated essential fatty acids (PUFAs) found in fish. Attempts have been made to weigh the risks and benefits of consuming fish, including quantifying the impact on various aspects of population and individual health. Overall, the debate has resulted in confusion as to how much fish should be consumed and by whom.

In considering this issue and subsequent recommendations on fish consumption for the residents of Leeds, Grenville, and Lanark counties, the following issues were considered:

- Current recommendations from Health Canada and the United States Environmental Protection Agency (EPA)
- Research compiled by Dietitians of Canada PEN (August 2006) and other research articles
- The approach of other Ontario Health Units in communicating risks and benefits of fish consumption
- Consultation among Registered Dietitians and other public health staff at various Health Units in Ontario
- The need for residents of Leeds, Grenville, and Lanark Counties to have a consistent message on which fish to eat and what is considered safe

Ultimately, after considering various sources of information, it was decided to use the recommendations as outlined by Toronto Public Health. These recommendations are more conservative than those outlined by Health Canada. However, it is expected that Health Canada will be releasing more detailed guidelines on fish consumption in 2008 and until that time, it was felt, based on the extensive research of Toronto Public Health, that a more conservative approach is warranted.

Supporting Evidence

A 2006 report from Toronto Public Health titled "Fish Consumption: Benefits and Risks for Women in Childbearing Years and Young Children" reports that mercury is present naturally or is released into water bodies in the environment by human activities and processed. Sources of mercury include direct discharge to water from industrial processes and air emissions such as those from coal-fired power plants and incineration. Airborne mercury is eventually deposited into water. Bacteria in the water convert mercury to the organic form, called **methylmercury**. Unlike other contaminants that are soluble in fat, the majority of methylmercury accumulates in the muscle tissue of fish rather than in the fat. Larger predatory fish accumulate a great amount of methylmercury in their muscle tissue over time.

When methylmercury is consumed by humans through eating contaminated animal flesh, about 95% of methylmercury is absorbed into the bloodstream and distributed readily throughout the human body to all tissues, including the brain, the fetus and the fetal brain.

The term methylmercury is used from this point on so to accurately refer to the form of "mercury" that is present in the human body.
Toronto Public Health titled "Fish Consumption: Benefits and Risks for Women in Childbearing Years and Young Children" focussing on pregnant women, women of childbearing age, and young children 0-4 years of age, reports the following:

- Fish as a Source of Omega-3 Fatty Acids
- Fish as a Source of Methylmercury and Other Contaminants
- Effects Associated with Methylmercury Intake from Fish Consumption
- Average Consumption of Methylmercury by Canadians
- Conclusion

Fish as a Source of Omega-3 Fatty Acids

The benefits of fish consumption are related to fish being a principal dietary source of two longchain omega-3 polyunsaturated fatty acids (PUFAs), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Omega-3 PUFAs have been studied in association with a variety of health impacts including their role:

- in improving cardiovascular health;
- as a treatment for various types of inflammatory disease, such as rheumatoid arthritis, asthma, bowel disease;
- in improving pregnancy outcome;
- in improving brain development and function;
- as a treatment for various mental health and behaviour disorders, such as dementia, bipolar disorder, depression, Attention Deficit Hyperactivity Disorder (ADHD), and autism.

Fish as a Source of Methylmercury and Other Contaminants

While fish are rich in high quality protein, essential nutrients and omega-3 fatty acids, they also sometimes contain environmental contaminants, usually at low levels.

The adverse health effects of methylmercury (MeHg) are often discussed for several reasons.

1) methylmercury has been most frequently detected in a wide variety of fish species compared to other contaminants in sampling programs;
2) methylmercury is found in commonly consumed commercial fish, such as tuna, therefore it is considered a priority in terms of public health;
3) the health effects of exposure to methylmercury due to fish consumption have been well demonstrated and reviewed extensively; and
4) methylmercury exposure is closer to the threshold of concern than exposure to the other contaminants from fish consumption.

When a pregnant woman consumes methylmercury contaminated fish, her fetus is exposed to methylmercury, and the fetal exposure is generally higher than that of the mother. When a woman is exposed to methylmercury before pregnancy, it is also of concern as this contributes to accumulation of methylmercury in the woman and may later result in exposure to her fetus. The newborn and infant are also susceptible (although less than the fetus) to harm from primary exposure to methylmercury because the protective blood-brain barrier does not develop fully until age six months.

Breast milk is a route of excretion and therefore, also an important route of exposure for the infant. However, the passage of methylmercury from blood to milk is low compared to the passage across blood-brain and blood-placenta barriers. Therefore, risk to an infant from methylmercury exposure is greater during pregnancy and less from breastfeeding.

Effects Associated with Methylmercury Intake from Fish Consumption

Although about 1% of the accumulation of methylmercury in the human body is excreted daily, mercury still accumulates in human muscle tissues if the rate of consumption is greater than the rate of excretion. About 10% of the human body accumulation of methylmercury is in the brain. Depending on the level of exposure, the effects of methylmercury accumulation in adults can include lack of muscle coordination, tingling of the skin, vision disturbances, hearing and speech impairment, abnormal behaviour, paralysis and death, as a result of destroyed nerve cells in the nervous system. The developing central nervous system is more susceptible than the adult's to the action of methylmercury. In infants exposed to high levels of methylmercury while *in utero*, the symptoms at birth may be similar to cerebral palsy, such as gross motor and mental impairment, sometimes accompanied by blindness and deafness. In milder cases, the effects may only become apparent later in childhood as motor and cognitive problems, including late onset of walking and talking.

A low exposure to methylmercury that does not appear to affect the mother can still have a dramatic effect on a developing fetus. The developing fetus is believed to be the most susceptible for two reasons: 1) methylmercury readily crosses the placental barrier; 2) methylmercury inhibits healthy brain development.

Children are also vulnerable to the neurological effects associated with mercury as their brains are still developing, although they are not as sensitive as the fetus or young

infant. They may be exposed to methylmercury from fish either indirectly through breast milk, or directly through the consumption of fish as a food source.

Mercury levels vary depending on the type of fish species and the water body from which the fish have been harvested. Mercury levels also vary with season and fish body conditions.

Canadian data on mercury in fish are less readily available than the U.S. data. Although the Canadian Food Inspection Agency (CFIA) tests pre-retail fish for mercury, they may not be representative of fish available at retail market. The U.S. data are likely to be more representative of fish available in the market.

Tuna, a predatory fish, accumulates mercury with substantial variation across tuna types. Fresh tuna can have a very high level of mercury, likely due to larger fish being required for fillets and steaks. Canned tuna, on average, does not exceed the methylmercury level thought to cause harm. There is a clear difference between light tuna and white tuna, also known as albacore tuna, which has been reported to have as much as three times the amount of mercury as light tuna.

Average Consumption of Methylmercury by Canadians

The average population intake of mercury has been estimated to be 0.022 µg/kg/day with a range from 0.012 in females over 65 years to 0.062 in infants one month or younger. These estimated mercury intake levels are below both the Canadian and U.S. EPA tolerable intakes of 0.2 and 0.1 µg/kg/day, respectively. These calculations were based on the 1972 Nutrition Canada Survey. However, based on Statistics Canada 2004 survey data on fish consumption frequency and taking into consideration today's customary portion size, the Canadian population likely consumes more fish currently than it did thirty or more years ago. Fetal methylmercury exposure is relatively substantially more than for the mother.

Salmon also fits two important criteria as a fish species that is low in mercury and high in omega-3 fatty acids. However, salmon may also contain measurable quantities of other organic contaminants such as PCBs, dioxins and polybrominated diphenyl ethers (PBDEs). The levels of these contaminants are higher in farmed salmon than in wild salmon. However, based on the analysis of Health Canada, these levels are well below tolerable maximum intakes for the contaminants. Unlike methylmercury that accumulates in the muscle of the fish, these contaminants accumulate in fatty tissues. Intake of these contaminants can be minimized by removing skin and any visible fat, and by cooking with methods that render fat from the fish, and by removing skin and any visible fat before eating.

With careful choices, the vulnerable subgroups addressed may safely eat two fish meals per week or 8 meals per month. That frequency represents at least double the average Canadian fish consumption of 3.3 fish meals per month according to Statistics Canada.

Conclusion

Consuming fish without attention to species may result in high intakes of methylmercury without necessarily obtaining the health benefits of omega-3 fatty acids. Fish species lower in methylmercury and higher in omega-3 fatty acid content include herring, sardines, mackerel (excluding King mackerel), salmon and trout.

It becomes increasingly difficult to stay below both the U.S. and Canadian mercury "tolerable" intake levels for pregnant or nursing women, women of childbearing age and young children if more than two fish meals per week are consumed. These vulnerable subgroups should choose fish species carefully, with emphasis on low mercury species, while avoiding or eating only rarely higher mercury species. Pregnant or nursing women should choose from low mercury species alone.

Careful, focused risk communication aimed at vulnerable subgroups should have the effect of moderating consumption to low mercury species rather than reducing overall fish consumption.

More frequent consumption than two 170 gram portions of fish per week by vulnerable groups is not recommended because the potential for exceeding the tolerable intake of methylmercury increases. It is possible for them to consume fish twice a week without exceeding the current methylmercury "tolerable" intake levels, but is more difficult to consume fish more frequently without exceeding the level unless sufficient care is exercised in choosing fish that have very low mercury content.