Store Bought Fish Consumption Advice

for women who are of childbearing age, pregnant, or breastfeeding,

and young children 0-4 years

Compiled by Dianne Oickle, MSc, RD, Public Health Nutritionist

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Table of Contents

Acknowledgements

LGLDHU = Leeds, Grenville, and Lanark District Health Unit

A collaboration of Ontario public health units (York Region Health Services, Peel Region Public Health, Simcoe Muskoka District Health Unit, others) as well as a consultant from Health Canada convened through the Ontario Public Health Association's (OPHA's) Environmental Health Workgroup in the fall of 2007. It is this collaborative group that is responsible for the development of the guidelines on fish consumption related to mercury exposure that have been adopted by the LGLDHU.

LGLDHU would like to acknowledge Toronto Public Health as the originator of the report titled "Fish Consumption: Benefits and Risks for Populations Vulnerable to Methylmercury." Toronto Public Health has subsequently updated their guidelines from this original report with the work of the collaborative group mentioned above.

Specific to tuna consumption, while more liberal than previous LGLDHU guidelines on canned tuna consumption related to mercury contamination, the current position is still more protective about canned albacore than Health Canada guidelines. This is in keeping with the work of the collaborative fish group and the conclusions of this group as well as Toronto Public Health individually. Health Canada recommendations are based on the "average" Canadian. However, as it is not known for certain what the specific fish consumption patterns are for residents of LGLDHU, it was felt that it is prudent to err on the side of caution and assume that canned tuna consumption is higher than the "average" Canadian. As well, it should be noted that the data used to classify types of store bought fish is the same data used by Health Canada, and therefore consistency in terms of mercury content and classification can be assumed.

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Consumption advice is organized into three categories of consumption frequency, including “eat often”, “eat sometimes”, and “avoid or eat rarely.” The “eat often” category was specifically developed to highlight the safe choices of fish to support the new Canada’s Food Guide advice to eat at least 2 servings of fish a week.

Low Mercury Fish Eat Often	Eat Sometimes	High Mercury Fish Avoid or Eat Rarely
Child: 7 servings per week **Women: 14 servings per week** Basa Capelin Kamaboko (fish cake; processed white fish) Octopus Oyster Pollock, Alaskan Salmon (Chum, Coho, Pink) Sea Cucumber Sea Urchin Tilapia **Child: 2 servings per week** **Women: 4 servings per week** Anchovies Clam Cockle (Greenland) Cod Flounder Haddock Hake (White) Herring Lingcod Mackerel (Atlantic) Mussel, Blue Periwinkle Plaice (Canadian) Prawn Quahog (Hardshell Clam) Rockfish Salmon (Atlantic, Chinook, Sockeye, Steelhead) Sardines Scallops Shrimp	**Child: 1 serving per week** **Women: 2 servings per week** Arctic Char Bullhead (Brown) Carp Catfish Crab Crawfish Croaker Jack (Blue runner, Crevalle, Common) Lobster Maria (Burbot, Ling) Monkfish Mullet (Common) Perch (White, Yellow) Pumpkinseed Skate Sturgeon (Lake, White) Turbot Tilefish (Atlantic) Whitefish (Lake) **Child: 2 servings per month** **Women: 4 servings per month** Amberjacks Drum (Freshwater) Eel (American, Conger, Sea Spiny, Spotted) Kingfish (Spanish, King Mackerel) Mahi Mahi (Dolphin Fish) Pike Redfish Trout, Lake Trout Wahoo Whiting	Barracuda Escolar (Snake Mackerel) Marlin Orange Roughy Sablefish (Black cod) Sea Bass (Chilean Seabass) Shark (Spiny Dogfish / Northern Shark, Porbeagle) Swordfish Tilefish (Gulf of Mexico) Tuna steak (various species) Health Canada recommends eating at least two (2) Canada Food Guide Servings of fish each week (total of 150 grams) that are high in Omega-3 fatty acids and that are low in mercury.

Shad (American) Smelt (Atlantic, Lake) Snapper Sole (Dover, Petrale) Squid Trout (Rainbow) Tongol Tuna (canned) Tuna, canned light (includes Skipjack, Yellowfin) Whelk	**Child: 1 serving per month** **Women: 2 servings per month** Albacore Tuna (canned) Cusk (Brismark, Moonfish) Grouper Halibut Sauger Tuna steak (Skipjack, Southern Bluefin, Yellowfin) Walleye (Yellow Pickerel)	

Notes:

Fish consumption advice only applies to commercially available fish (fish bought at the market or store). If sportfish are consumed, refer to the Ministry of the Environment's Guide to Eating Ontario SportFish. http://www.ene.gov.on.ca/envision/guide/.

Small children are between the ages of 1 and 4 years of age. Health Canada defines this age group as having a body weight of 16.5 kg (approximately 36 pounds). If your child is smaller than 16.5 kg, then you may wish to reduce the serving size of fish.

Small children can eat a maximum indicated meals in any category. If the maximum meals are eaten, that child should not eat from any of the other subcategories.

Childbearing women may eat a variety of fish, combining any two subcategories.

Older children ages 5 to 15 years of age can follow the consumption advice for young children, but they can eat a larger serving size.

Men and non-childbearing women can eat a variety of fish, choosing often from the low mercury selections, but should limit the high mercury fish to 1 per week.

With respect to canned tuna, a typical can of tuna is 120 grams (drained weight) which equals 1.6 Canada's Food Guide servings.

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. 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.

The guidelines presented herein are based on several developments that occurred in late 2006 through to early 2008:

- Eating Well with Canada's Food Guide, released in February 2007
    - This new Canada's Food Guide states a serving size (or suggested portion size) of 75 grams for the Meat & Alternatives food group
- New data on mercury levels in fish released in 2007
- The work of a collaboration of Ontario public health units (York Region Health Services, Peel Region Public Health, Simcoe Muskoka District Health Unit, others) as well as a consultant from Health Canada who convened through the OPHA's Environmental Health Workgroup in the fall of 2007.
- The development of categories of fish consumption and several consumer friendly and professional resources by other health units in 2008.

Prior to the guidelines contained herein, the LGLDHU took a more conservative position than Health Canada in giving advice on fish consumption related to mercury exposure. At the time, several other health units had also taken a more conservative position in light of inconsistencies in using Canadian Food Inspection Agency (CFIA) data on mercury content of fish versus the United States Environmental Protection Agency (EPA) data. However, with the developments listed above, guidelines that allow for greater fish consumption have resulted that are consistent with evidence based decision making.

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 to accurately refer to the form of "mercury" that is present in the human body.
A 2006 report from 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, reported the content of the following sections:

- 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.

Mercury concentrations in Canadian Fish (data collected by the Canadian Food Inspection Agency between 1999 and 2007)		
Fish	**Canadian Mercury Data (mean) ppm (ug/g)**	**Notes**
Sea Cucumber	0.00	
Sea Urchin (Green)	0.00	
Oysters (Pacific, American, unspecified)	0.01	
Basa	0.02	
Capelin	0.02	
Kamaboko	0.02	
Octopus	0.02	
Pollock	0.02	
Salmon (Chum, Coho, Pink)	0.02	
Tilapia	0.02	
Tuna (canned Tongol)	0.02	
Clams	0.03	
Mussels, Blue	0.03	
Salmon (Atlantic, Sockeye, Steelhead)	0.03	
Mackerel, Atlantic	0.04	
Prawn	0.04	
Scallops	0.04	
Trout, Rainbow	0.04	
Tuna (canned Tongol)	0.04	
Anchovies	0.05	
Cockle, Greenland	0.05	
Haddock	0.05	
Quahog/Hardshell Clam	0.05	
Salmon (Chinook)	0.05	
Sardines	0.05	
Shrimp	0.05	
Barracouta	0.06	
Cod, Atlantic, Pacific or unspecified	0.06	
Flatfish (Flounder)	0.06	
Herring, Atlantic and Pacific	0.06	
Plaice, Canadian	0.06	
Shad, American	0.06	
Tuna, Canned (Light; Yellowfin, Skipjack)	0.06	
Rockfish	0.07	
Snapper (Mangrove, Gray)	0.07	
Squid	0.07	US data
Whelk	0.07	
Hake, White	0.08	
Lingcod	0.08	
Sole (Dover, Petrale)	0.08	

Arctic Char	0.09	
Bullhead, Brown	0.09	
Crabs	0.09	Dungeness, Rock, Snow
Lobster	0.09	
Turbot	0.09	
Carp	0.10	
Crawfish	0.10	
Sturgeon (Lake, White)	0.10	
Whitefish	0.10	
Maria (Burbot; Ling)	0.11	
Monkfish	0.11	
Croaker, Atlantic	0.12	
Mullet, Common	0.12	
Pumpkinseed	0.12	
Skate	0.14	
Tilefish, Atlantic	0.14	CFIA data is 0.08 n = 1; US data used.
Catfish, Wild (or unspecified)	0.15	
Jack (Blue Runner, Crevalle/Common)	0.15	
Perch (White, Yellow)	0.15	
Amberjacks	0.17	
Eel (species not specified)	0.19	
Whiting	0.19	
Mackerel, King (Kingfish, Spanish Mackerel)	0.21	
Drum, Freshwater	0.22	
Mahi Mahi (Dolphin fish)	0.22	
Trout, Lake	0.23	
Pike	0.25	
Redfish	0.25	
Tuna, fresh/frozen (Albacore, White)	0.30	Average of all samples
Wahoo	0.30	Average of all samples
Bass, Striped	0.31	
Halibut	0.31	
Sauger	0.32	Average of all samples
Tuna, Canned (Albacore, White)	0.32	Average of all samples
Grouper	0.33	
Cusk (Brismark, Moonfish)	0.35	
Sablefish (Blackcod)	0.35	
Walleye (Yellow Pickerel)	0.37	
Tuna, Fresh & Frozen	0.42	Average of all samples
Orange Roughy	0.44	
Sea Bass	0.46	Average of all samples
Escolar (Snake Mackerel)	0.53	
Patagonian Toothfish	0.62	Chilean Sea bass
Shark	0.74	Average of all samples.
Barracuda	0.77	

Tilefish, Gulf of Mexico	0.80	Used US data
Marlin	0.92	Average of all samples
Swordfish	1.06	Average of all samples

Data Sources

Based on Health Canada (HC) mercury fish data, except where noted below (Human Health Risk Assessment of mercury in fish and health benefits of fish consumption. 2007. www.hc-sc.g.ca/fn-an/pubs/mercur/: and http://www.hc-sc.gc.ca/fn-an/pubs/mercur/merc_fish_poisson_e.html

Additional data was obtained directly from Canadian Food Inspection Agency (CFIA) for the following species: anchovies, sardines, crawfish, tilapia. Data were for the years 1999 to 2007.

US data from the Food and Drug Administration. http://www.cfsan.fda.gov/%7Efrf/sea-mehg.html. Accessed July 2007.

Omega-3 fatty acid information extracted from Health Canada, Nutrition Health Division resource based on USDA Handbook No. 8-15, 1987 and Ackman, RG and McLeod, C. 1988. Canadian Institute for Food Science and Technology. J. 21:390. High O-3 content is defined as >0.5%) 0-3 content by weight. Total O-3 is defined as 22:6 + 22:5 + 20:5 (DHA + DPA + EPA).

CFIA data for canned skipjack was used instead of the Dabeka data because of the much larger sample size. CFIA sample size was 114 with a mean of 0.06 ppm. The Dabeka et al. (2004) measured 7 samples of canned skipjack at an average concentration of 0.09 ppm.

CFIA mean for canned yellowfin was used instead of the Dabeka data because of the much larger sample size. CFIA sample size was 74 with a mean of 0.06 ppm. The Dabeka (2004) measured 11 samples of canned skipjack at an average concentration of 0.09 ppm.

Dabeka data for canned light tuna was used instead of the CFIA data because of the larger sample size. The Dabeka data had 5 samples (mean 0.05 ppm) and the CFIA had only 1 sample (0.14 ppm).

There was only one HC sample for tilefish (0.08 ppm). Thus, the FDA data for Atlantic tilefish were used; n = 32; taken 2002-2004 and the data for Gulf Tilefish; advisory; mean = 1.45 ppm; n=60; NMFS 1978. (Mercury Levels in Commercial Fish and Shellfish. www.cfsan.fda.gov).

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.