Mercury and Omega-3 Fatty Acids in Fish Sandwiches from Retail Restaurants

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ABSTRACT

Mercury and omega-3 fatty acids in fish sandwiches sold at six retail restaurants were measured. Total mercury ranged from 0.005 to 0.132 ppm and was well below the FDA action limit of 1 ppm. The sandwiches provided between 8 and 146% of the RfD for mercury for a 60 kg individual. The omega-3 fatty acid content (EPA plus DHA) ranged from 0.021 to 0.259 g per fish sandwich.

INTRODUCTION

Mercury is present naturally in the environment, and also enters through the burning of fossil fuels and waste. Mercury can move across the placenta, enter breast milk and cross the blood brain barrier (EPA, 2001). Mercury exposure during infancy has been associated with various neurodevelopmental defects (EPA, 2001).

Human exposure to mercury is predominantly through the consumption of contaminated fish. The FDA has issued an advisory for pregnant and lactating women against shark, swordfish, tilefish and king mackerel due to the high content of mercury (FDA, 2004).

However, fish may also be a good source of omega-3 fatty acids, such as EPA (C20:5n-3) and DHA (C22:6n-3), which play a pivotal role in fetal/infant brain and retina development (Lauritzen et al, 2001).

The Adequate Intake for EPA plus DHA for pregnant and lactating women set by the National Academy of Science (NAS) is 0.13-0.14 g/d (NAS, 2002).

Since the vast majority of the US population consumes fast-food, it is important to evaluate the safety of these foods. Therefore, the objective of the study was to measure mercury and omega-3 fatty acids in fish sandwiches obtained from retail restaurant chains to examine the safety of these popular options.

METHODS

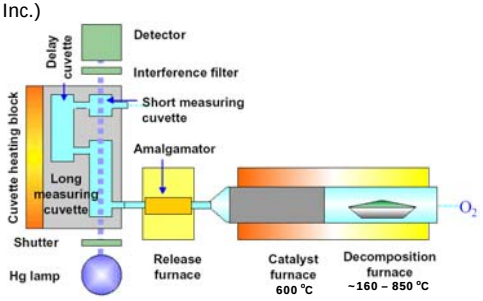
Fried fish fillets or tuna sandwiches were purchased from six retail restaurants (Burger King, Dairy Queen, Long Johns Silver, McDonalds, Subway, White Castle). Four stores were selected for each restaurant chain and 5 fish sandwiches were obtained from each store. The sandwiches were ordered without condiments or cheese, except for the tuna which contained mayonnaise, separated from the bun and homogenized.

The fish species were pollock or cod (Burger King), pollock or hoki (McDonalds), pollock (White Castle and Dairy Queen), cod (Long Johns Silver) and tuna (Subway).

Total fat was extracted with chloroform/methanol (2:1, v/v) using the method developed by Folch et al (1956) and further modified by Gallina et al (2003). Fatty acid analyses were carried out using AOAC Method 991.39

Mercury analyses were carried out by Thermal Decomposition-Amalgamation/Atomic Absorption Spectrophotometry (TDA-AAS) using a DMA-80 Mercury Analyzer (Milestone, Inc, Monroe, CT). The analyzer was calibrated with standard reference materials TORT-2 and DORM-2 in the range of 0-470 ng total Hg.

Figure 1. Thermal Decomposition-Amalgamation/Atomic Absorption Spectrophotometry (courtesy of Milestone, Inc.)



RESULTS

- None of the retail fish sandwiches/fillets exceeded the FDA action limit of 1 ppm of Hg.
- The sandwiches provided between 8 and 146% the RfD for mercury for an individual weighing 60 kg.

Table 1: Mercury in composite (n=5) fish samples

Restaurant	Number of stores	Hg content Mean ±S.D. (ppm)	Hg intake per fillet (μg)[a]	% RfD per sandwich[a]
Burger King	4	0.016 ± 0.01	1.20	20
Dairy Queen	4	0.033 ± 0.30	3.19	53
Long Johns Silver	4	0.006 ± 0.00	0.46	8
McDonalds	4	0.132 ± 0.07	8.42	140
Subway[a]	4	0.101 ± 0.04	8.78	146
White Castle	4	0.020 ± 0.02	0.75	12

[a]The calculation was based on an RfD of 0.1 μg/Kg body weight/day (EPA, 2001) for a 60 kg individual
[b]Tuna sandwiches were obtained from Subway while fried fish fillets were obtained from all other stores.

Table 2: Omega-3 fatty acids in composite (n-5) fish samples

Restaurant	Total Fat (%)	Average weight of fillet/tuna (g)	Omega-3 fatty acids (g/sandwich)			
			EPA	DHA	EPA + DHA	% AI[a]
Burger King	9.7±3.6	75.56	0.088	0.153	0.24	172
Dairy Queen	11.3±2.1	96.93	0.029	0.051	0.08	58
Long Johns Silver	12.3±7.8	77.32	0.197	0.323	0.52	372
McDonalds	11.6±7.2	63.84	0.074	0.195	0.27	192
Subway[b]	9.1±3.4	86.98	0.082	0.537	0.62	442
White Castle	10.6±2.2	37.61	0.048	0.074	0.12	86

[a]AI: Adequate Intake (0.13 g/d during pregnancy; 0.14 g/d during lactation)
[b]Tuna sandwiches were obtained from Subway, while fried fish fillets were obtained from all other stores.

CONCLUSIONS

- Mercury contents in fish sandwiches were below the FDA Action Limit of 1 ppm.
- The intake of mercury per sandwich was between 8 and 146% of the RfD for an individual weighing 60 kg.
- Fish sandwiches provided between 58 and 442% of the omega-3 fatty acid (EPA plus DHA) adequate intake for a pregnant and lactating woman.

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