

Mercury in fishmeal and fish oil

Fish and fish products, including fishmeal and fish oil, have health benefits. But there are concerns that they also contain persistent environmental chemicals or contaminants which pose risks to human health. In a series of briefing notes, FIN takes a close look at those chemicals by summarising the scientific facts on each contaminant and detailing the legislation relevant to fishmeal and fish oil which has been put in place to minimise exposure.

What is mercury?

Mercury is a metallic element, liquid at room temperatures. Its compounds are present in most foods naturally and take two forms – organic compounds (carbon containing) and inorganic compounds (salts). Methylmercury is the most common organic mercury compound due to its stability and is also the most toxic following ingestion. Emissions to air cause the most significant releases of mercury pollution, but mercury is also released directly to water and land.

The concerns

Methylmercury has the potential to build up in many edible freshwater and saltwater fish, and marine mammals, to levels that are considerably higher than the levels in the surrounding water.

Humans are exposed to inorganic and organic mercury. The major source of exposure to the most important compound, methylmercury, is through dietary intake, especially fish and other seafood.

Mercury compounds are neurotoxins, which may induce neurological alterations in the brain, with the greatest susceptibility during early development. It is thought that over exposure can also negatively affect the central nervous system, kidneys, liver and reproductive organs.

The main developments

1. Industrialisation has caused mercury releases to rise, with human activities increasing levels in the atmosphere by roughly a factor of three.
2. In 2004, the Joint Food and Agriculture Organisation of the United Nations (FAO)/World Health Organisation (WHO) Expert Committee in Food Additives (JEFCA) established a Provisional Tolerable Weekly Intake (PTWI) of 1.6 µg/kg bodyweight per week for methylmercury, in order to protect the developing foetus from neurotoxins.
 - Estimated average dietary exposure to methylmercury through fish is well within the current PTWI.
 - Adults can consume more than two times the set level before methylmercury is considered to pose a risk.
3. EU legislation has been put in place to limit the use and emissions of total mercury, thus reducing pollution at source. European emissions of mercury have been cut considerably in recent decades, falling by about 60% between 1990 and 2000. The EU has also set maximum levels for food and animal feed.
4. Fishmeal and fish oil supplies comply with these EU maximum permitted levels of methylmercury in both seafood and fish/animal feed. "Occurrence of these contaminants is generally below the EU maximum levels." European Food Safety Authority (EFSA) January 2007
5. Research shows the benefits of eating fish and fish products hugely outweigh the likely risks from trace contaminants. Current advice from the UK Food Standards Agency is that adults should consume at least two portions of fish a week, one of which should be oily.
6. Although fishmeal and fish oil contain methyl mercury, they are not the source. The fishmeal industry will continue to work with the authorities to minimise exposure to all contaminants.

Controlling emissions at source – EU

Overall contaminant levels are falling. Exposure to mercury in food in the UK has reduced over the past two decades through various reduction measures from controlling emission at source to applying direct limits on food and feed content. Other efforts exist to reduce total mercury use, such as developing and introducing safer alternatives and cleaner technology, the use of subsidies and incentives to encourage substitution efforts, voluntary agreements with industry and awareness-raising.

There is a comprehensive body of existing EU and national legislation in place to control releases of mercury. The main areas are concerned with emissions and use of mercury.

- **Controlling emissions at source**
 - The European Commission adopted a proposal for a new Directive to protect surface water from pollution on 17 July 2006 COM (2006) 397. This sets environmental quality standards which Member States must achieve by 2015 and set limits on concentrations in surface waters of 41 dangerous chemical substances (including mercury). This supports the Water Framework Directive.
 - EU Council Directive 76/769 restricts the marketing and use of dangerous substances and preparations.
 - The Fourth Air Quality Daughter Directive 2004/107/EC does not set a target value or quality standard for mercury – levels observed in ambient air are below those believed to have adverse health effects – but concentrations and deposition are to be measured to show geographical and temporal trends.

- **At EU level there are a number of major legal instruments to control mercury emissions from industrial sources:**
 - The EU Commission developed a 'Community Strategy concerning Mercury' {SEC (2005) 101} which was published in January 2005. This which sets out a series of objectives and actions to cut EU and global emissions and the use of mercury, including phasing out EU mercury exports by 2011. It also addresses safe storage of mercury decommissioned by EU industry.
 - The IPPC (Integrated Pollution, Prevention and Control) Directive is a key Community tool to reduce emissions of mercury. All industrial installations had to comply by 30 October 2007. The Commission is currently carrying out a review of the IPPC Directive, and related legislation on industrial emissions.

- **A number of international legally binding instruments have been negotiated and concluded to reduce and eliminate production, use and releases of dangerous substances, including mercury:**
 - International control is through the OSPAR convention for the protection of the marine environment of the north-east Atlantic; the UNECE convention on long-range transboundary air pollution; the UNECE heavy metals protocol; the Basel convention on transboundary movement and disposal of hazardous wastes; the Rotterdam convention on hazardous chemicals and pesticides in international trade; and it is listed as a substance for priority action on its control under the Helsinki Convention which protects the marine environment of the Baltic Sea.
 - The International Conference on Mercury as a Global Pollutant has become the premier international forum for the presentation and discussion of advances in the scientific understanding of environmental mercury. The last conference was held in August 2006.

The EU maximum permitted levels of mercury in feed and food

In 2005 the European Union (EU) introduced maximum permitted levels to control the amount of mercury in feedingstuffs and in food.

Maximum levels of mercury were calculated on the basis of WHO assessments, which look at how much mercury human beings can be exposed to every day over a lifetime, without causing harm. This is called a Tolerable Daily Intake (TDI).

The below table demonstrates the current EU limits for mercury in feed:

Products intended for animal feed	Maximum mercury content in mg/kg relative to feedingstuff (m.c. 12%)
Feed materials with the exception of:	0.1
<ul style="list-style-type: none"> feeding stuffs produced by the processing of fish or other marine animals 	0.5
<ul style="list-style-type: none"> calcium carbonate 	0.3
Complete feeding stuffs with the exception of:	0.1
<ul style="list-style-type: none"> complete feeding stuffs for dogs and cats 	0.4
Complementary feedingstuffs except:	0.2
<ul style="list-style-type: none"> complementary feeding stuffs for pets 	-

The below table demonstrates current EU limits for mercury in seafood:

Product	Max. Mercury level (mg/kg wet weight)
Fishery products and muscle meat of fish, excluding species listed below:	0.50
Muscle meat of the following fish: anglerfish (<i>Lophius</i> species),- Atlantic catfish (<i>Anarhichas lupus</i>), bonito (<i>Sarda sarda</i>), eel (<i>Anguilla anguilla</i>), emperor, orange roughy, rosy soldierfish (<i>Hoplostethus</i> species), grenadier (<i>Coryphaenoides rupestris</i>), halibut (<i>Hippoglossus hippoglossus</i>), marlin (<i>Makaira</i> species), megrim (<i>Lepidorhombus</i> species), mullet (<i>Mullet</i> species), pike (<i>Esox lucius</i>), plain bonito (<i>Orcynopsis unicolor</i>), poor cod (<i>Tricopterus minutus</i>), portuguese dogfish (<i>centroscymines coelolepis</i>), rays (<i>Raja</i> species), redfish (<i>Sebastes marinus</i> , <i>S. mentalla</i> , <i>S. viviparus</i>), sail fish (<i>Istiophorus platypterus</i>), scabbard fish (<i>Lepidopus caudatus</i> , <i>Aphanopus carbo</i>), seabream, pandora (<i>Pagellus</i> species), shark (all species), snake mackerel or butterflyfish (<i>Lepidocybium flavobrunneum</i> , <i>ruvettus pretiosus</i> , <i>Gempylus serpens</i>), sturgeon (<i>Acipenser</i> species), swordfish (<i>Xiphias gladius</i>), tuna (<i>Thunnus</i> , <i>Euthynnus</i> , and <i>Katsuwonus</i> species)	1.0

Actual levels of mercury in fishmeal and food

EFSA summary table December 2006 comparing EU limits with occurrence levels in fishmeal: non – regulatory

Contaminant	Unit	EU maximum limit in fishmeal	Range of occurrence levels in fishmeal	Human daily intake (per kg body weight)	Prov'al total daily intake (per kg body weight)
Mercury	µg/kg	500	<30 - 350	-	0.0016

EFSA commentary

The occurrence shows the samples of fishmeal produced from fish in the Northern hemisphere contain higher amounts of mercury than fishmeal from the southern hemisphere.

- **Levels of mercury intake in Europe vary**

In March 2004 EFSA published an opinion relating to mercury and methylmercury found in food throughout Europe. The mean intakes were in most cases below the Joint FAO/WHO Expert Committee on Food Additives (JEFCA) PTWI of 1.6 µg/kg but the average intake in some countries could exceed limits ie population-groups in Europe with a frequent consumption of large predatory fish at the top of the food chain ie swordfish and tuna.

Benefits of eating fish outweigh contaminant risks

- **Surveys support FSA fish consumption advice**

Research shows that the known benefits of eating fish and fish products hugely outweigh any possible risks. The UK Food Standards Agency advice is that adults should consume at least two portions of fish a week, one of which should be oily. This is supported by a number of surveys:

- **Harvard School of Public Health October 2006** – could find ‘no definite evidence’ that low levels of mercury that are typically found in seafood have any harmful effects. The worst they could say was that mercury ‘may lessen the cardiovascular benefit’ from eating *some* fish without causing any harm of its own.
- **US National Fisheries Institute August 2006** – The NFI claimed: ‘While trace amounts of mercury can be found in certain types of fish and seafood, the health benefits of consuming fish far outweigh the potential risk from minimal mercury exposure.’ This is supported by evidence from a Harvard Centre benefit/risk analysis.
- **US Non-Profit Centre for Consumer Freedom June 2006** - tested 142 canned tuna and fresh fish samples (including salmon, seabass and swordfish) and found every fish ‘safe to eat’. Lowest mercury levels were found in farmed salmon, followed by wild salmon.
- **UK Food Standards Agency (FSA) May 2006** - 165 samples of processed fish and fish products were analysed for mercury. The third highest level of mercury was found in a sample of swordfish. For almost all other samples, the levels of mercury were low and, in most cases, below the level where a measurement can be accurately quantified.
- **FSA October 2005** – tests for mercury were carried out on 125 shellfish samples. No samples exceeded the legal limit for mercury. Out of 100 samples of fish oil dietary supplements only 9 products contained detectable levels of mercury, and none were over the legal limit.

FIN briefing notes

This briefing note on mercury is one of a series prepared by FIN covering contaminants that may impact on fish and fish products. Other Briefing Notes include:

- Dioxins and dioxin-like PCBs
- Lead
- Cadmium
- Arsenic
- Organochlorines

Disclaimer

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Sources of information:

- Communication from the Commission to the Council and the European Parliament - Community Strategy Concerning Mercury {SEC(2005) 101}
- EU Commission Directive 2005/8/EC amended Annex I of Directive 2002/32/EC (came into force on 27 January 2005).
- UK Statutory Instrument 2006 No. 3120 (came into force on 26 December 2006).
- EU Commission Regulation (EC) 78/2005 specifically applies to heavy metal in fish, amending Commission Regulation 466/2001. (Adopted on 19 January 2005 and applied from 9 February 2005).
- EU Commission Regulation (EC) 1881/2006 condenses prior legislation on certain contaminants in food, including mercury. (This repealed 466/2001 and applied from 1 March 2007).
- FSA Food Safety Information Sheet 0806
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