Albacore Tuna & Mercury

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Mercury & Albacore Tuna

Introduction

The link between mercury and tuna consumption has long been a public health concern, particularly for vulnerable populations. However, there are also significant established health benefits associated with consuming seafood. The purpose of this information note is to clarify what mercury is, describe how it ends up in fish, and explain some of the guidelines and limits that the relevant authorities have put in place to ensure that food is safe.

Forms of mercury

Mercury (Hg) is a metal that can be released into the environment through various natural processes and human activities, such as industrial pollution. Mercury occurs in three main forms: elemental, inorganic (when it combines with other elements such as Sulphur and Oxygen) and organic (when it combines with Carbon).

Methylmercury (MeHg) is an organic compound of mercury that forms when inorganic mercury is converted via methylation by certain bacteria in aquatic environments. Methylmercury is found in fish and can build up to significant levels in large predatory fish as these fish consume smaller species that have taken up mercury in the environment. Methylmercury is a more toxic form of mercury, and it is more prone to bioaccumulation and biomagnification.

Mercury & Seafood

Mercury (Hg) is a naturally occurring element that can be found in various forms in the environment. Mercury can be released into the atmosphere through a range of processes such as volcanic eruptions or industrial emissions which then deposit onto land or sea. In aquatic environments, bacteria present can convert inorganic mercury into methylmercury (Houssard, et al., 2019). This methylmercury is absorbed by microscopic organisms such as plankton and enters the food chain as the plankton are consumed by larger organisms which are in turn consumed and this continues up the food chain. With each step, the concentration of methylmercury is increased resulting in biomagnification where top predators in the ecosystem such as sharks, swordfish, and tuna species, can accumulate significant levels of methylmercury over time. A major source of methylmercury intake in humans is fish and seafood products.

Potential health risks associated with methylmercury

Human consumption of high levels of methylmercury can lead to adverse health effects and the metal can accumulate in the human body over time. The most significant concern with methylmercury exposure is its potential to cause neurological problems, especially in developing foetuses and young children (Stamatis, et al., 2019). High levels of methylmercury can impair cognitive development, leading to issues with learning, memory, and motor skills. It's important to note that the health risks associated with mercury and methylmercury consumption depend on the type of seafood, the frequency and amount of consumption and type of mercury that has contaminated that seafood, and an individual's age, sex, and overall health.

Vulnerable populations

High-risk groups for exposure include pregnant women as developing foetuses are particularly vulnerable to the harmful effects of methylmercury. Mercury can cross the placenta and harm the developing brain and nervous system of the foetus. Breastfeeding women are considered a high-risk group as mercury can transfer to infants through breast milk and breastfeeding. Infants and young children are also at a high risk of mercury-related health issues because their developing brains and nervous systems are more sensitive to the effects of mercury.

Albacore Tuna

Tuna Species

Tuna is a diverse group of fish species belonging to the family Scombridae. These species are known for their

streamlined bodies, and high swimming speeds and have a wide distribution in oceans around the world. Some notable species include Skipjack (*Katsuwonus pelamis*), Yellowfin (*Thunnus albacares*), Bluefin (*Thunnus thynnus*), Bigeye (*Thunnus obesus*), and Albacore (*Thunnus alalunga*).

Albacore is the tuna species of importance to Irish fisheries with a Total Allowable Catch (TAC) of 3174 tonnes allocated to Ireland in 2023 (BIM, 2023). Albacore as the name suggests – 'alba' meaning white – has pale coloured flesh and a firm meaty texture. While albacore is one of the smaller tuna species, it grows up to 140cm and can weigh up to 60 kg.

The Irish Albacore tuna fishery is part of one of BIM's Fishery Improvement Projects (FIPs). FIPs provide a platform for fishermen, seafood buyers, and suppliers to develop a strategy to improve a specific fishery by considering better policies and management over a given time period. Engagement in a FIP allows producers and processors to access markets that demand sustainability and environmental credentials. A FIP aims to improve sustainability within a fishery and progress to certification under the Marine Stewardship Council (MSC) (BIM, 2021).

From a health perspective, tuna species can make an important nutritional contribution to the diet as they are high in protein, low in fat, and high in omega-3 fatty acids as well as being high in a range of micronutrients including phosphorus, selenium, vitamin D, niacin (vitamin B3), vitamin B6, vitamin D and vitamin B12 (Public Health England , 2021).

Market Insights

In Ireland, tuna is predominately sold in an ambient format with various different tuna species and formats on offer. Tuna is also available in some retailers in fresh format either in fillet format or a value-added prepared format.

Data from Kantar Worldpanel states that total tuna sales in Irish retail were valued at €20 million for the 52 weeks ending 25th December 2023, down 9% on the previous year. Tuna sales are the fifth highest sales in Irish retail behind Salmon, Cod, Prawns, and Alaskan Pollock.

In the ambient aisle tuna is available in the traditional tins and jar format either in brine, oil, or spring water. There are also value-added offerings in foil tray and pouch format for a more convenient solution. Brands in Irish retail include John West, Sunny South, Rio Mare, Ortiz, and Shines. The majority of tuna products available in the Irish retail market are Skipjack (*Katsuwonus pelamis*) tuna.

Regulatory Guidelines

Human consumption

In 2012 the EFSA Scientific Panel on Contaminants in the Food Chain (CONTAM) established a Tolerable Weekly Intake (TWI) for methylmercury of 1.3 µg/kg body weight/week, which is lower than the Joint FAO/WHO Expert Committee on Food Additives (JECFA) provisional TWI (PTWI) of 1.6 µg/kg body weight/week established in 2003 and re-confirmed in 2007. A TWI for inorganic mercury of 4 µg/kg body weight/week was also established by the EFSA CONTAM Panel which is in line with the PTWI established by JECFA in 2011. The EFSA determined that the high dietary exposure estimates were close to or above the TWI for methylmercury for all age groups. Furthermore, the EFSA concluded that high fish consumers, which might include pregnant women, may exceed the TWI by almost 6-fold. In 2014, the EFSA published an assessment on the health benefits of seafood consumption in relation to the

EU Legislation
Maximum level for mercury in tuna species = 1.0 mg/kg

EFSA Tolerable weekly intake (TWI)
Inorganic mercury = 4 µg/kg body weight/week (expressed as mercury)
Methylmercury = 1.3 µg/kg body weight/week (expressed as mercury)

health risks associated with exposure to methylmercury. The EFSA concluded that consumption of 1 to 2 servings of seafood per week and up to 3 to 4 servings per week during pregnancy has been associated with better neurodevelopmental outcomes in children (EFSA, 2014). In 2015, the EFSA published a statement concluding that in order to protect against the adverse effects of methylmercury and achieve the benefits of fish consumption, which are associated with 1 to 4 servings of fish per week, consumption of fish species with high concentrations of mercury should be limited (EFSA, 2015). Biomonitoring data on blood and hair concentrations indicated that in the general European population, methylmercury exposure is generally below the TWI (EFSA, 2012).

The Food Safety Authority of Ireland (FSAI) advises that vulnerable groups such as pregnant and breastfeeding women, women of childbearing age, and young children should limit consumption of tuna to one fresh tuna steak or two 225 g/8 oz cans of tuna per week (FSAI, 2017). The FSAI also advises these vulnerable groups to avoid swordfish, marlin, and shark however they should continue to consume other species of fish as part of a balanced diet. All other adults and young people should restrict their consumption of shark, swordfish, or marlin to not more than one portion per week and continue to eat tuna and fish products as vital components of a healthy diet (FSAI, 2019).

Nutritional advice and guidelines and continously updated by the FSAI. For the most uptodate guidelines refer to the FSAI website (www.fsai.ie).

Maximum acceptable levels of mercury in fish

The EU Commission amended the maximum levels for mercury in some fish species in 2022 however the levels in tuna species were maintained at 1.0 mg/kg (Appendix I) (European Commission, 2023).

Mercury Levels in Albacore Tuna

In Ireland, the Marine Institute carries out a mercury monitoring programme that was established for fish caught at major Irish fishing ports after the introduction of maximum levels for mercury in fishery products in 1993. This programme is under a service contract with the FSAI. The concentration of mercury in the edible part of the analysed fish ranges from 0.02 to 0.27 mg/kg wet weight. It's important to note that these catches typically do not include deep-water species like shark, swordfish, marlin, and tuna (FSAI, 2017). The Marine Institute also carried out additional monitoring of albacore tuna landed in Ireland, which had levels ranging from 0.12 to 0.41 mg/kg wet weight. Several studies are available in the literature investigating the concentrations of mercury in tuna in a range of different areas and countries (excluding Ireland) which are summarised in Table 1 (Appendix II). In 2023, BIM carried out mercury anaylsis on 8 samples of albacore tuna currently available on the Irish retail market. The mean mercury levels found in the samples were 0.25 ± 0.05 mg/kg (Appendix III). All studies carried out demonstrated results well below the European Union's maximum level in tuna of 1.0 mg/kg established in Commission Regulation (EU) 2023/915 (European Commission, 2023).

While the levels of Mercury in the primary habitat will influence the concentration of mercury and methylmercury, as tuna is a highly migratory species and there is a limited number of studies from different geographical areas it is unfeasible to designate fish from a certain fishing area as being higher or lower in mercury content than another.

The size and age of the tuna have been demonstrated to have a direct positive relationship with the mercury concentration (Teffer, et al., 2014) (Chen, et al., 2014). Houssard, et al. (2019) also noted that the concentrations of methylmercury generally rise with the age and size of fish, as larger tuna have lived longer and have had more opportunity to accumulate mercury over their lifetime. While the relationship between size/age and mercury concentration is seen in a number of studies there hasn’t been a conclusive opinion from an authority on the validity

of the claim. Furthermore, any call to utilise smaller fish for consumption due to their possible reduced levels of mercury would not be viable from a stock sustainability point of view.

Conclusions

Current levels of total mercury in albacore tuna in Ireland are lower than EU limits, and safe for consumption by the general population. While vulnerable groups such as pregnant women, breastfeeding women, and young children should be cautious about how much mercury they are potentially consuming, the FSAI is only limiting the advised intake of tuna to one fresh tuna steak or two 225 g/8 oz cans of tuna per week for this group. The consumption of albacore tuna and other seafood as part of a balanced diet is recommended to the general population as there are important health benefits of consuming seafood from a nutritional perspective.

Appendices

Appendix I – Maximum levels of mercury in foods established in Commission Regulation (EU) 2023/915

3.3	Mercury	
3.3.1	Fishery products ([26]) and muscle meat of fish ([24])([25]), excluding species listed in 3.3.2 and 3.3.3. The maximum level for crustaceans applies to muscle meat from appendages and abdomen ([44]). In case of crabs and crab-like crustaceans (*Brachyura* and *Anomura*), it applies to muscle meat from appendages.	0.50
3.3.2	Muscle meat of the following fish ([24])([25]): Axillary seabream (*Pagellus acarne*) Black scabbardfish (*Aphanopus carbo*) Blackspot seabream (*Pagellus bogaraveo*) Bonito (*Sarda sarda*) Common pandora (*Pagellus erythrinus*) Escolar (*Lepidocybium flavobrunneum*) Halibut (*Hippoglossus species*) Kingklip (*Genypterus capensis*) Marlin (*Makaira species*) Megrim (*Lepidorhombus species*) Oilfish (*Ruvettus pretiosus*) Orange roughy (*Hoplostethus atlanticus*) Pink cusk-eel (*Genypterus blacodes*) Pike (*Esox species*) Plain bonito (*Orcynopsis unicolor*) Poor cod (*Tricopterus species*) Red mullet (*Mullus barbatus barbatus*) Roundnose grenadier (*Coryphaenoides rupestris*) Sail fish (*Istiophorus species)* Silver scabbardfish (*Lepidopus caudatus*) Snake mackerel (*Gempylus serpens*) Sturgeon (*Acipenser species*) Surmullet (*Mullus surmuletus*) Tuna (*Thunnus species, Euthynnus species, Katsuwonus pelamis*) Shark (all species) Swordfish (*Xiphias gladius*)	1.0
3.3.3	Cephalopods Marine gastropods Muscle meat of the following fish ([24])([25]): Anchovy (*Engraulis species*) Alaska pollock (*Theragra chalcogrammus*) Atlantic cod (*Gadus morhua*) Atlantic herring (*Clupea harengus*) Basa (*Pangasius bocourti*) Carp (species belonging to the *Cyprinidae family*) Common dab (*Limanda limanda*) Mackerel (*Scomber species*) European flounder (*Platichthys flesus*) European plaice (*Pleuronectes platessa*) European sprat (*Sprattus sprattus*) Mekong giant catfish (*Pangasianodon gigas*) Pollock (*Pollachius pollachius*) Saithe (*Pollachius virens*) Salmon & Trout (*Salmo species* and *Oncorhynchus species*, except *Salmo trutta)* Sardine or Pilchard (*Dussumieria species*, *Sardina species*, *Sardinella species* and *Sardinops species*) Sole (*Solea solea*) Striped catfish (*Pangasianodon hypothalamus*) Whiting (*Merlangius merlangus*)	0.30
3.3.4	Food supplements ([39])	0.10
3.3.5	Salt	0.10

(European Commission, 2023)

Appendix II – Summary of studies on mercury levels in albacore tuna

Level of Mercury (mean) wet weight	Format	Location	Reference
0.455 ± 0.144 mg/kg	Muscle	Northwest Atlantic	(Teffer, et al., 2014)
0.332 ± 0.114 mg/kg	Canned	North West Spain	(García, et al., 2016)
0.190 mg/kg (median)	Muscle	Spain	(Besada, et al., 2006)
0.480 ± 0.152 mg/kg 0.401 ± 0.154 mg/kg	Muscle	North Aegean Sampling Station Area Southeastern Aegean Sampling Station Area	(Stamatis, et al., 2019)
0.428 ± 0.114 mg/kg (female) 0.461 ± 0.175 mg/kg (male)	Muscle	North Pacific	(Chen, et al., 2014)
0.179 ± 0.05 mg/kg 0.177 mg/kg (median)	Muscle	Southern Oregon and Washington Coast	(Morrissey& Geise, 2001)

Table 1: Summary of international studies on Mercury levels in albacore tuna

Appendix III – Summary of retail samples analysed for mercury levels in albacore tuna products in Ireland

Sample	Level of Mercury	Format	Location
1	0.163 ± 0.032 mg/kg	Jar	FAO 27
2	0.228 ± 0.046 mg/kg	Jar	FAO 27
3	0.228 ± 0.046 mg/kg	Jar	FAO 27
4	0.239 ± 0.048 mg/kg	Jar	FAO 27
5	0.249 ± 0.050 mg/kg	Jar	FAO 27
6	0.264 ± 0.053 mg/kg	Jar	FAO 27
7	0.291 ± 0.058 mg/kg	Jar	FAO 27
8	0.335 ± 0.067 mg/kg	Jar	FAO 27

Table 2: Summary of Irish study on Mercury levels in albacore tuna

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