Bord Iascaigh Mhara
Irish Sea Fisheries Board

Information note

Histamine in Seafood

Intoduction

Scombroid (Histamine) poisoning is a chemical intoxication which is caused by the ingestion of fish or fishery products that have undergone spoilage due to certain types of bacteria.

Some species of fish have larger quantities of a naturally occurring chemical called histidine in their flesh. These are members of the family *Scombridae* and include tunas, skipjack and yellow, and mackerel. It can also be present in non scombroid fish such as sardines, herrings, pilchards and marlin. When these fish are exposed to elevated temperatures for an extended period of time, spoilage bacteria can grow and produce an enzyme that can change the harmless amino acid called histidine into histamine and other amines which are toxic at high levels. The process that produces histamine (scombrotoxin) can start as soon as the fish dies, and can continue at any time thereafter if temperature abuse allows it. Lowering the temperature as quickly as possible will prevent these bacteria from growing and producing scombrotoxin. Fish species prone to histamine development must be handled properly, chilled rapidly, and kept cold to ensure their safety and quality. Scombrotoxin can develop if the temperature of these fish is allowed to remain above 40^{o}F for an extended period of time, and it can develop faster at higher temperatures. To ensure safety and maintain quality, fish should always be iced as soon as possible.

The Symptoms of Histamine Food Poisoning include:

Histamine poisoning causes symptoms similar to seafood allergic reactions and can often be mistaken for a fish, crustacean or shellfish allergic reaction.

- Nausea, vomiting, diarrhoea
- An oral burning sensation or peppery taste in the mouth,
- Hives, itching, red rash (flushing), and
- Hypotension (light-headedness, dizziness or fainting).

The onset of the symptoms usually occurs within a few minutes after ingestion of the implicated food and the duration of symptom ranges from a few hours to 24 hours. Studies have shown that toxic histamine levels can be reached within 12 hours or as little as 2 hours if the fish are not iced or refrigerated after catch. Histamine is not destroyed by cooking. Therefore, the best way to keep histamine at a minimum is to ensure proper temperature control. Sensory examination by the consumer cannot ensure the absence or presence of the toxin and chemical testing is the only reliable test for evaluation of a product. In some cases, low levels of histamine may already be present in the fish when you receive it.

Effect of Temperature on Histamine Formation

Scombroid fish poisoning is frequently encountered if dead fish remain in set nets during warm sea temperatures, the fish is improperly refrigerated or when refrigeration is delayed. Histamine-forming bacteria are capable of growing and producing histamine

over a wide temperature range. Growth is more rapid, however, at high-abuse temperatures (e.g. 21.1°C) than at moderate-abuse temperatures (e.g. 7.2°C). Growth is particularly rapid at temperatures near 32.2°C. Histamine is more commonly the result of high temperature spoilage than of long term, relatively low temperature spoilage. Once the enzyme histidine decarboxylase is formed, it can continue to produce histamine in the fish even if the bacteria are not active. The enzyme can be active at refrigeration temperatures. The enzyme is likely to remain stable while the fish is frozen and may be reactivated very rapidly after thawing. Freezing may inactivate the enzyme-forming bacteria. Cooking can inactivate both the enzyme and bacteria. However**,** once histamine is formed, it cannot be removed by heat or freezing. It can also survive canning and retorting processes. The best way to prevent scombroid poisoning is rapid chilling of the fish from the time of catch on the vessel and control of the temperature of the fish throughout processing, storage and distribution. This is particularly important for fish that are exposed to warmer waters or air, and for large tuna that generate heat in the tissues of the fish following death. Freezing of the fish can significantly reduce the bacterial load, but will not limit the activity of decarboxylase enzymes that may have been produced prior to freezing. Therefore, it is important to know the temperature history of the frozen fish, since outbreaks of histamine poisoning can be caused by the ingestion of thawed- frozen fish containing biogenic amines if the fish was previously temperature abused.

On- board Practices to Control Histamine

Fish can be chilled with ice, slurry ice (a mixture of seawater and ice), or mechanically refrigerated sea water (rsw). The rate at which the internal temperature of the fish cools will depend on:

1. The amount of ice used, or the temperature of the ice slurry or refrigerated sea water.
2. The temperature of the fish when brought on board the vessel;
3. The size of the fish and/or the amount of fish added to the slurry or refrigerated sea water.
4. If the fish has been gutted.
5. The air temperature on the deck and in the storage hold.

To achieve the most rapid cooling as much surface area of each fish as possible should be in direct contact with the cooling medium (ice or sea water). Most of the heat will be removed from the fish during the initial cooling stages. The ice will melt faster, or the temperature of the slurry or refrigerated sea water will increase faster, during this initial chilling period. More ice or refrigeration is necessary to cool fish after they are landed than during storage. Large fish will cool much more slowly than small fish. For large fish, more time is required to transfer the heat from inside the fish to the surface. For this reason, gutting large fish and then packing the gut cavity with ice, or immersing it in slush ice or refrigerated sea water will cool the fish faster.

Generally, fish should be placed in ice or in refrigerated seawater or brine at 4.4°C or less within 12 hours of death, or placed in refrigerated seawater or brine at 10°C or less within 9 hours of death.

Fish exposed to air or water temperatures above 28.3°C, or large tuna (i.e., above 20 lbs.) that are eviscerated before on-board chilling, should be placed in ice (including packing the belly cavity of large tuna with ice) or in refrigerated seawater or brine at 4.4°C or less within 6 hours of death.

Large tuna (i.e., above 20 lbs.) that are not eviscerated before on-board chilling should be chilled to an internal temperature of 10°C or less within 6 hours of death.

Seafood Processing Practices to control Histamine

The key measure for the control of histamine production in fish is, rapid chilling as soon as possible to inhibit formation of the enzyme histidine decarboxylation. Good hygienic practice is required at every step of processing of the fish. Careful handling to avoid damage to muscle tissue is also important in preventing contamination. Puncture wounds in fish can introduce contaminating bacteria into deep tissue where large concentrations of histidine are available. Good practice at processing and preparation stages further along the supply chain such as cutting and packing is also required.

To stop Histamine increasing to levels of concern, you should always:

- Purchase from reputable suppliers who store the fish on ice or under refrigeration.
- Receive product at refrigerated temperatures (<5°C).
- Place the fish under refrigeration as soon as it is received.
- Keep the fish at refrigerated temperatures when not being used.
- If the fish is frozen, thaw the fish under refrigeration.

Legislation relating to Histamine

European legislation states that fish species belonging to families known to contain large amounts of histidine (e.g. Scombridae, Clupeidae etc) in their tissues should be tested for the presence of histamine. See table for sampling and limits.

Relevant legislation: Commission Regulation 853/2004 as amended (see in particular Part B, Chapter V, Section VIII in Annex III of the Regulation). The methods used for determining histamine and its permitted levels are described in Annex I of Regulation 2073/2005.

Product Sampling and EU Limits for Histamine

Food category	Maximum permitted level of histamine
Fishery products from fish species associated with a high amount of histidine	Nine samples to be taken, of which: the average histamine content must be 100mg/kg or less; no more than 2 samples may have levels between 100mg and 200mg/kg; and no sample may have a level above 200mg/kg.
Fishery products which have undergone enzyme maturation treatment in brine, manufactured from fish species associated with a high amount of histidine	Nine samples to be taken, of which: the average histamine content must be 200mg/kg or less; no more than 2 samples may have levels between 200mg and 400mg/kg; and no sample may have a level above 400mg/kg.

Summary

The best way to prevent scombroid poisoning is rapid chilling of the fish from the time of catch on the vessel, control of the temperature during transport of the fish to the premises where it will be processed, and ensuring that the temperature is controlled throughout processing, storage and distribution.

Disclaimer

This information note does not purport to be comprehensive or to be a legal interpretation or to constitute legal or other professional advice.
Changes to the legislation may be expected that will necessitate this information note to be further updated.