

Marine Toxins and Food Poisoning

Marine toxins are chemicals produced by naturally occurring marine algae or bacteria.

Marine algae (tiny sea plants) produce toxins that can accumulate in fish and shellfish that feed on them. As large fish eat smaller fish, toxins accumulate to higher levels in large fish at the top of the food chain.

Eating certain species of fish or shellfish harvested in areas with toxic algal blooms may result in foodborne illness. The seafood may look, smell, and taste normal. Marine toxin poisoning happens mostly in summer.

Scombrototoxin, or histamine, is made by bacteria naturally found on the gills and gut

of live salt-water fish. Suppose these fish are time/temperature abused after they are caught. In that case, the bacteria rot the fish, digest the protein and release histamine, which causes the symptoms.

There are no specific treatments for marine toxin poisoning. Treatment generally consists of managing complications and being supportive until the illness passes.

Control: Cooking or freezing does not destroy the toxins. It is imperative to buy fish and shellfish from approved waters and suppliers.

Types of marine toxin poisoning

Scombrototoxin (histamine):

- Toxin made by bacteria when fish is exposed to temperatures between 21° - 32°C (70-90°F) for extended periods after the catch
 - Duration: 3 hours to several days
 - Initial symptoms: tingling or burning sensation in the mouth, metallic taste, rash on the upper body, drop in blood pressure, headache, itching of the skin
 - Later symptoms: nausea, vomiting, diarrhea
- Fish involved: tuna, mackerel, bluefish, mahi-mahi, sardines, bonito, jacks, herring and marlin. Fish may not show signs of rotting (smell, look).
- Symptoms:
 - Onset of symptoms: immediately to under 30 minutes
 - Treatment: Mild symptoms go away on their own within a few hours. Severe cases may need antihistamines or epinephrine.

- Control:
 - Rapid chilling to 4°C (40°F) or lower on ice or refrigeration and time or
 - temperature control after harvest
 - Hygienic processing: eviscerating, butchering, filleting

Ciguatera:

- Caused by ciguatoxins, produced by toxic marine algae.
- Fish involved: tropical and subtropical (Caribbean, Atlantic and Gulf of Mexico) reef fish that kill other fish such as barracuda, and other fish such as seabass, mullet, jacks, king mackerel, triggerfish, large groupers and snappers
- Symptoms:
 - Onset: a few minutes to 30 hours
 - Duration: 1 to 4 weeks
 - Gastrointestinal, neurological and cardiovascular symptoms are known. Diarrhea, abdominal pain, nausea, vomiting and unusual taste sensations.
 - Abnormal or impaired skin sensations (burning, "pins and needles"), vertigo, lack of muscle coordination, cold-to-hot sensation reversal, joint and muscular pain, dizziness, itching, nightmares and hallucinations: Arrhythmia and reduced blood pressure.
 - Death is infrequent but may occur

Shellfish poisoning

Bivalve molluscan shellfish such as clams and oysters obtain food by pumping water through their system and filtering out tiny organisms. If large numbers of the toxic algae (mostly dinoflagellate s) are present in the water, then the shellfish can accumulate high levels of the toxin.

Four types are known: paralytic, neurotoxic, diarrhetic, and amnesic shellfish poisoning.

Paralytic shellfish poisoning:

- A toxin is produced by dinoflagellate marine algae, which have a red-brown colour. These algae can cause a red streak called "red tide" in the ocean.
- Shellfish involved: mussels, cockles, clams, scallops, oysters, crabs, and lobsters from colder coastal waters, such as the Pacific Northwest and New England.
- Symptoms:
 - Onset: 15 minutes to 10 hours of eating the shellfish.
 - Tingling, burning, numbness, drowsiness, incoherent speech. Symptoms are usually mild, although severe symptoms of respiratory paralysis and death have occurred.

- Treatment: respiratory support within 12 hours of exposure results in

complete recovery.

Neurotoxic shellfish poisoning

- Toxins are produced by a dinoflagellate marine algae that kill fish and makes shellfish toxic to humans.
- Shellfish involved: oysters, clams, and mussels from the Gulf of Mexico and the Atlantic Coast of the southern United States.
- Symptoms:
 - Onset: 1 to 3 hours.
 - Duration: Symptoms usually last 2 to 3 days.
 - Numbness, muscular aches, dizziness, loss of coordination, diarrhea, vomiting, and tingling in the mouth, arms, and legs

Diarrhetic shellfish poisoning

- Toxins are produced by dinoflagellates
- Shellfish involved: mussels, oysters, and scallops from Japan, southeast Asia, Scandinavia, Western Europe, New Zealand and Eastern Canada
- Symptoms: not life-threatening
 - Onset: 30 minutes to 3 hours
 - Duration: 2 to 3 days, with or without treatment
 - Mild diarrhea, nausea, vomiting, abdominal pain, chills, headache, fever

Amnesic shellfish poisoning

- Toxins produced by dinoflagellates
 - symptoms in 48 hours.
- Shellfish involved: blue mussels feeding on algae, razor clams, squid, viscera of crabs (Dungeness, tanner and red rock) and anchovies from northeast and northwest coasts of North America
- Symptoms:
 - Duration: self-limiting within several days. Short-term memory loss can be permanent.
 - Vomiting, diarrhea, confusion, memory loss, disorientation, seizure, coma
 - Onset: gastrointestinal symptoms within 24 hours, neurological

Other marine toxins:

Tetrodotoxin	- Produced by puffer fish (also known as "fugu" or "blowfish") in the Atlantic Ocean, Gulf of Mexico and Gulf of California - The toxin can be found found in the ovary, liver, intestines and skin of fish, not destroyed by cooking or freezing - Symptoms: onset within 10 minutes of eating puffer fish. Early signs of numbness and tingling of mouth followed by weakness, paralysis, and decreased blood pressure. Death can occur within 30 minutes. - Fish need to be prepared by a highly trained expert to ensure poison does not get into the edible muscle - Treatment: no known antidote for poisoning. Treatment is symptomatic. Respiratory support may result in full recovery.
Tetramine	- Found in salivary glands of whelk - Control: Removal of salivary glands before cooking whelk
Gempylotoxin	- Produced by escolar or oily fish - Symptoms: diarrhea

References:

Food and Drug Administration. Bad Bug Book, Foodborne Pathogenic Microorganisms and Natural Toxins. Second Edition. 2012. <https://www.fda.gov/food/foodborne-pathogens/bad-bug-book-second-edition>

<https://www.healthlinkbc.ca/health-topics/ug2961>