Toxins [1]

Overview

Some species of naturally occurring marine algae (phytoplankton) have the ability to produce toxins that can cause consumer illness. These toxins can accumulate in fish and shellfish that feed on these algae. As large fish eat smaller fish, some of these toxins can accumulate to higher levels in large fish at the top of the food chain. Humans can ingest these naturally occurring toxins by eating shellfish like clams, oysters and mussels, the internal organs of crustaceans like crabs and lobsters, or certain species of fish harvested in areas where toxin producing algae have bloomed. Another type of toxin, called histamine or scombrotoxin, can be created when certain types of fish are temperature abused after they are caught.

Shellfish Toxins

There are several different types of shellfish toxins associated with naturally occurring marine algae that can accumulate in bivalve molluscan shellfish like clams, oysters and mussels. Marine toxins are not ordinarily a problem in scallops if only the adductor muscle is consumed. However, products such as roe-on scallops and whole scallops do present a potential hazard for natural toxins. The following information on the four shellfish toxins that are most likely to be encountered in the U.S. is adapted from the FDA Fish and Fishery Products Hazards and Controls Guide.

Paralytic shellfish poisoning (PSP) in the U.S. is generally associated with the consumption of molluscan shellfish from the northeast and northwest coastal regions of the United States. PSP in other parts of the world has been associated with molluscan shellfish from environments ranging from tropical to temperate waters. In addition, in the U.S., PSP toxin has recently been reported from the viscera of mackerel, lobster, Dungeness crabs, tanner crabs, and red rock crabs. While the viscera of mackerel are not normally eaten, the viscera of lobster and crabs are. However, the levels of PSP toxin that are found in lobster tomalley are not likely to pose a health hazard unless large quantities are eaten from a heavily contaminated area. **Neurotoxic shellfish poisoning** (NSP) in the U.S. is generally associated with the consumption of molluscan shellfish harvested along the coast of the Gulf of Mexico, and, sporadically, along the southern Atlantic coast. There has been a significant occurrence of toxins similar to NSP in New Zealand, and some suggestions of occurrence elsewhere. **Diarrhetic shellfish poisoning** (DSP) is generally associated with the consumption of molluscan shellfish, but here has been no documented occurrence to date in the U.S. However, instances have been documented in Japan, Southeast Asia, Scandinavia, Western Europe, Chile, New Zealand, and eastern Canada. **Amnesic shellfish poisoning**(ASP) is generally associated with the consumption of molluscan shellfish from the northeast and northwest coasts of North America. It has not yet been a problem in the Gulf of Mexico, although the algae that produce the toxin have been found there. ASP toxin has recently been identified in the viscera of Dungeness crab, tanner crab, red rock crab, and anchovies along the west coast of the United States.

Fish Toxins

Fish toxins can be caused either by naturally occurring marine algae or can be associated with unique characteristics in certain species of fish. However, the most common type of intoxication caused by fish in the U.S. is actually caused when certain types of fish are subjected to temperature abuse which allows naturally occurring spoilage bacteria to produce metabolic products that create high levels of histamine. The following information on the fish toxins that are most likely to be encountered in the U.S. is adapted from the FDA Fish and Fishery Products Hazards and Controls Guide.

Ciguatera fish poisoning is caused by the consumption of fish that have eaten toxic marine algae directly or have eaten other toxin-contaminated fish. Ciguatera toxin(s) can accumulate in the flesh of predator

species of reef dwelling fish. Not all fish within a given reef or common catch are equally contaminated; fish caught side by side may have widely differing contamination levels. Ciguatera is common in tropical and subtropical areas of the South Atlantic Ocean, the Caribbean Sea, the South Pacific Ocean, and the Indian Ocean. In the south Florida, Bahamian, and Caribbean regions, and certain parts of the northern Gulf of Mexico barracuda, amberjack, horse-eye jack, black jack, and other large species of jack, king mackerel, large groupers, and snappers are particularly likely to contain ciguatoxin. Many other species of large fish-eating fishes may be suspect. In Hawaii and throughout the central Pacific, barracuda, amberjack, and snapper are frequently ciguatoxic, and many other species both large and small are suspect. Mackerel and barracuda are frequently ciguatoxic from mid to northeastern Australian waters.

There are naturally occurring toxins in some species that do not involve marine algae. Escolar or oilfish contains strong purgative oil called **gempylotoxin** that may cause diarrhea when consumed. FDA advises against importation and interstate marketing of these fish. Puffer fish, or fugu, may contain **tetrodotoxin**. Poisonings from tetrodotoxin have usually been associated with the consumption of puffer fish from waters of the Indo-Pacific ocean regions. However, several reported cases of poisonings, including fatalities, involved puffer fish from the Atlantic Ocean, Gulf of Mexico, and Gulf of California. There have been no confirmed cases of poisonings from northern Atlantic puffer fish but there is still reason for concern. **Tetramine** is a toxin that is found in the salivary glands of a type of whelk. The hazard can be controlled by removing the glands.

Scombrotoxin (Histamine)

Scombrotoxin formation which is caused by time/temperature abuse of certain species of fish can cause consumer illness. The illness is most closely linked to the development of histamine in these fish, but there is some evidence that other chemicals (e.g. biogenic amines, such as putrescine and cadaverine) may also play a role in the illness. Scombroid poisonings have primarily been associated with the consumption of tuna, mahi mahi, and bluefish. However, a number of other species such as bluefish, mackerel, herring, amberjack and other jacks, and marlin are also capable of developing elevated levels of histamine when temperature abused. 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. 70°F [21.1°C]) than at moderate-abuse temperatures (e.g. 45°F [7.2°C]). Growth is particularly rapid at temperatures near 90°F (32.2°C). Histamine is more commonly the result of high temperature spoilage than of long term, relatively low temperature spoilage. Nonetheless, there are a number of opportunities for histamine to form under more moderate abuse temperature conditions.

Tips to Minimize Risk

The following tips can help reduce potential risks associated with fish and shellfish toxins.

Buy clams, oysters, and mussels from a reputable dealer.

Use caution if you harvest bivalve shellfish or tropical reef fish yourself. Obey posted warnings and check with local authorities to verify that the waters are certified for fish or shellfish harvesting before you harvest them or decide to eat them.

Handle fish properly. Keep seafood below 40°F at all times using ice or adequate refrigeration. This is especially important for species like tuna, mackerel, bluefish, mahi-mahi, jacks, herring and marline whether you purchase them or catch them yourself.

Resources for Health Educators and Consumers

Seafood Network Information Center - Seafood Safety. *This resource from the University of California at Davis provides information on seafood safety hazards including toxins. Click here to visit this site [2].*

Food and Drug Administration - Fresh and Frozen Seafood: Selecting and Serving it Safely. Fact sheet of information from FDA on selecting and handling seafood safety. To view this resource click here [3].

University of Delaware Sea Grant - A Consumer's Guide to Safe Seafood Handling. This 12 page consumer publication provides tips on selecting, selecting, handling and storing seafood safely. To see a PDF

version of this publication click here [4].

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