Ciguatera & Lionfish

What is ciguatera, and where does it come from?

Ciguatera is a toxin responsible for the food-borne illness, Ciguatera Fish Poisoning (CFP). It is produced primarily by microscopic dinoflagellates (free-living, single-celled organisms) of the genus Gambierdiscus (1).

Gambierdiscus live in shallow tropical and subtropical waters, where they associate with macroalgae (1), dead coral (2) and sand (3). They thrive in the same conditions as coral, and so the distributions of coral reefs and Gambierdiscus overlap (4,5).

Occasionally, Gambierdiscus densities suddenly increase to 1000 or more cells per gram of algae, increasing the risk of CFP (6,7). These blooms are most likely caused by anthropogenic and natural conditions that promote algal growth, such as elevated sea surface temperature, nutrient runoff, dredging and other disturbance events (7–10).

When herbivorous fish eat algae, they also inadvertently eat Gambierdiscus and the ciguatera toxin, which is stored in their flesh and never excreted. These smaller herbivorous fish are, in turn, eaten by larger predatory fish, and so the ciguatera toxin is passed up the food chain in a process known as bioaccumulation (11).

Ciguatera does not affect a fish’s health, smell, appearance, or taste (12).

Over four hundred species of fish have been found to contain ciguatera, from a wide range of families and locations. Barracuda, snapper, grouper, parrotfish, wrasse, surgeonfish, jacks, mackerel, anchovy, and moray eels are all listed as potential carriers of ciguatera in the USA Food and Drug Administration’s (FDA) Fish and Fishery Products Hazards and Controls Guidance (13).

As a relatively recent addition to American menus, lionfish was added to this list in an official guidance on ciguatera in November 2013 (11).

What happens if a human eats ciguatera?

If a person eats a fish with unsafe levels of ciguatera, they are susceptible to falling ill with CFP. FDA guidelines for ciguatera toxicity in fish is 0.1ppb, which includes a ten-fold safety factor.

CFP is a particularly nasty type of illness with a wide range of symptoms, from ‘typical’ food poisoning symptoms such as vomiting and diarrhoea, to severe cardiovascular and neurological symptoms, such as numbness, dizziness, muscle pain, and temperature sensation reversal. Symptoms usually occur six hours after consumption of a fish with unsafe levels of ciguatera toxins, and whilst usually lasting only a few days, some have reported neurological symptoms lasting years. Very rarely (in less than 1% of cases) CFP leads to death (11,13).

Global distribution and prevalence of CFP – Red indicates high-risk areas, yellow indicates moderate-risk, green indicates potential risk areas with no documented cases, and white areas have no potential risk (15).
How can I avoid getting CFP?

Unfortunately, there is no way of detecting ciguatera in fish without complicated, time-consuming, expensive scientific investigation, ranging from mass spectrometry to mouse assay (14).

As a result, it is not feasible for seafood distributors and restaurants to test every fish sold. Instead, it is recommended that distributors and restaurants do not source their seafood from high-risk areas, such as the north-eastern Caribbean and Flower Garden Banks in the Gulf of Mexico (11).

Consumers should be aware, however, that eating any finfish from anywhere with tropical or subtropical coral reefs does come with an associated risk of CFP.

Are lionfish more likely to have ciguatera than other fish?

There is no reason to believe that lionfish are more likely to have ciguatera than other fish, but in order to accurately answer that question, scientists first need to determine how prevalent ciguatera is in other fish.

Some groups from high-risk ciguatera areas have already conducted ciguatera tests on lionfish samples; Bernard Castillo from the US Virgin Islands found 3 out of 27 lionfish in St. Croix had ciguatera levels detectable above FDA guidance (pers. comms). Nicholas Diaz from the French West Indies found ciguatera toxicity to be highly dependent upon location, with almost half testing positive from St. Barthélemy, and none from St. Martin or Guadeloupe (pers. comms).

However, test results may be complicated by the relatively recent discovery by Christie Wilcox that lionfish venom might interfere with traditional methods for detecting ciguatera, providing a positive result where one doesn’t truly exist (pers. comms).

In a statement released in January 2013, and repeated during her presentation at the lionfish session at the 66th GCFI Conference in Texas, Dr. Pat Tester (NOAA) said that, “[to date] there have been no reports of ciguatera fish poisoning from eating lionfish.”

This does not mean that it is impossible for lionfish to carry ciguatera, but it does indicate that lionfish are at least as safe to eat as other reef fish.

References