CIGUATERA

Is That Beaut (Colour) Fish Safe To Eat ?

In this special review of ciguatera tropical fish poisoning, recently retired marine scientist from JCU (in Townsville) Dr David Hopley, examines in some depth the probable causes and possible common sense solutions to the vexing issue of making sure the fish fillets we bring back to our families with pride for dinner - are in fact safe to eat. As with so many of these contentious issues, there is no hard and fast solution, but as David explains, there are steps we can take to minimise our exposure to likely contaminated fish species . . . .

About 20 years ago after driving back to Townsville from Cairns, I started to feel nauseous and within half an hour was suffering severe vomiting and diarrhoea which went on throughout the night.

The next day my GP gave me an injection to limit the amount of dehydration I was suffering and, based on other symptoms such as a tingling in my lips, muscle pains and heat sensitivity reversal, diagnosed the problem as tropical fish poisoning, or ciguatera. The cause was a fish meal in Cairns the night before, the culprit fish being Spanish Mackerel. Some of the symptoms lasted more than a week.

Subsequently I have had a return of much less severe symptoms after eating various species of tropical fish even when companions eating the same fish have not experienced any ill effects.

This is typical of ciguatera which is estimated to affect up to 60,000 people worldwide annually. Several hundred people in Queensland are reported with ciguatera poisoning each year. This is not a newly discovered illness but has affected Pacific Islanders for centuries. One of the first recordings in western literature was by Captain James Cook in 1774 whilst in Vanuatu after he ate Red Bass. Subsequently, reports have come from tropical coasts throughout the world. Enigmatically, the word 'ciguatera' is a Spanish word for a Caribbean snail which may have caused some kind of poisoning but in all probability not ciguatera.

Graham Bell red bass pic

Symptoms of Ciguatera

The symptoms depend on the amount of toxic flesh eaten. Typically the first symptoms such as sweating and tingling of the fingers and mouth, occur 2 to 24 hours after eating followed by severe diarrhoea and vomiting. There may be associated muscular aches especially in the legs and back, swollen hands and itching of the skin. Stiffness of the joints may resemble or intensify existing arthritis. A very common occurrence is temperature sensory reversal by which cold items feel hot and hot ones cold. All these symptoms are intensified by alcohol.

In the most severe cases there may be muscular paralysis, reduction in blood pressure and respiratory problems. Although the death rate worldwide is reported as high as 10% it varies greatly with location and in Australia is very low with possibly only one death recorded in Queensland. Numerous deaths have been recorded in some Pacific Islands and there is a historical record of 1500 military personnel dying during the British naval expedition against Mauritius in 1748.

Typically symptoms last about 8 days, but in more severe cases last weeks or

months. No immunity is developed after the attack and in fact only minute doses of the poison can cause relapses.

What Is The Cause?

The ciguatoxin is a neurotoxin produced naturally by plants called dinoflagellates, the most probable species being Gambierdiscus toxicus. It is a tiny single cell organism which lives on and within the seaweeds of coral reefs and rocky shores. A particular host may be the seaweed Turbinaria sometimes called 'Spiny Tops".

Concentration of the toxin occurs up the food chain. Herbivorous fish eat the algae and these in turn are eaten by larger fish. The poison becomes more concentrated up the chain so that the most likely to have significant amounts are the larger pelagic predators. The toxin may be found throughout infected fish but is especially concentrated in the viscera especially the liver.

Over 400 species of fish have been associated with ciguatera. These obviously vary geographically and according to what species may be harvested. For example, on Pacific islands smaller reef species such as Surgeonfish, Unicorn Fish and smaller Bat Fish may be taken by the local inhabitants but are rarely kept in Australia so are not normally associated with ciguatera. At the top of the list here are Red Bass, Chinaman and Barracuda although individuals of even these species may not contain ciguatoxin. The larger the fish the more possible the danger.

Unfortunately, many of our best table fish may also accumulate ciguatoxin on some occasions. For example, a few years ago

Above: Gulf of Mannar, India. In many undeveloped countries, even very small fish are caught and eaten meaning that species not normally associated with ciguatera in Australia, do actually cause poisoning. These fish being displayed for sale, are from the reefs of the Gulf of Mannar in southern India.

Below: Male Fish Markets, Maldives. Fish for sale in the Male fish market in the Maldives, include species which would be avoided in Australia, such as Chinaman and Red Bass. However, the absence of the small din flagellate which reduces the poison can allow these fish to be eaten.

the Surf Life Saving Association reported that Coral Trout accounted for about 60% of the cases reported in Townsville with other species being large Cod, Wrasse (including the Hump Head or Napolean Wrasse), Mackerel and Red Emporer. Again, the larger the fish (over 6kg) the greater the chance but the fact that these fish are eaten regularly indicates that the risk is very low. Nonetheless, it is still there.

Where and When?

Even more confounding than the occasional occurrence of ciguatoxin in some fish is the fact that phenomenon can vary with time and place. There may be instances of ciguatoxin fish being found on one side of an island and not on the other, even in the case of the same species. Reef fish from Western Australia are reported as being far less likely to contain ciguatoxin than those from the Great Barrier Reef. This geographic variability is not really surprising when it is remembered that accumulation depends on the occurrence of the small organism at the bottom of the food chain, and the feeding habits of reef fish, both of which will vary with environmental factors. The abundance of the small alga may also vary with time with "blooms" at particular times of the year and ciguatera poisoning becoming more frequent in subsequent months. For some reason Mackerel caught around mid October in the Cairns area have been reported as particularly risky.

A number of years ago, major disturbances to coral reefs caused by Crown of Thorns Starfish or cyclones were thought to have increased the incidences of ciguatera as damaged reefs often became overgrown by algae, but this is still to be confirmed.

Prevention

The enigmatic occurrence of ciguatera has made it very difficult to identify and to avoid. No amount of cooking, marinating or soaking in water will remove the toxin and tropical fish containing ciguatoxins look, smell and taste normal. Long-recommended preventative measured have included:

- Do not eat the most suspect species such as Chinaman and Red Bass
- Keep away from larger specimens of reef fish
- Never eat the internal organs, especially the liver and gonads of reef fish
- Try to avoid eating successive meals from the same fish
- Try to avoid eating the same species frequently
- If in doubt, stick to estuarine fish such as

barramundi, flathead, whiting and bream – *but you are going to miss out on some superb fish meals!*

Myths

Because of the uncertainties, many myths exist about ciguatera poisoning. Probably the best known is to feed a piece of suspect fish to your (or your neighbours!) cat. In some countries the test animal is the mongoose.

Although extremely toxic fish may cause illness, death or strange behaviour in animals there is no guarantee as the physiology of animals is very different to that of humans and levels which can be very poisonous to humans may have no effect on other animals.

Similarly, seeing if a piece of fish, especially the liver, causes tingling to lips is equally unsure and even if it works may only apply to major accumulation of ciguatoxin. Other myths include the tarnishing of copper or silver against the flesh of ciguatoxic fish. In Pacific Islands it has been suggested that cooking ciguatoxic fish in coconut milk may reduce the effect, or grated coconut may turn green when placed against the flesh. Another tradition is using the root of the pandanus tree as an antidote. Research studies have found no foundation for these traditional methods.

Treatment

If symptoms occur medical aid should be immediately sought. No anti toxin or specific treatment is available and stomach pumping may do no good if the fish meal has been consumed hours earlier. In severe cases basic first aid which keeps the airways clear and monitors essential functions such as heartbeat and circulation are recommended. Maintenance of hydration (keeping up liquid levels) is also necessary. Some relief of symptoms has been reported from calcium based medicines, mannitol and atropine and long term joint stiffness may be relieved with anti inflammatory medicines.

Identification

Had this article been written only a few years ago, the field identification of ciguatoxin affected fish would have been totally impossible. Complex laboratory methods could identify the toxin and there was a method of establishing the toxicity of suspect fish through a mouse bioassay test (a bit more complex and scientific than using the family moggie!). Now, as the result of research carried out by the University of Hawaii a relatively inexpensive and easy to use test kit for ciguatera fish poison is available.

The kit, called **Cigua-Check®** can detect ciguatoxin in fish generally below the levels that can cause clinical symptoms in humans. The method uses the monoclonal antibody to ciguatoxin and involves the application of a membrane stick which changes colour when in contact with the toxin. With over 12,000 tests performed there has yet to be a confirmed report of poisoning after a negative result. A few results which have falsely indicated the presence of the toxin have occurred but this is intentional as the test kit has been designed to detect very low levels and may be sensitive to molecules of a similar structure. Each kit contains 3 tests and costs US$24.99 + postage and handling. The shelf life is 6 months.

There is currently no Australian dealer for the **Cigua-Check® Kit** but further details can be obtained from **ToxiTec Inc.** 1001 Bishop Street, Pacific Tower, suite 2970, Honolulu, Hawaii 96813, USA. Email: **cigua@oceanit.com** or visit the company web page at www.cigua.com

The Future

Ciguateratoxin is on the rise globally, thought to be caused by a combination of reef disturbance and global warming. These are considered to cause an increase in the numbers of the dinoflagellate that is responsible. Global warming over the next century may see it extending further poleward and perhaps affecting subtropical and even temperate species. Ciguatera is also more widespread because of the increased international trade in reef fish. It is not surprising to find therefore that research into fish poisoning is increasing and further beneficial results should become available in future years.

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