

Preliminary Results: Screening of Ciguatera Toxins Found in Indo-Pacific Lionfish (*Pterois volitans*) in St. Croix, US Virgin Islands

Resultados Preliminares de la Detección de Ciguatoxinas en el Pez León del Indopacífico (*Pterois volitans*) que Habita St. Croix (Islas Vírgenes Estadounidenses)

Résultats Préliminaires : Examen des Toxines Ciguateriques Trouvées dans des Poisson-Lions de L'indo-Pacifique (*Pterois volitans*) À Sainte-Croix, Iles Vierges Américaines

BERNARD CASTILLO^{1*}, KYNOCH REALE-MUNROE¹,
ALISON ROBERTSON², and JOHN RUBATTINO³

¹University of the Virgin Islands RRI Box 10000 Kingshill, St. Croix 00850 US Virgin Islands.

*bcastil@live.uvi.edu. ²Dauphin Island Sea Laboratory, Dauphin Island, Alabama 36528 USA.

³CORE Foundation, Charlotte, Amalie 00802 US Virgin Islands.

ABSTRACT

Ciguatera fish poisoning (CFP) is a food borne illness caused by the consumption of fish that contain ciguatera toxins (CTXs). Typically, ciguatera fish poisoning symptoms include gastrointestinal and neurological effects. Ciguatera toxins are secondary metabolites that are produced by marine dinoflagellates, more specifically, of the genus *Gambierdiscus*. Local government agencies and environmental groups have encouraged the consumption of the invasive Indo-Pacific lionfish (*Pterois volitans*) whose white flesh tastes similar to a snapper or grouper. Our preliminary results showed that 40% (n=20) of the lionfish tested from the west end of St. Croix indicated the presence of CTX in their tissue. Results also showed that 15% of the tissue samples had levels above the 0.1 ppb FDA guidance for consumption.

KEY WORDS: Lionfish, St. Croix, USVI, ciguatera, Virgin Islands

INTRODUCTION

Ciguatera fish poisoning is a food borne illness caused by the consumption of fish that contain ciguatera toxins (CTXs). About 400 species (or more) of tropical and subtropical coral reef fish accumulate the toxin in their flesh and viscera (Wong, et al. 2005). Typically, ciguatera fish poisoning symptoms include gastrointestinal and neurological effects. Ciguatera toxins are secondary metabolites that are produced by marine dinoflagellates, more specifically, of the genus *Gambierdiscus*. The CTXs are transmitted through metabolic processes and transferred up the food chain (Caillaud et al. 2010). The toxins are first accumulated by herbivorous fish, which are then consumed by larger carnivorous fish and finally by humans (Lewis and Holmes 1993). It takes approximately 0.1 ppb of CTXs to pose a threat to human health (Pierce and Kirkpatrick 2001). Globally, estimates of 50,000 people are affected annually by CTXs (Daranas, et al. 2001 and Sumner, et al. 2004). Ciguatera fish poisoning is present in the Caribbean (Vernoux and Lewis 1997). As a way to control the lionfish population, lionfish derbies and bounties are very popular in some areas in the Western Atlantic and the Bahamas. Local government agencies and environmental groups have encouraged the consumption of lionfish whose white flesh tastes similar to a snapper or grouper. The FDA has reported levels of ciguatera in several lionfish collected from waters surrounding St. Thomas, that were above the current guidance levels for CTXs. The current FDA guidance for Caribbean CTXs is 0.1 ppb.

METHODS

Scuba divers collected the lionfish using a pole spear or a detuned spear gun. The speared lionfish were immediately euthanized underwater by cervical vertebrae dislocation with a dive knife. Fish were transferred then stored in collection bags during the remainder of the dive. Upon returning to the surface, the lionfish were transferred to ice immediately. Fish were frozen at -20°C before they were shipped to US FDA Dauphin Island Laboratory for CTX toxin analysis. The samples were tested using neuroblastoma cytotoxicity assay (N2a assay) for composite toxicity assessment, which was followed by liquid chromatography tandem mass spectrometry (LC-MS/MS) to confirm the presence of the CTX.

RESULTS

Twenty lionfish samples were sent to FDA Dauphin Island Marine Laboratory for CTX analysis. The samples were removed from St. Croix, US Virgin Islands, mainly from the western side of the island between January - June 2011. The lionfish size ranged from 200 - 240 mm in total length and 113 - 227 g in weight. The lionfish were collected primarily between 12 - 24 m in depth and on gently sloping, continuous reef habitat. Results showed that 40% of the samples tested (n = 20) had detectable levels of CTX, with a mean concentration of 0.07 ppb and maximum of 0.15 ppb. Results also showed that 15% of the tissue samples had levels above the FDA guidance for consumption (0.1 ppb) that ranged from 0.11 - 0.15

ppb. We are continuing to collect tissue samples from other areas around St. Croix and have expanded the sample ranges to include St. John, St. Thomas, US Virgin Islands and the British Virgin Islands.

CONCLUSIONS

This is the first study that quantifies the concentration of CTX in lionfish collected from the waters of St. Croix, US Virgin Islands. To date, we are not aware of reports of ciguatera fish poisoning associated with the consumption of lionfish in U.S. Virgin Islands. However, the results of this study show a 40% prevalence rate of CTX found in the tissue of lionfish collected from waters of St. Croix, which potentially poses a human health risk.

LITERATURE CITED

- Caillaud, A., P. De la Iglesia, H.T. Darius, S. Pauillac, K. Aligizaki, S. Fraga, M. Chinain, and J. Diogene. 2010. Update on methodologies available for ciguatoxin determination: perspectives to confront the onset of ciguatera fish poisoning in Europe. *Marine Drugs* **8**:1838-1907.
- Daranas, A.H., M. Norte, and J.J. Fernández. 2001. Toxic marine microalgae. *Toxicon* **39**:1101-1132.
- Lewis, R.J. and J.M. Holmes. 1993. Origin and transfer of toxins involved in ciguatera. *Comparative Biology and Physiology* **106C**:615-628.
- Pierce, R.H. and G.J. Kirkpatrick. 2001. Innovative techniques for harmful algal toxin analysis. *Environmental Toxicology and Chemistry* **20**:107-114.
- Sumner, J., T. Ross, and L. Ababouch. 2004. Application of Risk Assessment in the Fish Industry, FAO Fisheries Technical Paper 442. Food and Agriculture Organization of the United Nations, Rome, Italy.
- Vernoux, J. and R. Lewis. 1997. Isolation and characterization of Caribbean ciguatoxins from the horse-eye jack (*Caranx latus*). *Toxicon* **35**:889-900.
- Wong, C.K., P. Hung, K.L.H. Lee, and K.M. Kam. 2005. Study of an outbreak of ciguatera fish poisoning in Hong Kong. *Toxicon* **246**:563-571.