Journal of
Dairy & Veterinary Sciences
ISSN: 2573-2196

Juniper Publishers
key to the Researchers

Mini Review
Volume 13 Issue 4- August 2019
DOI: 10.19080/JDVS.2019.13.555866

Dairy and Vet Sci J

Heavy Metal Bioaccumulation by Cestode Parasites of *Mustelus Schmitti* (Chondrichthyes: Carcharhiniformes), from the Bahía Blanca Estuary, Argentina

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Submission: August 29, 2019**; Published:** September 06, 2019

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Abstract

The environment of the Bahía Blanca estuary is considered a hot spot in terms of pollution. Bioindicators should have the ability to react relatively fast to certain pollutants and environmental disturbances. Therefore, an exploratory study was carried out determining and quantifying the concentrations of cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb) and zinc (Zn) in the muscle and liver of *Mustelus schmitti* narrownose smooth-hound and were compared with the values obtained from their respective helminth assemblies. In most of the fishes analyzed, the concentration of heavy metals was higher in the infra communities of cestodes compared to the host. Our results position the cestodes as efficient sentinel species of pollution by bioaccumulating higher concentrations of heavy metals than the host tissues, thus behaving in excellent early warnings of environmental pollution, more real than quantifications in sediments, in water and fish.

Keywords: Heavy metals; Bioaccumulation; Sentinels parasites

Introduction

The estuary of Bahía Blanca (39° 03′44 ″ S 62° 04′00 ″ W) is an adequate environment to develop pollution studies, considering that it is an area that includes urban centers, several industrial parks and deep-water ports. All the effluents are discharged with different degrees of pretreatment, so they generate different impacts on the ecosystem. In environmental monitoring to detect heavy metals, organisms are often used as bioindicators, which have the ability to react relatively fast to certain toxic products and environmental disturbances. Some of these organisms, such as parasites, may be highly sensitive to brief exposures, poorly detected in water, sediment or fish [1-5]. Our previous studies in the estuary have focused on evaluating the parasitism of fish in the time scale to be able to compare and analyze them as effect indicators altering some parasites population parameter such as prevalence and abundance or causing symptoms in their hosts in response to environmental disturbances [6-10]. The narrownose smooth-hound *Mustelus schmitti* Springer, 1939 is a resident fish of the estuary of Bahía Blanca and third in importance as a fishing resource. Based on the fact that some parasites, such as cestodes, have the ability to absorb and accumulate more chemicals than their host tissues [11].

The objective of the present study was to analyze whether a higher concentration of metals in the parasites respect to their host was applicable in the cestodes- narrownose smooth-hound model and to evaluate if these helminths possess ecotoxicological value and could be used in the study area as early bioindicators of anthropic impact. Therefore, an exploratory study was carried out in order to determine and quantify the cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb) and zinc (Zn) concentrations in the muscle and liver of the narrownose smooth-hound and compared with the values obtained from their respective cestode assemblages (*Dollfusiella* sp., *Orygmatobothrium schmittii*, *Calliobothrium australis* and *Symcallio* sp.) The samples were analyzed by Inductive Coupling Plasma Atomic Emission Spectrometer (ICP-AES, LANAQUI-CERZOS-CONICET-UNS). The values were compared with the limit values allowed by the European Union for fish meat.

Results and Discussion

In most of the fishes analyzed, the concentration of heavy metals was higher in the infra communities of cestodes compared to each host. The parasites concentrated 270 times more Cadmium than the fish muscle. For this metal, the standards established in

the liver and those of the parasites were exceeding the limits established by the European Union for muscle or liver. Chromium was bioconcentrated in the cestodes two times more than the muscle and six times more than the liver. Copper was accumulated with values 65 times more than muscle and up to four times more than in the liver. Lead had values 48 times more in helminths than both muscle and liver of fishes. For this metal in most dosages, the concentration measured in parasites exceeded the limit value established by the European Union. Zinc bioaccumulated in parasites seven times more than muscle and four times more than liver. Only in one case the Zinc concentration was three times higher in the liver than in parasites.

The environment of the Bahía Blanca estuary is considered a hot spot in terms of pollution and is included among the most eutrophic coastal ecosystems known [12]. Also, since many years it have been reported high concentrations of heavy metals and pesticides in water and sediments [13,14]. The combined effect of these pollutants, plus the sewage discharge, the industrial effluents of petrochemical origins, and the overheated water from a thermoelectric power station (620MW) all of them represent a growing threat to the environment. These increase in anthropogenic activity around estuaries, coupled with the persistence of heavy metals, their high toxicity, strong tendency to bioaccumulate, and non-degradability [15], usually affect water. As negative effects it could change the trofic web in the aquatic fauna, eliminate the spawning and larval recruitment sites and a potential decrease in diversity, affecting all the ecosystem [16,17]. That is why the need to choose of efficient bioindicators in the evaluation of the quality of the environment [18].

Conclusion

The estuary of Bahía Blanca is one of the most important in Argentina, having the main deep-water port system in the country. Although fish species can be used as efficient and useful bioindicators, our results position cestodes parasites as sentinel species of contamination for the fact that reported higher concentrations of heavy metals than their hosts. This would avoid possible underestimations in pollution levels by being quantified only in sediments, in water and in fish.

Conflict of Interest

The authors declare that no economic or other interest conflict exist.

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How to cite this article: Tammone Santos A, Schwerdt C, Tanzola R, Guagliardo S. Heavy Metal Bioaccumulation by Cestode Parasites of *Mustelus Schmitti* (Chondrichthyes: Carcharhiniformes), from the Bahía Blanca Estuary, Argentina. Dairy and Vet Sci J. 2019; 13(3): 555866.
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