

Heavy Metal Determination of Bivalves in Cagayan Valley, Philippines

Jitty Raju*, Jobin Johnson, Akshay Jeevan, and Julius T. Capili

Cagayan State University, Tuguegarao City, Cagayan, Philippines

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*Corresponding author: Jitty Raju

Abstract

Original Research Article

Level of heavy metals like Cadmium (Cd) and Lead (Pb) in bivalves has been intensively studied during recent years as these hazardous substances could be accumulated in the biota and has been a hot issue in marine environmental studies. By consuming the shellfish, risk of bivalve related diseases may increase. And this shellfish poisoning is a concern to public health. This research study aims to determine if the Bivalves in Cagayan Valley, Philippines is safe to consume. The Freshwater clam (*Corbicula fluminea*) and the Marine mussel (*Mytilus edulis*) in Cagayan Valley, Philippines was collected for this study. The byssus and shells were removed, leaving only soft tissues to be used for the analysis and they were categorized into two. Graphite Furnace- Atomic Absorption Spectrophotometer (GFAAS) was used to determine the concentrations of Cadmium (Cd) and Lead (Pb). The results showed that the Freshwater bivalves *Corbicula fluminea* has a concentration 0.006 $\mu\text{g/g}$ of Lead (Pb) and a concentration 0.016 $\mu\text{g/g}$ of Cadmium (Cd) while for Marine bivalves *Mytilus edulis*, the concentration of Pb was 0.011 $\mu\text{g/g}$ and the concentration of Cd levels was 0.015 $\mu\text{g/g}$. The test results showed that the heavy metals, lead, and cadmium, were at low levels when referred to guidelines on heavy metals for food safety by different countries, particularly Malaysia. Thus, the results that were found were quite lower and there are no health risks to the people when consuming these bivalves collected from the province of Cagayan. Based on the results of the study conducted, the researchers recommend using different bivalve species to know the levels of heavy metals on bivalve species, investigate lead and cadmium heavy metals concentrations of one species collected in different areas/locations in Cagayan Valley and investigate the lead and cadmium heavy metal concentration of different bivalves in a regular basis i.e., monthly, or quarterly for at least 1 year.

Keywords: Heavy metals, Bivalves, Cagayan, *Corbicula fluminea*, *Mytilus edulis*, Cadmium, Lead, Graphite Furnace-Atomic Absorption Spectrophotometer.

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INTRODUCTION

Bivalve mollusks such as clams, oyster, and cockles are found on the mangrove mudflats and intertidal sandy beaches and are well-known accumulator of heavy metals and have been widely used as bioindicator for monitoring heavy metal pollution in aquatic environment. These animals ingest metal-enriched particles directly, thereby giving an indication of the bioaccumulation ability of metals. The increased in anthropogenic activities contribute to the accumulation of hazardous chemicals, such as heavy metals, in the environment.

There is very little documented information available about the metal contents specifically Cadmium (Cd) and Lead (Pb) in Freshwater clam (*Corbicula fluminea*) and in the Marine mussel (*Mytilus edulis*) despite the popularity as a source of food in Cagayan. Thus, it is very necessary to study about edible mollusks and with the aim of the present study which in to assess

the heavy metal such as Cd (Cadmium) and Pb (Lead) accumulation in the body of bivalves.

This research will help people to understand the level of heavy metals accumulation in the edible bivalves. Thereby educating people about the high metal toxicity accumulation. The result of the study will help the community to be aware of the possible harmful effects of heavy metals when, that can cause diseases and intoxication in humans due to the consumption of marine bivalves and freshwater bivalves.

MATERIALS AND METHODS

A. Collection Of Mollusks

Freshwater clam (*Corbicula fluminea*) and Marine mussel (*Mytilus edulis*) collected from Cagayan sites by the help of Bureau of Fisheries and Aquatic Resources (BFAR) Region 02, Tuguegarao, Cagayan. The bivalves were kept in a customized cage under controlled conditions. The permit for conducting

experiments on the freshwater and marine bivalves were obtained from the Bureau of Fisheries and Aquatic Resources (BFAR) Region 02, Tuguegarao, Cagayan 3500.

B. Processing and Analysis

All samples are weighed and dissected at the Department of Science and Technology (DOST) Lab, Region 02. The byssus and shells were removed, leaving only soft tissues to be used for the analysis and they were categorized into two labelled glass bottles. Then the tissues were washed and drained. The tissues are

weighed and homogenized in a blender. The homogenized samples are weighed and frozen. Approximately 1 gram of samples are dried and added to digestion tube. 10 ml of 65% nitric acid is added to each test tube and allowed to predigest. The tubes were placed in a digestion block and heated about 130⁰ C and a clear solution will be obtained. 10 ml of 65% nitric acid is again added to prevent charring. The solution is filtered and diluted to 25 ml, deionized, and stored at 4°C. Later the Cadmium (Cd) and Lead (Pb) concentrations were determined by a Graphite Furnace- Atomic Absorption Spectrophotometer (GFAAS).

Figure 1: Study of Heavy Metals Found in Bivalves in various countries [1]

COUNTRY	Cd($\mu\text{g/g}$)	Cu ($\mu\text{g/g}$)	Pb ($\mu\text{g/g}$)	Zn($\mu\text{g/g}$)
Malaysian Food Regulation (1985)	1.00	30.00	2.00	100.00
International Council for the Exploration of the Seas(1988)	1.80	----	3.00	----
Brazilian Ministry of Health (ABIA, 1991)	5.00	150	10.0	250
Ministry of Public Health, Thailand(MPHT, 1986)	----	133	6.67	667.00
Food and Drug Administration of the United States (USFDA, 1990)	25.0	-----	11.50	----
Australian Legal Requirements for Food Safety (NHMRC, 1987)	10.00	350	----	750
Hong Kong Environmental Protection Department (1997)	2.00	----	6.00	----

RESULTS

This chapter discusses the results of the lead and cadmium analysis in the two different species samples collected from Cagayan.

The results obtained from the collected specimen by Graphite Furnace-Atomic Absorption Spectrophotometer (GFAAS) method is as follows:

Table 2: Concentration of Heavy metals of different Bivalves

SAMPLE DESCRIPTION	PARAMETER	RESULT ($\mu\text{g/g}$ dry weight)
<i>Corbiculla fluminea</i>	Lead	0.006
	Cadmium	0.016
<i>Mytilus edulis</i>	Lead	0.011
	Cadmium	0.015

DISCUSSION

The table shows concentration of heavy metals in the Freshwater bivalves *Corbiculla fluminea* the concentration of Lead (Pb) was 0.006 $\mu\text{g/g}$. And the concentration of Cadmium (Cd) was 0.016 $\mu\text{g/g}$. For Marine bivalves *Mytilus edulis* the concentration of Pb was 0.011 $\mu\text{g/g}$. And the concentration of Cd levels was 0.015 $\mu\text{g/g}$. For the marine bivalves *Mytilus edulis* the concentration of Pb was less than <0.1 $\mu\text{g/g}$. And the concentration of Cd was also less than <0.1 $\mu\text{g/g}$. The same goes for freshwater bivalves *Corbiculla fluminea*.

The lead and cadmium levels were also less than <0.1 $\mu\text{g/g}$.

The test results showed that the heavy metals, lead, and cadmium, were at low levels when referred to guidelines on heavy metals for food safety by different countries, particularly Malaysia where the heavy metal levels set by the food regulation for Pb, and Cd were 1.00 $\mu\text{g/g}$ and 2.00 $\mu\text{g/g}$ respectively. This implies that the results that were found were quite lower as compared to Malaysia and other Asian countries. Thus, there are no health risks to the people when consuming these bivalves

collected from the province of Cagayan. And the area can also be noted as safe or low pollution level of Pb and Cd.

CONCLUSION

In this study, it was found that the heavy metals, Cadmium (Cd) and Lead (Pb) in the bivalves, Freshwater clam (*Corbicula fluminea*) and Marine mussel (*Mytilus edulis*) collected in the province of Cagayan, has no health risks to the people when consuming it. The results revealed that the freshwater bivalve *Corbicula fluminea* has a 0.006 µg/g concentration of Pb and 0.016 µg/g concentration of Cd, while for the marine bivalves *Mytilus edulis*, the concentration of Pb level was 0.011 µg/g and concentration of Cd level was 0.015 µg/g. Both results were at low levels when referred to guidelines on heavy metals for food safety by different countries, particularly Malaysia where the heavy metal levels set by the food regulation for Pb, and Cd were 1.00 µg/g and 2.00 µg/g respectively.

RECOMMENDATIONS

Based on the results of the study conducted, the researchers recommend the following:

1. Research studies should be conducted using different bivalve species to know the levels of heavy metals on bivalve species.
2. Studies should investigate lead and cadmium heavy metals concentrations of one species collected in different areas/locations in Cagayan Valley.
3. Studies should investigate the lead and cadmium heavy metal concentration of different bivalves in a regular basis i.e., monthly, or quarterly for at least 1 year.

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