HEAVY METALS CONCENTRATIONS IN TISSUES OF *Egeria radiata* FROM CREEKS IN BURUTU SOUTH LOCAL GOVERNMENT AREA OF DELTA STATE, NIGERIA

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ABSTRACT

An experiment was conducted to evaluate the levels of heavy metals concentrations in tissues of Egeria radiata from Obotobe and Gbekobor Creeks in Burutu Local Government Area were investigated. The samples were collected fortnightly for 12 months in 2008. The soft tissues were extracted, weighed and dried in oven for 3 days at constant temperature. Ten grams of the dried samples were homogenized and digested before analysis using the Atomic Absorption Spectrophotometer (AAS). The results obtained showed that the mean concentrations of heavy metals in tissues of Egeria radiata followed an increasing sequence of Hg < Cd < Cr < Mn < Pb < Cu < Ni. Heavy metal concentrations were higher but not significant in the dry season than in the rainy season. Mean levels of lead (Pb) and Cadmium (Cd) were found to be higher than FAO/WHO acceptable standard in fishes and shell fish though not significant, yet manganese and nickel were significantly lower than the standard. There is a need for constant monitoring of levels of heavy metals in the area of study in order to forestall any significant rise in their levels among others was recommended.

Keywords: *Heavy metals, Egeria radiata, creeks, Burutu, Nigeria.*

INTRODUCTION

Egeria radiata is a fresh water clam inhabiting the lower reaches of some large West African rivers (Udoidiong and Akpan, 1991). Most clams occur in shallow waters, in which they are generally protected from wave action by the surrounding bottom. Clams lie buried just beneath the surface to depth of about 2 feet. The possession of inhalant and exhalent siphons enables the clams to obtain food by filter feeding from incurrent water and expel wastes from the exhalent current. Whetstone, Sturmer and Oesterling (2005), reported that clams prefer a combination of mud and sand as substrates among other suitable substrates. Lorio and Malone (1995) noted that the distribution of clams is determined by hydrodynamic factors that affect various pre and post settlement processes which may be related to geographic locations such as sediment types and depths.

Shell fishes in general including clams are good indicators of the levels of contamination of water bodies due to their filter feeding habits and contact with bottom sediment. Ahn (2005) reported that clams are particularly biomonitors by virtue of their distribution, large body size and high population density. Heavy metals can therefore bioaccumulate in tissues of benthic organisms such as Egeria radiata. Heavy metal contamination has been known to impact negatively on aquatic organisms. Jackson, Baird and ELS (2005) reported that lead (Pb) and zinc (Zn) contamination caused impairment of brood and larval development of Callisiassa kraussi (burrowing crustacean). Contamination above FAO acceptable limit in fish, Oreochromis nitoticus and Synodontis been reported for the hard clam, Meretrix lusona (Chin and Chen, 1993). Aspects of the biology and temporal trends in heavy metal concentration in Egeria radiata have been studied (Moses, 1990; Etim, Akpan and Muller 1991).

According to Ipingbemi (2009), Saxena and D'Suoza (2005), heavy metals contamination are of special concern because they are non-degradable and therefore persist in the ecosystem. Most of the creeks in Burutu are contaminated with heavy metals due to crude oil exploration and exploitation activities in the area and environs especially Warri, which is an industrialized town with lots of petrochemical industries (Adekoya, 1997; Ipingbemi, 2009). Rainbow (1995) stated that the use of biomonitors offer time integrated measures of portions of the ambient metal load that are of direct ecotoxicological relevance. Egeria radiata happens to be one of the fishery resources in the area and is consumed by people in the area of study. In view of the toxicological importance of this edible clam, this study is undertaken to assess the levels and seasonal variation of heavy metal contamination of Egeria radiata from creeks in the study location in order to ascertain their suitability and safety as shell fish food in and around the study location.

MATERIALS AND METHODS

Egeria radiata samples for the study were collected fortnightly from Obotobe and Gbekebor creeks in Burutu South Local Government Area. The study lasted 12 months from January to December, 2008. The soft tissues of Egeria radiata were extracted, weighed and dried in the laboratory oven for 3 days at a constant temperature of $60^{o}C$. The dried samples were weighed and homogenized in a porcelain mortar and stored in an air tight container. Ten grams of the dried and homogenized samples were weighed into a 250 ml conical flask.

Twenty ml of perchloric acid ($HCLO_4$) and 20 ml of nitric acid (HNO_3) in a ratio of 1:1 were added to the sample in the conical flask. The content of the flask was heated at a temperature of $160^{o}C$ using a burner (digester) to reduce the volume of the content of the flask to 5 ml. The residue was then energized with 5 ml 20% hydrochloric acid (HCL) and filtered into 100 ml volumetric flask made up to the 100 ml mark with deionized water. The digest was transferred to plastic bottles and later analyzed using Atomic Absorption Spectrophotometer. Heavy metals analysed were copper, lead, manganese, cadmium, mercury, chromium and nickel. Data obtained were subjected to analysis of variance at 95% confidence limit. Duncan Multiple Range Test (DMRT) was also used to separate the means.

RESULTS AND DISCUSSION

Analysis of heavy metal contamination in Egeria radiata shows that tissues of Egeria radiata from the creeks were contaminated with heavy metals. The mean concentrations of heavy metals in tissues of Egeria radiata followed an increasing sequence of Hg < Cd < Cr < Mn < Pb < Cu < Ni (Mercury, Cadmium, Chromium, Manganess, Lead, Copper, Nickel). The mean concentrations of heavy metals in tissues of Egeria radiata observed in 2008 were copper 5.43 mg/kg, lead 3.30 mg/kg, manganese 2.71 mg/kg, cadmium 1.04 mg/kg, mercury 0.42 mg/kg, chromium 2.68 mg/kg and nickel 7.10 mg/kg (Table 1). Heavy metal concentrations in Egeria radiata was observed to be higher during the dry season than in the rainy season though not significantly higher ($P > 0.05$). Monthly mean levels of heavy metal contaminations were highest in the months of February>October>January>November. Differences in mean levels of individual heavy metals were observed. Mean concentrations of heavy metals in tissues of Egeria radiata from the creeks show that Obotobe and Gbekebor creeks were contaminated with heavy metals. Copper, manganese, cadmium, mercury and nickel were higher in concentration in tissues of Egeria radiata from Obotobe while lead and chromium were higher in concentrations in tissues of Egeria radiata from Gbekebor creek. Table 2, shows mean concentrations of heavy metals in tissues of Egeria radiata from the creeks studied.

Table 1: Monthly variation of heavy metals in fresh water clam, Egeria radiata

Months	Heavy Metal Concentration							
	Cu	Pb	Mn	Cd	Hg	Cr	Ni	Means
January	4.21	1.46	2.43	0.92	1.5	3.05	10.09	3.35
February	4.21	5.38	0.56	1.05	0.2	3.78	34.31	7.07
March	3.25	4.17	2.04	0.91	0.17	0.87	0.24	1.66
April	3.25	4.07	2.10	1.35	0.17	0.86	0.78	1.80
May	4.91	3.90	3.34	1.34	0.16	2.03	0.87	2.36
June	9.73	3.71	3.52	0.93	0.15	2.47	2.08	3.23
July	10.32	2.19	3.94	0.92	0.16	2.91	2.09	3.22
August	5.43	3.83	4.15	1.15	0.16	3.68	4.05	3.21
September	7.14	3.21	3.78	1.02	0.15	2.90	2.76	2.99
October	4.24	4.11	2.12	1.01	0.37	3.21	9.73	3.54
November	4.22	2.18	2.21	0.95	0.82	3.35	9.02	3.25
December	4.22	1.38	2.32	0.92	1.19	3.12	9.13	2.18
Mean (x)	5.43	3..30*	2.71*	1.04*	0.42	2.68	7.10	3.24

* Indicate means higher than world standard (FAO/WHO 1984). **Source:** Field Survey, 2008.

Mean levels of lead (Pb) and cadmium (Cd) were found to be higher than the world standard but not significantly higher. Mean heavy metal concentration in tissues of Egeria radiata compared with world standard is shown in table 3. Manganese and nickel were however, significantly ($P > 0.05$) lower than world standard. Figure 1, shows a comparison of mean levels of heavy metal concentration in Egeria radiata with world standard.

Table 2: Mean Concentrations of Heavy Metals in Tissues of Egeria radiata from creeks in Burutu South L.G.A.

Heavy Metal (mean - mg/kg)	Obotobe	Gbekebor
Cu	5.69	5.17
Pb	3.25	3.35
Mn	2.90	2.52
Cd	1.18	0.90
Hg	0.50	0.34
Cr	2.49	2.87
Ni	7.54	6.66

Source: Field Survey, 2008.

Table 3: Mean Heavy Metal Concentrations of Egeria radiate from study area compared with world standard

Heavy Metal (mean - mg/kg)	Concentrations in tissues of Egeria radiata	World Standard (FAO/WHO, 1984)
Cu	5.43	20.0
Pb	3.30	1.5
Mn	2.71	1.0
Cd	1.04	0.5
Hg	0.42	13.0
Cr	2.68	13.0
Ni	7.10	80.0

Source: Field Survey, 2008.

Tissues of Egeria radiata from Obotobe and Gbekebor creeks were found to be contaminated with heavy metals. This shows that aquatic organisms from most creeks in oil polluted environments are likely to be contaminated with heavy metals. Duruibe, Ogwuegbu and Egwurugwu (2007) reported that heavy metals are released into the environments by both natural and atmospheric sources especially mining, industrial activities and automobile exhaust. Ali and Fisher (2005) also reported that some benthic invertebrates and fish accumulate heavy metals from water and sediments and that mollusks and crustaceans have higher concentrations than other invertebrates. There were variations in levels of heavy metals in Egeria radiata from the Obotobe and Gbekebor creeks. This indicated that heavy metals vary in their levels of pollution into the creeks and on the levels of bioaccumulation which could be attributed to the different sources of pollution in the creeks. Heavy metal concentration in the creeks studied varied but not significantly different ($P > 0.05$). Obotobe creek however, had higher concentration in most of the heavy metal analysed from tissues of Egeria radiata. Such variations are possible because of differences in sources of contaminations and individual differences in the bioaccumulations of heavy metal in the aquatic organisms.

Monthly variation in heavy metal concentration was not significant. This shows that a rise in water level does not significantly cause any increase or decrease in heavy metal uptake by the clams. However, the monthly variations observed in this study indicated that levels of heavy metals were higher in the dry season than in the rainy season. The higher levels observed in the dry season could be due to concentration effect of low volume of water while the lower levels observed could be attributed to the influx of water from surface runoffs which is capable of washing away some of the heavy metals, thereby reducing their levels. Ideriah, Braide and Briggs (2006), reported that flushing of levels of heavy metal could occur during the rain. This report is however, contrary to the findings of Savari, Lockwood and Sheader, (1991), who reported low levels of heavy metal concentrations in cockles from Southamptom water during the dry season.

Levels of heavy metals in tissues of Egeria radiata were found to be below the acceptable limits of heavy metal pollution of fishes and shell fishes (FAO/WHO, 1984). Mean levels of lead (Pb) and cadmium (Cd) were observed to be higher than the world standard but not significantly higher. This shows that the levels of lead and cadmium in the creeks are still tolerable. There is a need for constant monitoring of the levels of lead, cadmium and other heavy metals to forestall any significant rise in their levels. The insignificant low levels of manganese and nickel in the tissues of Egeria radiata in this study show that manganese and nickel contamination of Egeria radiata may not be envisaged in the nearest future.

However, it should be noted that Lenntech (2004), reported that heavy metals have relatively high density and are toxic or poisonous even at low concentrations. In view of this, heavy metal pollution of water bodies (especially in the areas of study and environs) should be reduced to the barest minimum. This is to minimize shellfish and fish food contamination which will in turn reduce clinical poisoning in human who consume Egeria radiata and other fishery products from Obotobe and Gbekobor creeks.

CONCLUSION

This study was designed to examine the levels of heavy metal concentrations in tissues of Egeria radiata from Obotobe and Gbekobor Creeks in Burutu Local Government Area of Delta State, Nigeria. The results obtained show that tissues of Egeria radiata from the creeks were contaminated with heavy metals. Heavy metal concentrations in tissues of Egeria radiata were higher but not significant in the dry season than in the rainy season. Levels of heavy metals in tissues of Egeria radiata were found to be below the FAO/WHO acceptable limits of heavy metal pollution in fishes and shell fish. Mean levels of lead (Pb) and Cadmium (Cd) were found to be higher than world standard but not significant. Manganese and nickel were significantly lower than world standard. There is a need for constant monitoring of levels of heavy metals in the area of study in order to forestall any significant rise in their levels.

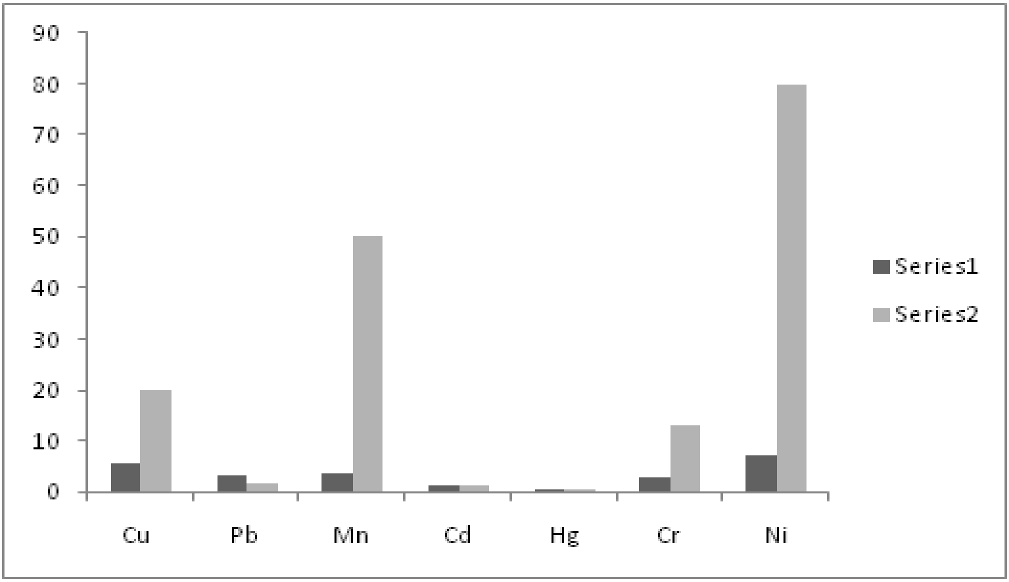

Figure 1: Heavy Metal concentration in Egeria radiata compared with world standards

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