CONCENTRATIONS OF HEAVY METALS IN TISSUES OF *EGERIA RADIATA* (BIVALVIA: TELLINACEA) FROM CREEKS IN BURUTU IN DELTA STATE, NIGERIA

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ABSTRACT: The concentrations of heavy metals in tissues of *Egeria radiata* were investigated from Obotebe and Gbekobor Creeks in Burutu Local Government Area of Delta State were investigated. Samples of *E. radiata* were collected fortnightly for 12 months in 2008. The soft tissues of *E. radiata* were extracted, weighed and dried in oven for three days at 60^0C. Ten grams of the dried samples were homogenized and digested before analysis using the atomic absorption spectrophotometer (AAS) to determine levels of heavy metals such as cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), manganese (Mn), mercury (Hg), and nickel (Ni). The mean concentrations of heavy metals in tissues of *E. radiata* followed an increasing sequence of Hg < Cd < Cr < Mn < Pb < Cu < Ni. Heavy metal concentrations in tissues of *E. radiata* were higher but were not significant at ($P>0.05$) in the dry season than in the rainy season. Mean levels of Cr, Cu, and Hg in tissues of *E. radiata* were lower but not significantly ($P>0.05$) than the FAO/WHO acceptable limits of heavy metal pollution in fishes and shell fish while mean levels of lead (Pb), manganese (Mn) and Cadmium (Cd) were found to be higher than world standard but not significant ($P>0.05$). Nickel was 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.

INTRODUCTION

E. 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. Clams possess of inhalant and exhalent siphons which enable to obtain food by filter feeding from incurrent water and expel wastes from the exhalent current. Whetstone *et al.* (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.

Clams are bio-monitors by virtue of their distribution, large body size and high population density (Phillips, 1976; Ahn, 2005; De Astudillo *et al.*, 2005; Kanakaraju *et al.*, 2008). Shell fishes in general including clams have been noted as good indicators of the levels of contamination of water bodies due to their filter feeding habits and contact with bottom sediment. Heavy metals can therefore bioaccumulate in tissues of benthic organisms such as *E. radiata.* Heavy metal contamination has been known to impact negatively on aquatic organisms. Jackson *et al.* (2005) reported that lead (Pb) and zinc (Zn) contamination caused impairment of brood and larval development of *Callisiassa kraussi* (burrowing crustacean). Chin and Chen (1993a) reported contamination above FAO acceptable limit in *Oreochromis* *niloticus* and *Synodontis* species and in the hard clam, *Meretrix lusona.* Studies on the aspects of the biology and temporal trends in heavy metal concentrations in *E. radiata* have shown that every metal displayed a peculiar temporal fluctuational pattern and that variation in the concentration of some of the heavy metals appeared to be strongly related to the tissue weight of the clam (Moses, 1990; Etim *et al*., 1991). Saxena and D'Suoza (2005) reported that heavy metal 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 the presence of petrochemical industries (Adekoya, 1997; Ipingbemi, 2009).

E. 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 *E. radiata* from creeks in the study location in order to ascertain their suitability and safety as shell fish for the local people.

MATERIALS AND METHODS

Benthic sample of E. radiate were collected from January to December 2008 in Obotebe and Gbekebor creek of Burutu Local Government Area of Delta State. Twenty samples of *E. radiata* ranging from 6.9cm to 10.7cm in length were purchased monthly from Obotobe and Gbekebor creeks each for the study. The soft tissues of *E. radiata* were extracted, weighed and dried in the laboratory oven for three days at a constant temperature of 60^oC. 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 (HClO4) and 20 ml of nitric acid (HNO3) in a ratio of 1:1 was added to the sample in the conical flask. The content of the flask was heated at a temperature of 160^oC 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 heavy metals analyzed were copper, lead, manganese, cadmium, mercury, chromium and nickel using Atomic Absorption Spectrophotometer (model- unicam 969)
Data obtained were subjected to analysis ing Duncan Multiple Range Test (DMRT).

RESULTS

The mean concentrations of heavy metals in the issues of *E. radiata* from the creeks followed an increasing sequence of Hg < Cd < Cr < Mn < Pb < Cu < Ni. The mean concentrations of heavy metals in tissues of *E. radiata* observed 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 *E. radiata* were observed to be higher during the dry season than in the rainy season though not significantly higher ($P > 0.05$). The concentration of copper throughout the study period remained below the WHO permissible limit of 20mg/kg. The highest concentrations of copper in the tissues of *E. radiata* tissue 10.32mg/kg was obtained in July followed by June. Higher mean concentration of 5.38mg/kg lead was observed in the tissues of *E. radiata* in the month of February compared with WHO limit of 1.5mg/kg and least in the month of December. Manganese was highest in concentration in the month of August with 4.15mg/kg in tissues of *E. radiata* which was higher than WHO limits of 1.0mg/kg and least in February with 0.56mg/kg. Cadmium was also higher than WHO permissible limits with highest values of 1.35 and 1.34mg/kg in the months of April and May respectively and lowest in the month of December and January with 0.92mg/kg. Mercury, chromium and nickel were highest in mean concentrations in the months of January for mercury and February for chromium and nickel with values of 1.50, 3.78 and 34.31mg/kg and lowest mean concentrations of 0.15, 0.86 and 0.24mg/kg in June, April and March in tissues of

E. radiata respectively. Copper, manganese, cadmium, mercury and nickel were higher in tissues of *E. radiata* from Obotebe while lead and chromium were higher in concentration in tissues of *E. radiata* from Gbekebor creek (Table 2).

Mean levels of lead (Pb), manganese (Mn) and cadmium (Cd) were found to be higher than the world standard but not significantly higher. Mean heavy metal concentration in tissues of *E. radiata* compared with world standard is shown in table 3. Nickel was however, significantly (P <0.05) lower than world standard.

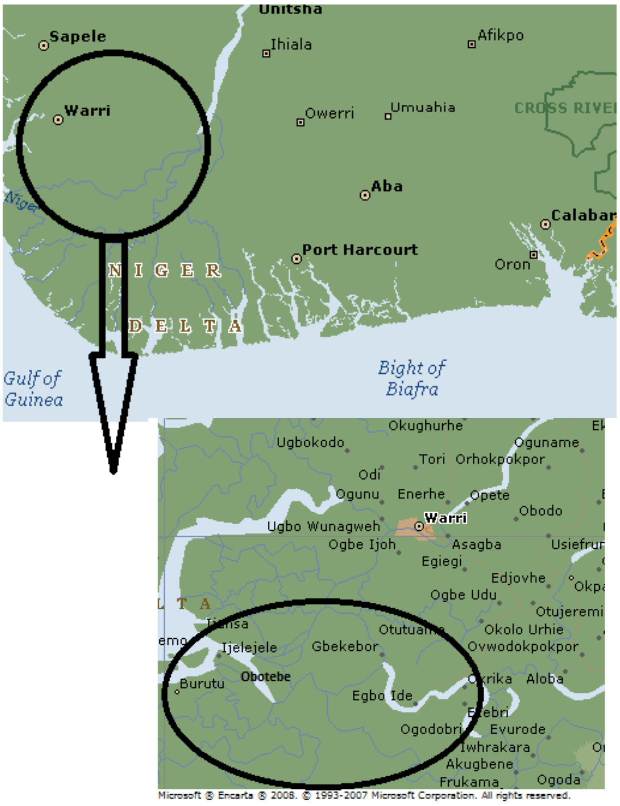

Figure 1. Map of Niger Delta Showing sampling locations at Gbekebor and Obotebe.

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

Months	Heavy Metal Conc. (mg/kg)							Means
	Cu	Pb	Mn	Cd	Hg	Cr	Ni	
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 ($\bar{x}$)	**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).

Table 2: Mean Concentrations of Heavy Metals in Tissues of *E. radiata* from creeks in Burutu

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

Table 3: Mean Heavy Metal Concentrations of *E. radiata from study area* compared with world standard

Heavy Metal (mean – mg/kg)	Conc in tissues of *E. 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

DISCUSSION

Tissues of *E. radiata* from Obotebe 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 (Kori-Siakpere, 2000, Agbodidi *et al.*, 2005). Heavy metals have been noted to be released into the environments by both natural and atmospheric sources especially mining, industrial activities and automobile exhaust (Duruibe *et al.*, 2007). Ali and Fisher (2005) also reported that some benthic invertebrates and fish accumulate heavy metals from water and sediments and that molluscs and crustaceans have higher concentrations than other invertebrates. There were variations in levels of heavy metals in *E. radiata* from Obotebe and Gbekebor creeks. This indicated that heavy metal concentration in the creeks studied varied but not significantly different ($P > 0.05$). Etim (1990) also reported heavy metal accumulation in *E. radiata* from Cross River. Obotebe creek however, had higher concentration in most of the heavy metal (copper, manganese, cadmium, mercury and nickel) analyzed from tissues of *E. 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 (Ibok *et al.*, 1989, Kanakaraju *et al.*, 2008). The observed monthly variations of heavy metals in this study indicated that levels were not significantly ($P>0.05$) higher in the dry season than in the rainy season. This shows that a rise in water level does not significantly cause any increase or decrease in heavy metal uptake by the clams. The higher levels observed in the dry months 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 *et al.* (2006) reported that flushing of levels of heavy metal could occur during the rain. This report is however, contrary to the findings of Savari *et al.*, (1991) who reported low levels of heavy metal concentrations in cockles from Southampton water during the dry season. Levels of Copper, mercury, Chromium and nickel in tissues of *E. radiata* were found to be below the acceptable limits of heavy metal pollution in fishes and shell fish (FAO/WHO, 1984). Mean levels of lead, manganese and cadmium 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, manganese, cadmium and other heavy metals to forestall any significant rise in their levels. The insignificant low level nickel in the tissues of *E. radiata* in this study shows that manganese and nickel contamination of *E. 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 particularly in the areas of study should be reduced to the barest minimum. Monitoring of the levels of heavy necessary in order to minimize shellfish and fish food contamination which will in turn reduce clinical poisoning in human who consume *E. radiata* and other fishery products from Obotebe and Gbekobor creeks.

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