Sumerianz Journal of Scientific Research, 2019, Vol. 2, No. 12, pp. 197-200
ISSN(e): 2617-6955, ISSN(p): 2617-765X
Website: https://www.sumerianz.com

Original Article Open Access

Heavy Metal Concentration in the Gut of the Edible Crab (*Uca Tangeri*) in the New Calabar and Brass Rivers, Niger Delta Nigeria

Alagoa K. J.*
Department of Biological Sciences, Niger Delta University, Amassoma, Bayelsa State, Nigeria

Yabefa J. A.
Department of Sciences Laboratory Technology, Bayelsa State Polytechnic, Aleibiri

Abstract

The concentration of the heavy metals lead (Pb), iron (Fe), nickel (Ni) and chromium (Cr) was examined in the gut of the edible land crab (*Uca tangeri*) in the New Calabar and Brass rivers respectively. This was done in order to ascertain the amount of heavy metals in the crab samples and its implication on human health and safety as a result of bioaccumulation and bio-magnification respectively. Crab samples from the New Calabar and Brass rivers were obtained in triplicates and transported to the Chemical Science Laboratory of the Niger Delta University. They were oven dried and the gut contents analysed using the atomic absorption spectrophotometer (AAS).Data were subjected to calculations of means, standard deviation and the use of T-test to compare means. This was aided by the use of the SPSS® 21.0 software. Result showed significant difference ($P<0.05$) in all metal parameters between the Brass and New Calabar rivers. All metal parameters are lower than the international permissible limit. It can therefore be concluded that eating crabs from these rivers do not portend an immediate danger to human health and safety. However, the consumption of one too many crabs may result in health issues because of the risk of bioaccumulation. Also, we therefore discourage future anthropogenic inputs as further additions may radically change the health dynamics of consuming these fishery products.
Keywords: Heavy metals; Gut; Edible; Land crab; Uca tangeri; New calabar river; Brass river.

1. Introduction

In the Niger Delta of Nigeria, the edible land crab forms one of the most important delicacies and sources of protein and calcium particularly for pregnant woman. They are readily available, affordable and can be sourced all year round. They are available mostly at low tidal areas and are so intricately associated with the environment where they are found. They borrow into the “chikoko” mud flats from where they get their nutrient and nourishment.

Sadly, the aquatic environment the world over has suffered perennial abuse from industrial discharges, agricultural drainage, municipal waste and other anthropogenic inputs [1]. These inputs make additions of heavy metals, aliphatic and aromatic compounds, nutrients and other organic waste into receiving waters. Heavy metal pollution in the marine ecosystem is of grave concern because of its persistence in the environment, non-biodegradability and its ability to be easily absorbed into tissues of aquatic organisms. The Brass River and the New Calabar River are two river systems exposed perennially to the abuse of pollution of all sorts.

Levels of heavy metals have been found in fish and other aquatic biota including crabs [2, 3]. As the consumption of heavy metal contaminated crab possess a serious threat to human health there is an acute need to monitor heavy metal characteristics in the edible crab following its massive acceptability and consumption. This study is an attempt to gauge the heavy metal content in the edible crab in order to determine the safety and suitability of consuming it using internationally set benchmarks.

2. Materials and Method

2.1. Description of Study Area

The New Calabar River is located on the eastern flank of the Niger Delta River System. It lies between longitude 06^0 5.35’ 38.6’’ E of the Greenwich meridian and latitude 04^0 53’ 19 02’’ N of the equator in Choba, Rivers State, Nigeria and extend far into Port Harcourt. It takes its rise from Elele-alimini where it is acidic, fresh and non-tidal. At Aluu, it is joined by a smaller tributary river which took its rise at Isiokpo. It is a black water type and empties into some creeks and lagoon bordering the Atlantic Ocean.

Brass River is located in Bayelsa State, Niger Delta Region, Nigeria. The river lies between the coordinates of latitude 04^o 19’ 1’’ (N) and longitude 06^o 19’ 40’’ at. Twon-Brass. Brass River is distributary and it also flows into the Atlantic Ocean.

2.2. Study Organism (Crab: Uca tangeri)

The edible crabs are (*Uca tangeri*) are decapods crustacean which reside in the swampy tidal zones of the ocean, they can also live in the rocky shorelines. They have a very short tail and are covered with a thick shell or

*Corresponding Author

exoskeleton and are armed with a single pair of claws. They have flattened bodies, two feeler antennae and two eyes located on the end of the stalks and they are 10-legged animals that walk sideways.

2.3. Sample Collection and Transport

The crab samples were collected from the shores of New Calabar river water front within the fish camps. They were transported to Yenagoa Bayelsa state by road. The other crabs were caught at Ada-ama Twon in Brass, Bayelsa State and brought in plastic buckets to Yenagoa through boat transport.

2.3.1. Sample Preparation

Crab samples (*Uca tangeri*) were brought to the laboratory alive and were dismembered by getting rid of their limbs. They were washed under a running tap, drained, dried and placed in the hot air-drying oven. They were dried overnight and cut open to extract the internal organs. They were further dried and grinded to powdered form.

1g of each sample was weighed into a digestion flask, 15ml of digestion acid was added (1:3 of concentrated HNO_3+ H_2SO_4). This was heated on a hot plate in a fume cupboard until a clear solution was obtained.

20ml of distilled water was added to dilute the digest and this was them filtered into a 100ml volumetric flask. The solution was further made up to the mark (100ml) with distilled water.

2.3.2. Atomic Absorption Spectroscopy

This technique makes use of absorption spectrometry to assess the concentration of trace heavy metal in the sample. The digested crab samples were then subjected to atomic absorption spectroscopy analysis for the various trace metals. The analysis was done with acetylene/ air gas combination at various lamp current and wavelengths.

2.4. Statistical Analysis (Data Analysis)

Means and standard deviation were calculated for all metal parameters for the experimental crab sample. T-test was used to compare means for the heavy metal characteristics of crabs from Brass and New Calabar Rivers. Correlation analysis was employed to measure the degree of variability and relatedness of the heavy metal characteristics. SPSS ® (version 21.0) software was employed to aid in the data analysis procedure.

3. Result

The result of this study is captured in Table 1 and Figure 1 respectively. The suggested international permissible limit of heavy metals in fish and other aquatic biota are as presented in Tables 2 and 3

Table-1. Heavy metals in Crabs/WHO permissible limit of heavy metals

Heavy metal	Brass River(ug/g)	New Calabar River(ug/g)
Fe	$1.7360{\pm}0.00200^b$	3.7850 ± 0.0100^a
Pb	$0.2090{\pm}0.00100^b$	0.6770 ± 0.0010^a
Cr	ND	ND
Ni	$0.2830{\pm}0.00300^b$	0.2570 ± 0.0100^a

Means ± Standard Deviation. Means with the same letter superscript along the same row are not significantly different (P=0.05)

Figure-1. Heavy metal concentrations in Crabs in study areas

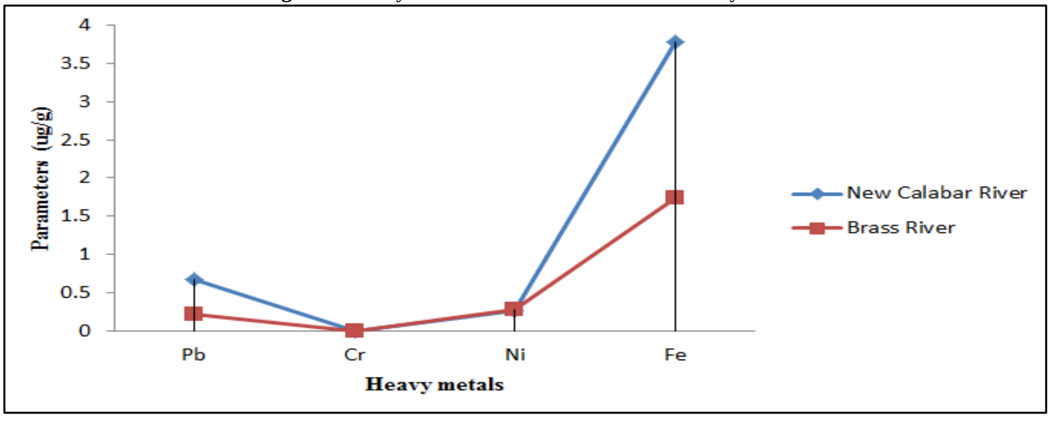

Table-2. EU and Australian permissible limit for Heavy metals in Aquatic Organisms

S/N	Metals	Value for fish (mg/kg or ppm)	Value for abalone (mg/kg) (Australia	Value (mg/kg) European Regulation
1	Cd	-	2.0	0.05
2	Cu	0.5	2.0	-
3	Pb	0.5	2.0	0.30
4	Hg	1.0	0.5	0.5

Source: EU regulation 1881/2006/. Australian National Seafood (Fish, Mollusc and Crustacean) guideline for heavy metals

Table-3. FAO/WHO Permissible limit of Heavy metals in Animal Tissues

S/N	Heavy metals	Permissible Value mg/kg (ppm)
1	Cu	30 (FAO/WHO, 1983)
2	Ni	70-80 (USFDA, 1993b)
3	Fe	100 (FAO/WHO, 1989)
4	Co	-
5	Mn	1.0 (FAO/WHO, 1989)
6	Zn	100 (FAO/WHO, 1989)

4. Discussion

The result obtained from this study show significant disparity and lower values from the survey of heavy metals in the catfish *Synodontis clarias* conducted by Agbozu, *et al.* [4] in Taylor creek and shellfish of the Niger Delta [5].

The concentrations of Fe and Pb were significantly higher in the New Calabar River than the Brass River whereas Ni was significantly higher in the Brass River than in the New Calabar River. (Table 1 and Figure 1). One reason for the higher concentration of Pb in New Calabar River than the Brass River is that the Brass River is far removed from human activities and vehicular movement which is a major factor in the addition of Pb from Petro-lead and other combustible activities [4, 6]. This relatively high concentration could be associated with its presence in crude oil [7]. This could also be a result of high lead (Pb) laden waste which is a constant feature in the river. This may result from autocrats' who frequently ply along the Calabar River either to Buguma or neighbouring communities [8]. Heavy metals are known to have a high affinity to accumulate in the sediments, which act as sink for these pollutants. Therefore crabs known as sediment feeders, would record elevated levels of heavy metals in the study area.

There is a non-detectability of Cr in this study. The non-detectability of Cr in the Crab may be as a result of the fact that Cr is a metal of low bioavailability and is not easily found in natural environments.

Fe displayed the greatest prevalence of all the mental sampled in New Calabar River (3.7850 ± 0.001^a). This could be as a result of the mining of Fe enriched Ores, intensified forestry, peat production and agricultural draining [9]. Another reason for the higher concentration of Fe in New Calabar River than the Brass River is that the Brass River is far removed from human activities and vehicle movement.

Ni showed the highest prevalence in Brass River (0.2830 ± 0.003^b). A reason for the appreciable concentration of Ni in *Uca tangeri* in Brass River may be as a result of the fact Ni is widely available to aquatic ecosystems through a variety of anthropogenic source, such as household waste waters and other inputs [10]. This could also be as a result of increase in petroleum spills in the shores as well as domestic sewage, increase in industrial discharge as well as industrial waste and increase in dumping of decaying roofing sheets [8].

The levels reported in this study are an indication of pollution particularly, when this metal had been classified as very toxic to aquatic life and relatively accessible [11]

Tables 2 and 3 shows international permissible limits of heavy mental in fish and other aquatic biota. The result from tables shows that all metal parameters were lower than international permissible limits in *Uca tangeri* in both New Calabar and Brass Rivers. This imply that the consumption of crab is still permissible as metal contents are yet to reach and exceed safety thresholds.

4. Conclusion

The determination of the concentration of the heavy metal Pb, Ni, Cr, and Fe in the gut of edible land crab (*Uca tangeri*) has provided a baseline information and data on the pollution status of the New Calabar River and Brass River respectfully.

The concentration of heavy metals detected in the crab samples from the New Calabar River and Brass River are variable. Values for Pb and Fe were higher for the New Calabar River than the Brass River except for Ni which was slightly lower in the New Calabar River. All metal parameters from New Calabar River and Brass River are lower than the international permissible limits

The crab samples are fit for human consumption since the heavy metals concentrations are below the recommended permissible safe level for human consumption by World Health Organization and Food and Agricultural Organization etc. However, the consumption of one too many crabs may portend grave danger due to the risk of bioaccumulation.

This data can serve as a guide for researchers and environmental managers to safeguard our waters and discourage future anthropogenic inputs as further additions may radically change the health dynamics of consuming these fishery products.

References

[1] Cheung, M. S. and Wang, W. X., 2008. "Analyzing biomagnification of metals in different marine food webs using nitrogen isotopes." *Marine Pollution Bulletin*, vol. 56, p. 20822105.

[2] Alam, A. M. S., Islam, M. A., Rahman, M. A., Siddique, M. N., and Matin, M. A., 2003. "Comparative study of the toxic metals and non-metal status in the major river system of Bangladesh." *DhakaUniversity Journal of Science*, vol. 51, pp. 201-208.

[3] Wachira, D. N., 2007. *Physico-electrochemical assessment of pollutants in Nairobi river*. Thesis, University of Nairobi.

[4] Agbozu, I. E., Ekweozor, I. K. E., and Opuene, K., 2007. "Survey of heavy metals in the catfish Synodontis clarias." *Int. J. Environ. Sci. Tech.*, vol. 4, pp. 93-97.

[5] Kakulu, S. E., Osibanjo, O., and O., a. S., 1987. "Trace metal content of fish and shellfishes of the Niger Delta Area of Nigeria." *Environ. Int.*, vol. 13, pp. 247-251.

[6] Arah, R. O., 1985. "Lead-free gasoline in Nigeria by year 2000. ." In *Proc 4th Int Seminar on Petroleum Industry and the Nigerian Environment, Fed Min Works Housing/Nig Nat Pet Corp Kaduna, Nigeria.* pp. 339-346.

[7] Lolomari, O., 1993. "Petrochemicals in the Nigeria environment proc." In *Inter. Seminar on the Nigerian Environment.* pp. 45-49.

[8] Ideriah, T. J. K., David-Omiema, S., and Ogbonna, D. N., 2012. "Distri-bution of heavy metals in water and sediment along Abonne-ma Shoreline." *Nigeria.Resources and Environment*, vol. 2, pp. 33-40.

[9] Livingstone, R. M., Baird, B. A., Atkinson, T., and Crofts, R. M. J., 1979. "The effect of different patterns of thermal processing of potatoes on their digestibility by growing pigs." *Anim. Feed Sci. Technol.*, vol. 4, pp. 295-306.

[10] Alagoa, K. J., 2019. "An appraisal of heavy metals in water column and bottom substrate of Aba river, Abia state, Nigeria." *GSC Biological and Pharmaceutical Sciences*, vol. 06, pp. 045-050.

[11] Forstner, U. and Wittman, G. T. W., 1983. "Metal pollution in the Aquatic Environment." In *New York.*Verlag Publishers. pp. 18-9.