

Evaluation of Trace Metals in Water and Fish Meat, from Lake Nubia and Khartoum City, Sudan

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Abstract

The purpose of this work was to investigate the concentrations of some heavy metals, cadmium, nickel and lead, in two commercial fish species (*Oreochromis niloticus* and *Bagrus bayad*) procured from River Nile and Nubia Lake fisheries sites, during the period of time from May 2015 to January 2016. Desired fish and water samples from every species and water were randomly gathered via occasionally from the two fisheries production sites. In order to perform those three heavy metals level by utilizing atomic absorption spectroscopy (AAS). The results of concentrations of heavy metals in fish flesh were revealed a significantly differences ($P < 0.01$). The concentration level of Ni, Pb were detected a higher in fish flesh of *Bagrus bayad* of Nubia Lake than the *Oreochromis niloticus*. Likewise level of Cd demonstrated the highest value in *Oreochromis niloticus* only.

Heavy metals contents in water samples at various sites were demonstrated that the most note worthy concentration of Pb in Nile River (Khartoum city), which was (0.056 ppm) as significantly higher than that (0.042ppm) from Lake Nubia tests. The level of Cd and Ni were (0.011, 0.027ppm) in Nile River (Khartoum city) and (0.005 and 0.015ppm) in Lake Nubia, there were no significant diverse between them.

Overall results showed none of the trace metals examined at both studied sites and fish flesh was over the prescribed admissible level showed by FAO/WHO and EC Committees.

Keywords: Bagurs bayad; Oreochromisniloticus; Heavy metals

Introduction

The contamination and pollution of the dirt, water, and air has turned out to be unavoidable accordingly of

anthropogenic exercises. Natural contamination by harmful metals has expanded consistently since the mechanical insurgency, in this manner bringing about genuine biological issues [1]. The contamination of the

sea-going environment with substantial metals has turned into an overall issue amid late years, since they are indestructible and the greater part of them effect sly affect life forms [2]. Among natural toxins, metals are of specific worry, because of their potential harmful impact and capacity to bioaccumulate in amphibian biological systems [3]. Trace metals can be named conceivably harmful (cadmium and lead), most likely fundamental (Nickel), and basic (copper, Zinc, and Selenium). The fundamental metals can likewise deliver lethal impacts when the metal admission is too much raised [4,5]. Heavy metals are characteristic follow segments of the oceanic environment; however their levels have expanded because of modern, agrarian and mining exercises. Accordingly, sea-going fish species are presented to hoisted levels of heavy metals.

The levels of metals in upper individuals from the food web like fish can achieve values commonly higher than those found in amphibian environment or in silt. Therefore contamination in the area is a critical issue with respect to the strength of the sea-going creatures and thusly, soundness of the fish customers [6].

Fish species are regularly the top buyers in sea-going biological systems and along these lines metal fixations in fish can go about as an ecological marker for the natural state [7,8]. Fish are known to bioaccumulate metals and hence can be utilized as bio-monitors; likewise they have the upside of permitting the correlation of metal focuses among locales, where water tests are close or underneath the detection limits of the atomic absorption technique [9].

The goals of this study are:

1. To determine the concentrations of nickel, lead and cadmium in some fish species and water samples in Nile River (a round Khartoum city) and Lake Nubia at northern border of the Sudan.
2. To find a correlation between the presence of heavy metal in the two fish species and water sites.

Materials and Methods

Fish samples

Two regularly commercial fish species namely: *Bagrus bayad*, local name (*Bayad*) and *Oreochromis niloticus* local name (Bulti or Tilapia). Were chosen from two sites, Nubia Lake and River Nile in Khartoum city express (these ranges are experiencing serious unsettling

influence human movement) for this examination. The samples gathered during May 2015 to January 2016.

These specimens were arranged and washed with tap water to expel any following soil or clay, then put in protected boxes containing ice for safeguarding amid evaluation records and transferring to research laboratory for heavy metals determination.

Water samples were taken from these sites at a profundity of 50 cm underneath the water surface at morning time. The specimens were kept in a plastic holder and were alluding to research center for heavy metals examination.

Determination of Heavy Metals

Water tests: Heavy metal concentrations in water were dictated by Atomic Absorption Spectrophotometer. (Model: 210/211VGP Atomic Absorption Spectrophotometer, Operator's Manual, January 2003, VER 3.94 C).

The samples were arranged and broke down consecutively for cadmium, nickel and lead. The samples were sifted and afterward finished to required volume (100ml).

Fish samples: Forty fish of each two species (*Oreochromis niloticus* and *Bagrus bayad*) were gathered from every site for heavy metal investigation. The gathered fish were washed with clean water, put in cleaned plastic sacks and put away solidified until examination was done. The internal viscera, head and scurfs were removed.

The fish flesh samples were dried utilizing an electric stove at 105°C for around 18hours till a consistent weight is accomplished. Dried samples were granulated utilizing manual porcelain mortar. Powder samples were kept in sealed shut plastic packs till investigation.

2.0g of fish powder set in a silica vanishing pot of known weight the cauldron was put on a hot plate and allow evaporating until totally scorched the exchanged to a stiffler heater at of 550°C and hurt at this temperature for eighteen hours. At the point when the throbbing is finished, cooled, and extricated with 5ml of 20% HCl and filtrated, arrangement and make up to 50ml with water, and blended utilized for heavy metals assurance by utilizing Atomic Absorption Spectrophotometer [10].

Results and Discussion

Heavy metals in water samples as per sites were exhibited in table (1). The levels of studied metals Cd, Ni and Pb in water from Nile River (Khartoum city) were recorded (0.011, 0.027 and 0.056 and 0.005, 0.015 and 0.042 ppm) from Lake Nubia, respectively. The concentrations of heavy metals for samples gathered from Nile River (Khartoum city) were higher than that gathered from Lake Nubia. However the high concentration might be resulted from anthropogenic procedures, for example, industry, agriculture, development, transportation, or residence, which are all around spoke to in the city. The outcome demonstrated that the high concentration of Lead (Pb) in Nile River (Khartoum city) and lower in Lake Nubia. This could be credited to wastes of industrial, farming or human activities releases around the urban areas (Khartoum Site). The findings in concurrence with Khalifa who found that the level of Cd and Pb 0.03 and 0.05, respectively in fish species and water samples could be high around coastline and cities [11].

Heavy metals contents in water samples at various sites were exhibited in table (1) and figure (1). The outcome demonstrated that the most noteworthy concentration of Pb in Khartoum city, which was (0.056ppm) as significantly higher than that (0.042ppm) from Lake Nubia tests, there were no critical diverse between them.

Sites	Level of Heavy Metals (ppm)		
	Cd	Ni	Pb
Khartoum City(Nile River)	0.011± 0.001	0.027± 0.001	0.056± 0.003
Lake Nubia	0.005± 0.001	0.015± 0.001	0.042± 0.004
Sig	**	***	**

Table 1: Heavy metals (ppm) in water samples according to sites collection.

Values are means of three replicates. Values are means ± Standard error.

Cd = Cadmium, Ni = Nickel, Pb = Lead

**= highest significance ($P < 0.01$).

*** = highest significance ($P < 0.001$).

± = standard error

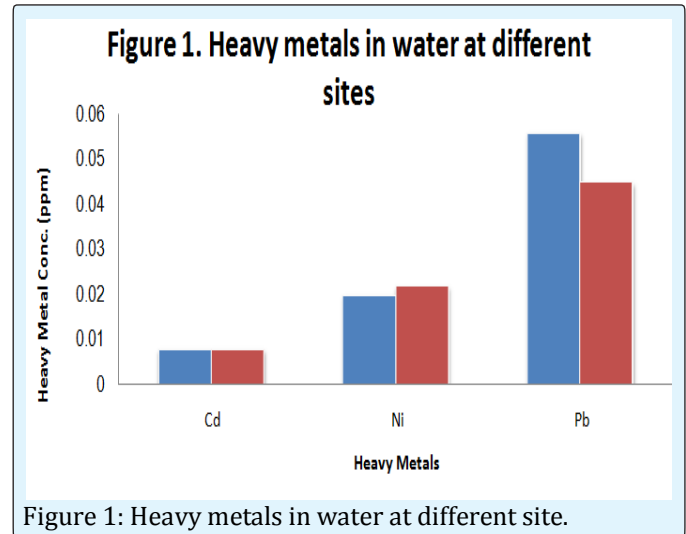


Figure 1: Heavy metals in water at different site.

Heavy metals concentration in fish samples according to sites were shown in table (2). The concentrations of trace metals (Cd, Ni and Pb) in *Orochromis niloticus* samples were (0.045, 0.037 and 0.028 $\mu\text{g/g}$), respectively in Nile River (Khartoum city) and that of Lake Nubia were (0.043, 0.036 and 0.028 $\mu\text{g/g}$). Lake Nubia tests demonstrated that there were lower gathered of heavy metals than that of Khartoum city tests. However Fish is among the dominant bio-indicator species used for acute toxicity assay of pollutants such as heavy metals since much attention has been drawn due to the wide occurrence of metals pollution in aquatic system. The quick advancement of businesses and agribusinesses have advance the expansion of ecological contamination albeit heavy metals in water framework can be normally created by moderate draining from rocks and soil into water which happens at low levels. Additionally Cd and Pb were among the aquatic metals pollutants, which generally exhibit at huge levels in water framework which may posture high toxicities on the sea-going living beings [12]. The present outcomes were in concurrence with Nor Hasyimah *et al.*, who found that the level of metals Cd, Ni and Pb in fish muscles (0.042, 0.13 and 0.05 $\mu\text{g/g}$) respectively [13].

Sites	Fish Species	Level of heavy metals in ($\mu\text{g/g}$) fish sample		
		Cd	Ni	Pb
Khartoum (River Nile)	Oreochromis niloticus	0.036 \pm 0.003	0.037 \pm 0.001	0.027 \pm 0.001
	Bagrus byad	0.038 + 0.003	0.037 + 0.001	0.026 + 0.001
Nubia Lake	Oreochromis niloticus	0.045 \pm 0.003	0.036 \pm 0.001	0.028 \pm 0.001
	Bagrus byad	0.036 + 0.003	0.036 + 0.001	0.027+ 0.001
Significance level		*	NS	NS

Table 2: Heavy metals in fish samples at different sites.

Values are means of three replicates. Values are means \pm Standard error.

Cd = Cadmium, Ni = Nickel, Pb = Lead

*= significance ($P < 0.05$).

NS =not significance ($P < 0.001$).

\pm = standad error

The outcomes demonstrated that the abnormal amounts of Cd were (0.043 $\mu\text{g/g}$) in *Oreochromis niloticus* and the brings down were (0.038 $\mu\text{g/g}$) in *Bagrus bayad*, there was most noteworthy significant ($P < 0.001$). The abnormal state of Pb were 0.028($\mu\text{g/g}$) likewise in *Oreochromis niloticus* than that lower were 0.026 ($\mu\text{g/g}$) in *Bagrus Bayad*, there was elevated significantly ($P < 0.05$).While there was no centrality distinctive in level of Ni 0.037 ($\mu\text{g/g}$) for two species.

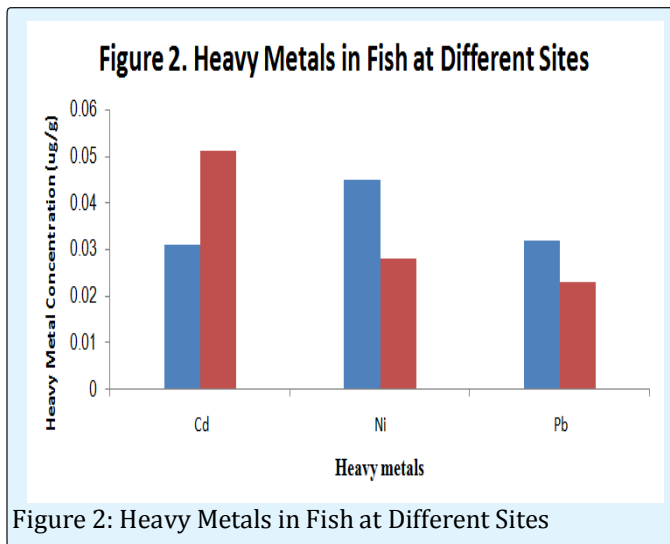


Figure 2: Heavy Metals in Fish at Different Sites

Conclusion

We concluded that, the different concentration of heavy metals such as Cd, Ni and, Pb in the studied fish flesh of fresh water organisms collected from both sites Nile River (Khartoum city and Lake Nubia) were found to be below the permissible level set by world health advisories (CODEX STAN 193-1995 (Amendment: 2010, Regulation (EC) No. 1881/2006 and FDA, 2001) [14-16].

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