# HEAVY METAL CONCENTRATION IN TILAPIA (TILAPIA ZILLI) FROM MINI-NDAI CREEK, RUMUOLUMENI, PORT HARCOURT.

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## Abstract

Heavy metals are naturally occurring elements but industrial activities and other anthropogenic activities can also release them into our environment to levels causing pollution. Heavy metals in high concentration in the aquatic organisms may pose a health risk when these organisms are consumed. The aim of the study was to evaluate the state of heavy metal contamination of the Mini-Ndai creek. Heavy metal concentrations in *Tilapia zilli* from Mini-Ndai Creek, Rumuolumeni, Port Harcourt were determined using Atomic Absorption Spectrophometer (AAS). Samples were collected in January, March and May. Data were analyzed using mean and standard deviation represented in bar graph. The heavy metals analyzed are Ni, Cd and Mercury. The resulted indicated high concentrations of Ni (3.94µg/g) and low concentrations of Hg (0.02µg/g). The trend of heavy metals concentration can be represented as Ni>Cd>Hg, with their concentrations as (3.94>0.17>0.02)µg/g. Hg was within the safe limits while Ni and Cd were seen to be above the safe limits for human consumption. It is recommended that further studies of heavy metals should be carried out to monitor the physicochemical parameters and the heavy metal content of the creek.

**Keywords:** Concentration, heavy metals, Mini-Ndai creek, Tilapia

## Introduction

The continual developments of the petroleum industry as well as other industrial and urban activities are giving rise to a number of environmental problems. These environmental problems are due to a variety of waste products generated from these activities that are not being managed properly. As a result of the poor management of these waste materials discharged into aquatic habitats, many contaminants such as heavy metals have become major concerns due to their toxicity; bioaccumulation and that they are not readily biodegraded (Al-Busaidi*et al*., 2011).

Any metallic chemical element having a relatively high density above 5g/cm$^3$ and toxic nature even at low concentrations are often referred to as heavy metals. Examples; Mercury, Cadmium, Nickel, Arsenic, Chromium, Cobalt and Lead. Trace elements likeCopper, iron, Zinc, Manganese and Selenium, are important as they help maintain the metabolism of the human body (Igwemmar*et al*., 2013). However, at high concentrations can lead to poisoning.

Skeat (2005) revealed that "heavy metals are members of a loosely defined subset of elements that exhibit metallic properties which include solubility in water; and strong attachment of polypeptides and protein".

Heavy metals are 'naturally occurring in the ecosystem with varying concentrations. Some of the metals present in the water environment like the streams and rivers come from industrial wastes, municipal and urban run-offs which can be a threat to life' (Tolcin, 2011).

In recent times, there has been an increase in the world consumption of fish simultaneously due to the growing concern of their benefits therapeutically and nutritionally. In addition to it being an important source of protein, fish typically have rich contents of important minerals, vitamins and unsaturated fatty acids (Medeiros *et al*., 2012). Fishes are somewhat situated at the top of the aquatic food chain; as a result of this, they can accumulate heavy metals from food, water and sediments. (Yilmaz *et al*., 2007).

Toxic heavy metal content in fishes can hinder their beneficial nature; the severe unfavourable effects of heavy metals to the health of human have been identified for long time (Castro-Gonzalez *et al*., 2008). This may include severe health issues like kidney failure, liver damage, cardiovascular diseases and may even lead to death (Al-Busaidi*et al*., 2011). Therefore, many international monitoring programs have been established in order to assess the quality of fish for human consumption and to monitor the health of the aquatic ecosystem (Meche *et al*., 2010).

There are varying levels of heavy metal toxicity as the surrounding environment also affects it through certain factors. Even in fishes, the toxicity levels of these heavy metals like Pb, Hg, Cu and Znplays certain roles that could cause some harm. When water and fishes contaminated with heavy metals are consumed, diseases could occur due to these heavy metals being bioaccumulated in the body system of human beings, thus leading to serious health problems and eventually death. Also, many of these metals are carcinogenic in nature and cannot be easily destroyed by heat (Adeosun *et al*., 2015).

Due to the bioaccumulation of heavy metals, they are somewhat dangerous.

Bioaccumulation means 'an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment' (Lenntech, 2005).

The aquatic environment being contaminated with heavy metals has led to a lot of researches on the effect of heavy metal pollution. The source of pollutants in the aquatic environment can be from industrial wastes, agricultural and geochemical structures, and these wastes can affect the water quality as well as the aquatic species.

Fishes that inhabit aquatic bodies where heavy metal pollution is prevalent take up these pollutants which bioaccumulate in their body tissues. Majority of the population in Nigeria consume fishes on a daily basis because they are seen to be good sources of protein and are cheap and easily affordable. Fishes that contain heavy metals that are been consumed by either humans or animals poses a serious health risk.

Studies carried out by Anaero-Nweke*et al*. (2018) on various concentration of heavy metal in fish from the Upper Bonny Estuary showed "Cr and Ni to be above the FAO/WHO (2012) permissible limits of 0.5mg/kg and 0.6mg/kg respectively".

Alinnor& Obiji (2010), carried out an investigation to survey heavy metal content of fish samples from Nworie River. Results showed that "Fe, Cd, Mn were present in the fish species, *Tilapia guineensis* with mean values of 3.275, 0.048 and 0.103ppm respectively".
Umunnakwe and Aharanwa (2014) carried out an investigation in different fish species which included Tilapia fish and found out that "Ni and Cd exceeded the permissible limits and Fe had the highest concentration, and the trend of accumulation was Fe>Cd>Ni>Hg>Cr".
This study is of great importance because it tends to evaluate out the concentration of heavy metals in *Tilapiazilli* found in the Mini-Ndai creek located at Rumuolumeni, Port Harcourt.
This fish is been consumed on a daily basis, hence the need for the evaluation for heavy metal contents in it to monitor potential hazards and provide possible early warnings.

**Aim and Objectives of the study**

The aim of the study was to evaluate the state of heavy metal contamination of the Mini-Ndai creek. The objectives of this study was to determine the relative concentrations of Nickel (Ni), Cadmium (Cd), Mercury (Hg)in the Tilapia fish.

**Materials and Methods**

**Study Area**

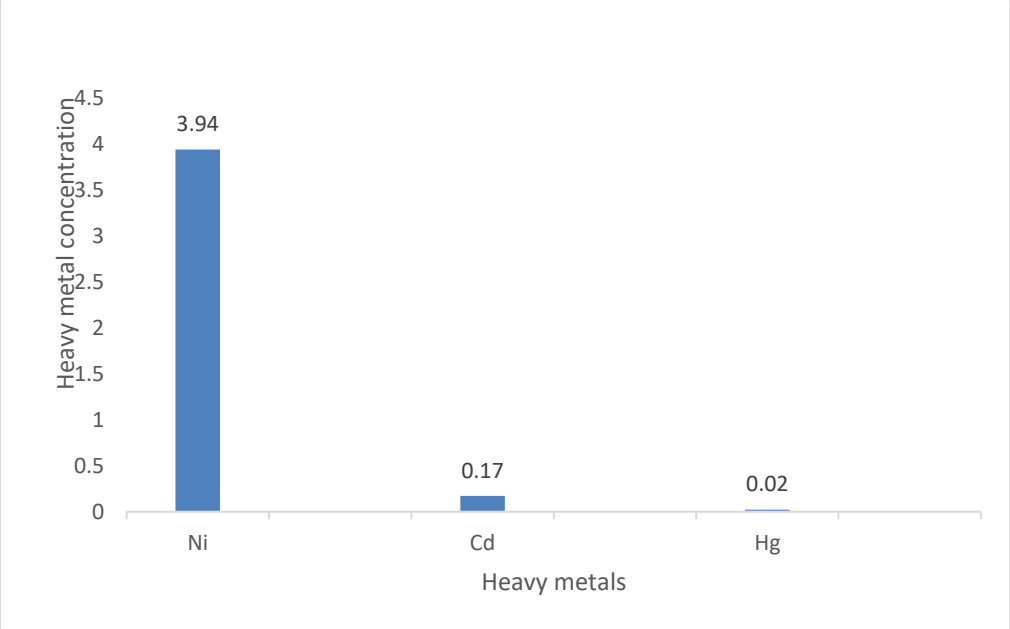
The study was carried out at the Mini-Ndai creek situated at Rumuolumeni, Port Harcourt, Rivers State. Water enters the creek at high tide from the New Calabar River and drains from the surrounding mangrove swamp into the river as the tide ebbs.

**Fish Sample:** Fish samples were purchased from the local fishermen and fish sellers of the creek. They were immediately transferred into plastic containers containing ice and stored in a freezer prior to analysis.

**Sample Preparation:** On the day of analysis, the fish samples were taken out of the freezer and thawed at room temperature. They were oven dried and pulverized to produce its powdered form.Powdered samples were digested with nitric acidand then analyzed for Nickel (Ni), Cadmium (Cd) and Mercury (Hg) using the Atomic Absorption Spectrophometry (AAS).

**Statistical Analysis:** Statistical analysis was carried out and the results obtained using arithmetic mean and standard deviation.

**Results:** The mean concentration of heavy metals in Tilapia fish are presented in Fig. 1. The mean concentrations of Ni, Cd and Hg in the *Tilapia zilli*were 3.94±0.17µg/g, 0.17±0.04µg/g, 0.02±0.01µg/g respectively. Ni had the highest concentration in the *Tilapia zilli*among other heavy metals studied. The order of heavy metal concentration in the *Tilapia zilli*was Ni>Cd>Hg.




**Discussion of Findings**

The study revealed that Mercury analyzed in the Tilapia fish sample was within the safe limits while Nickel and Cadmium were seen to be above the safe limits.

Although, the order of heavy metal concentrations in the *Tilapia zilli is* Ni>Cd>Hg; which contrasts slightly with the trend Fe>Cd>Ni>Hg>Cr as reported by Umunnakwe and Aharanwa (2014). This indicates that Nickel had the highest concentration in the fish sample, while Hg had the least concentration in *Tilapia zilli.*

**Conclusion**

Heavy metals are known to affect aquatic lives. When these heavy metals accumulate over a long period, it exerts direct consequences to aquatic biota and in turn man within the ecosystem. The heavy metals except Ni and Cd were within the safe limits for consumption.

With these findings, one may admit that the continuous eating of these fishes could have adverse effects (such as carcinogenic effects, kidney damage and cardiovascular effects) on human health as regards the adverse nature of these heavy metals (Ni and Cd)(Chervona*et al*., 2012 and Duruibe*et al*., 2007).

Based on theresults obtained fromthe study area, the following measures need to be noted.

1. The abbatoir effluents discharge into the creek should be discouraged.
2. Further researches should be carried out on the creek to check the physicochemical parameters and the heavy metal content of the creek.

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