DETERMINATION OF CADMIUM LEVELS OF WATER AND FISH FROM SELECTED AREAS OF ANURADAPURA DISTRICT

H.Y.Y.Fonseka[1], C.J.S. Weerasinghe[1], E.M.R.K.B. Edirisinghe[1]*and B.K.K.K. Jinadasda[2]

[1]Department of Physical Sciences, Faculty of Applied Sciences, Rajarata University of Sri Lanka, Mihintale

[2]Institute of Post HarvestTechnology, National Aquatic Resources Research & Development Agency (NARA), Colombo 15.

* Corresponding Author: ranjith_e@hotmail.com

Keywords: Heavy metal toxicity, Cadmium, Water, Fish

Abstract

Heavy metal contamination in foodsand water is of serious concern due to the potential health risks involved specially in the chronic kidney disease (CKD) affected North Central Province of Sri Lanka. This study aimed at analysing the concentrations of Cadmium in water and fish obtained from Madawachchiyaand comparing with Cd values of fish and water obtained from Mihintaletank. Cadmium levels of various water sources including dug wells and tube wells, water purification plants and tanks from both areas were studied (n= 40). Further, the Cd levels of Thilapiafish (n = 20) were also analysed. The samples were digested by a microwave digestion system and analysed for Cadmiumby using cold vaporAtomics Absorption Spectroscopy (AAS).

The highest Cd levels in water were reported from three dug wells (mean: 0.18 µg/l)from Madawchchiya area and the lowest Cd values was reported from Halambagaswewatank in Madwachchiya and Mihintale tank which were below the detection limitation.Thilapiafish obtained from Mihinthale tank showed higher Cd levels (25.6 µg/Kg) than the Thilapia obtained from Sangilikanadarawa tank in Madawachchiya(12.9 µg/Kg). However, these Cd levels of water and fish were below the maximum allowable limit for human consumption according to US environmental protecting agency (EPA) and world health organization (WHO) standards.

Introduction

Sri Lanka has one of the highest densities of reservoirs in the world and about two percent of the area of Sri

Lanka is covered with reservoirs [1]. Metals are natural components in aquatic ecosystem. Most of metals present in ionic form in water and some are bounded to organic and inorganic compounds. Beside these metals particular group of metals are existed in nature they are known as heavy metals. Some heavy metals such as Zn and Cu are needed in micro quantities for organisms but it is obligatory essential for keep life in biota. Whereas some heavy metals such as Cadmium, Arsenic, Mercury and Lead are biologically non-essential and which can be toxic to biota even in very low concentration. These heavy metals could be entered to water bodies through anthropogenic activities and bioaccumulation and biomagnification could be happen and reach toxic amount for human being [2, 3].Meanwhile Cadmium, Arsenic is suspect as the Causal for Chronic Kidney Disease (CkD) that prevalence in north central province of Sri Lanka [4,5].

The main objective of this study is to determine the Cadmium levels in water sources of Halabagaswewavillage and the nearby tank Sangilikandarawain Medawachchiyawhich the area having higher percentage of CKD patients in the North Central Province. Further, the levels of Cd of water in Mihinthale Tank also measured for comparison purposes. The Sangilikandarawa tank is having agricultural runoffs whereas the Mihintale tank is not having any agricultural runoffs as there are no any agricultural fields in tank feeding area.

Material and Methodology

Water sample were collected in August, 2013 from Mihinthale tank, Sangilikanadarawa tank, and Halabagawewa area. Samples were collected into pre acid wash polypropylene bottles and kept in polystyrene box with ice until transported to the analytical chemistry laboratory of the Institute of Post-Harvest Technology (IPHT) of the National Aquatic Resource Research and Development Agency (NARA), Colombo 15. Fish samples were kept in ice and transported into the laboratory and stored in freezer (-25°C) until analysed. Water and fish samples were digested using a Mars CEM XP-1500 (Matthews, USA) microwave accelerated system. 10 mL of conc. HNO_3 was added and allowed 15 min for pre digestion. Digested samples were transferred to 50 mL volumetric flasks and filled up with double distilled water. Spiked samples and reagent blanks were run with each batch. A Spectra AA Varian atomic absorption spectrometer AAS-240 FS (Varian Australia, Pty Ltd, Mulgrave, Victoria) with graphite tube atomizer GTA 120 was used for Cd determinations. The analytical wavelengths used were for Cd is 228 nm and all statistical analysis was conducted using Microsoft Excel 2009 version. Standard quality control material (T/0774, Fapas, UK) was used to validate the results.

Result and Discussion

Cd levels of Mihintale and Sangilikandarawatanks are shown in figure 1 and figure 2. The details of the sources of water from

Halambagaswewa area are given in table 1.

Table 1: Details of water sources of Halabagaswewa village in Madawachchiya

Site No:	Type
Site No:1	Water purification plant (water source is drinking well
Site No:2	Village Tap line (water source : dug well)
Site No:3	Tube wells
Site No:4	Drinking water well (Abundant)
Site No:5	Drinking water well
Site No:6	Village Tank
Site No:7	Drinking water well
Site No:8	Tube wells
Site No:9	Drinking water well
Site No:10	Agro well

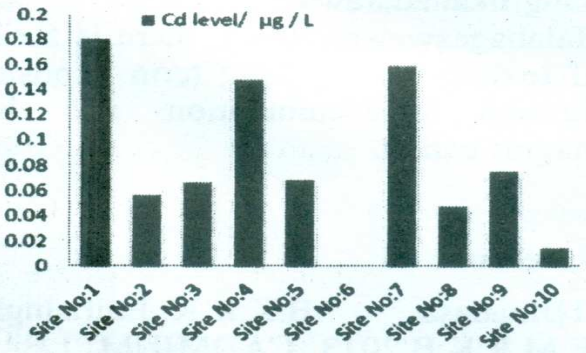

Figure 1. Cd Levels of water sources of Halabagaswewa village in Madawachchiya

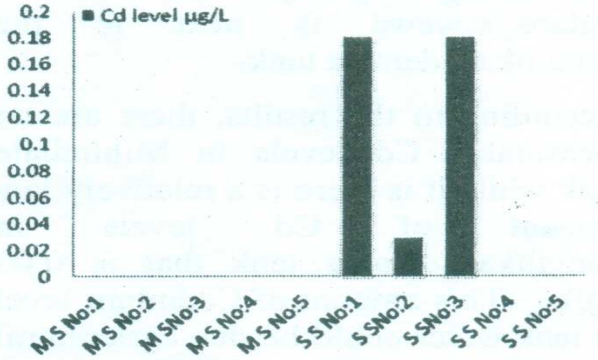

Figure 2.Cd Levels of water in Mihintale and Sanngilikandarawa Tanks bagaswewa village in Madawachchiya

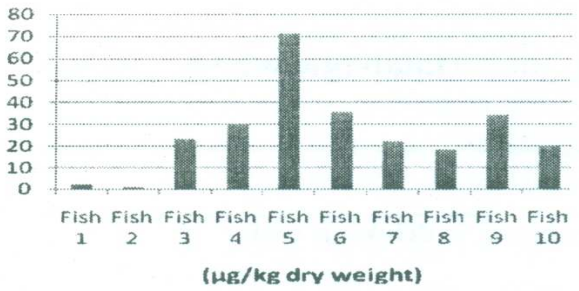

Figure 3. Cd Levels of Thilapia from Mihintale tank

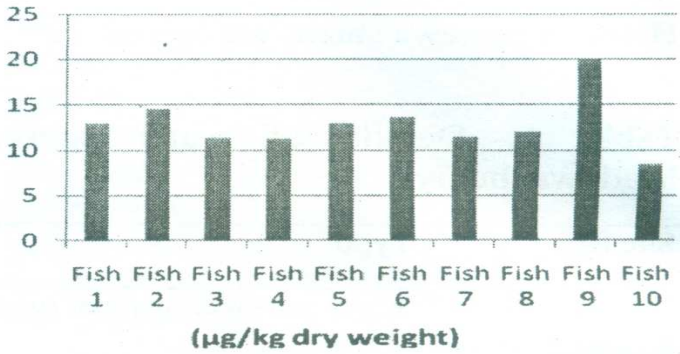

Figure 4. Cd Levels of Thilapia from Sagilikandarawa tank

Recent studies founded that the relatively high chronic kidney disease (CkD) patients reported in Medawachchiya district and Halabagaswewa area is one of the highest hit area of Madachachchiya district and relatively low CKD patients reported in Mihinthale area. Minnthale tank is not exposed to agricultural runoff water meanwhile Sangikanadarawa always enrich from agricultural runoff water came from surrounding paddy lands and Halabagaswewa is next to the Sangilikanadarawa tank.

According to the results, there are no measurable Cd levels in Mihinthale tank while it is there is a relatively law amount of Cd levels in Sangilikanadarawa tank that is 0.05 µg/L . This amount of Cadmium level in tank water could be due agricultural run of water. Further, there is no relatively large variation of Cd level of water purification plant. Among them, the highest Cd was recorded at water shop i.e. 0.1807 µg / L. and the lowest at small tank i.e. is not in detectable limitation to AAS.

According to the EPA (US Environmental Protection Agency), the maximum contamination level of Cadmium in drinking water is 0.005 mg/L. Thilapia fish obtained from Mihinthale tank showed higher Cd levels (25.6 µg/Kg) than the Thilapia obtained from Sangilikanadarawa tank in Madawachchiya (12.9 µg/Kg), and below the maximum allowable limit. Although the maximum contamination level of Cadmium in water and fish obtained from Mihinthale tank, Sangilikanadarawa tank and Halabagaswewasources, there is a risk of toxicity during long term exposure through bioaccumulation and bio magnification.

Reference

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