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SEASONAL STUDY ON BIOACCUMULATION OF HEAVY METAL, LEAD IN VARIOUS TISSUES OF FISH, *HARPODON NEHEREUS* COLLECTED FROM SASSOON DOCK, MUMBAI COAST OF MAHARSHTRA, INDIA.

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ABSTRACT

Fishes are the ecologically important aquatic organisms as it provides an indication of pollution stress in aquatic environment. Harpoon nehereus commonly called Bombay duck and locally called Bombil forms major fishery along west coast of India. Estimation of heavy metals in various tissues of the selected fish helps to determine the extent of pollution in the marine environment. Heavy metals cannot be destroyed by environmental degradation and leads to bioaccumulation of these toxicants in environment and causes deleterious effects on both human and animals consuming these aquatic organisms as a food source. Thus the present study aims to estimate the levels of lead in liver, gill, muscle and brain tissues of Harpodon nehereus during different seasons of the year 2016-17 collected from Sassoon dock, Mumbai coast of Maharashtra. The level of lead in the selected tissues during the pre-monsoon season was found to be in order liver>muscle>gill>brain and the values in all the tissues ranges from 4.25 mg kg $^{-1}$ *to 6.58* mg kg $^{-1}$*, during monsoon season it was 0.4* mg kg $^{-1}$ *to 1.55* mg kg $^{-1}$ *in the order of Gill>liver>brain>muscle and during post-monsoon the order was gill>liver>muscle>brain and the value ranges between 1.25* mg kg $^{-1}$ *to 13.94* mg kg $^{-1}$.

Keywords: *Bioaccumulation, Harpodon nehereus, lead, pollution stress, Sassoon dock.*

I. INTRODUCTION

Aquatic organisms particularly fishes acts as a pollution indicator and thus helps in determining the pollution stress in the aquatic ecosystem. Bombay duck is one of the most common and locally available estuarine fish of west coast of India. It is most consumable fish from west coast of Maharashtra and also provides great source of nutrition to the consumers. Sassoon dock is the oldest and famous fish landing center located in Mumbai from where most of the sea foods are supplied throughout the Mumbai region.

Heavy metals are discharged into the marine environment through urban discharge, agriculture, mining, combustion and industrial discharge and can be taken up by organisms, thus creating a potential source of heavy metal pollution in the aquatic environment [1-6]. Heavy metal pollution is a very serious issue in many countries and is caused by industrial waste disposal into the sea, where it becomes toxic for many marine organisms [7]. Metropolitan cities like Mumbai due to its highest population and large number of industries that generates huge amount of waste water which has to properly treated before its discharge into the sea however many industries discharge their effluents directly into the ocean. Sea foods particularly fishes are commonly consumed as rich source of nutrition and thus lead to transfer toxic metals into the food chain.

Lead is a highly toxic element that has no biological role and causes carcinogenic effects in marine biota [7, 8]. Due to its bioaccumulation properties, heavy metals like lead is toxic even in trace amounts [9,10]. Thus the present study aims to estimate the level of lead in liver, muscle, gill and brain tissues of commonly consumed fish Bombay duck, Harpadon nehereus collected from well-known fish landing center, Sassoon dock, Mumbai during different season of the year 2016-17. The concentration of lead was expressed in terms of mean of each season (Table: 1). Further, their hazardous levels were compared with available certified safety guidelines proposed by Food and Agricultural Organization, 1983 for human consumption [11].

II. MATERIALS AND METHODS:

The fresh fishes measuring 26-30 cm and 160-180 grams were collected from Sassoon dock. The fresh fishes were immediately collected after the landing and brought to the laboratory in ice box. Fishes were dissected under sterile conditions to remove the liver, gill, muscle and brain tissues respectively. 0.1 g of Tissue was taken and 4 ml of conc. HNO_3 was added to it and heated on hot plate. When it started boiling 1 ml of $HClO_4$ was added and heating continued to destroy the organic matter from the sample. Samples were then diluted with 5 ml distilled water to make the total volume to 10 ml. Concentration of lead was evaluated by using ICP-AES (Inductively coupled Plasma Atomic Emission Spectroscopy). Entire experiment including additions of chemicals was performed in a sterile condition and the chemicals used for the analysis were of AR grade.

III. FIGURES AND TABLES:

Table 1: Seasonal variation of lead content in liver, gill, and muscle and brain tissues of *Harpodon nehereus* collected from Sassoon dock, Mumbai during the year 2016-17.

Tissue sample	Concentration of Lead during different season (mg kg $^{-1}$)		
	Pre-monsoon	Monsoon	Post-monsoon
Liver	6.58± 1.47	0.85 ± 0.07	11.8 ± 8.34

Gill	4.46 ± 3.07	1.55 ± 1.62	13.94 ± 12.78
Muscle	6.4 ± 1.90	ND	1.25 ± 0.07
Brain	4.25 ± 0.56	0.4 ± 0.28	ND

Values are expressed as mean ± standard deviation

ND means the values not detected i.e. less than 0.01

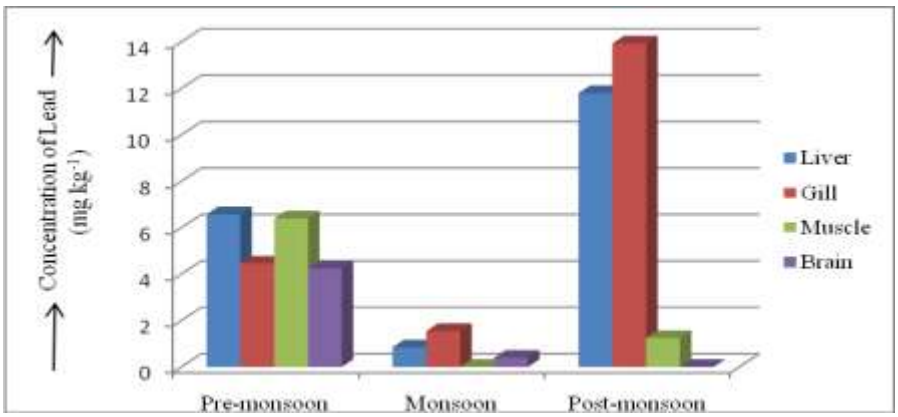

Fig 1: graph showing the difference between the concentration of lead during various season

Fig 2: Fresh species of *Harpodon nehereus* collected from popular fish landing center, Sassoon dock, Mumbai

IV. RESULTS AND DISCUSSION

In polluted aquatic habitats the concentration of metals in the fish muscle may exceed the permissible limits for Human consumption and imply severe health threats [12]. The maximum permitted lead level determined by FAO (1983) is 0.5 mg kg^{-1} [3,9,13,14]

In the present work, the amount of lead was found to be highest in liver during the pre-monsoon season in the fish, Bombay duck with the mean value of 6.58 mg kg^{-1}, in muscle it was 6.4 mg kg^{-1}, in gills it was found to be 4.46 mg kg^{-1} and in brain the value was 4.25 mg kg^{-1}. Concentration of lead in all the tissues was more than the maximum permissible limit set by FAO, during the pre-monsoon season. In the Monsoon season the concentration of lead in muscle and brain tissues were found to be lower than maximum permissible limit set by FAO however in liver and gill tissues the amount of lead was 0.85 mg kg^{-1} and 1.55 mg kg^{-1} respectively, which was higher than FAO permissible limits. During the post-monsoon season the level of lead was found to be highest in the gill and liver tissues of the fish with the mean value of 13.94 mg kg^{-1} in gills and 11.8 mg kg^{-1} in liver and in muscle tissues the level of lead was 1.25 mg kg^{-1} all of which were found to be higher than the maximum permitted limit set by FAO, 1983 [11]. Heavy metal gets accumulated in organs like gills and liver leading to increase their concentration in these tissues. Higher accumulation of heavy metal in Liver may alter the levels of various biochemical parameters in liver [15, 16]. Metals like lead (Pb) have long been known to accumulate within the aquatic food chain [17]. These metals accumulate in the tissues of aquatic animals, therefore heavy metals measured in the tissues of aquatic animals reflect past exposure [13].

Similar observations of increase in lead concentrations above the acceptable values for human consumption was recorded by various authors in their study. M. Kalay, 1999 [18] observed increase in Pb concentration i.e., 7 mg/kg in fish tissues from northeast Mediterranean sea; P. Sivaperumal, 2007 [14] recorded, increased Pb concentration in 25% of the fishes from internal markets of India, ranging from 01–1.32 mg/kg in their edible portion; Meltem Dural,2007 [13] obtained highest metal accumulation in liver and gill tissues of fish species with the lead concentration of 6.75 µg/g. Presence of higher concentration of Pb in edible fish was also observed by Abhijeet patil,2016 [19].; M. Canli, 2003 [8] also obtained higher concentrations of lead in the liver and gill tissues of Mediterranean fish species.; E.O. Farombi,2007 [20] recorded increased concentration of lead in liver tissue of African Cat fish from Nigeria Ogun River.; Khalifa, 2010 [21] reported the increased lead concentration of upto 2.38 mg/kg in fish species of Mediterranean sea (Libyan coastline). Amani S.,2012 [9] obtained the lead concentration in the range of 2.01–10.49 µg/g in fish, meat from Saudi Arabian markets. Similarly in the present research work, the increased amount of lead was noted in tissues of commonly consumed fish, Bombay duck, *Harpadon nehereus* which was collected from Sassoon dock, Mumbai coast of India.

V. CONCLUSION:

Thus in agreement with the above research work and explanations by various authors and increase in the level of lead in our present work, it can be concluded that the selected fish is at the high risk of damage due to pollution stress in the marine environment. The concentration of lead in the present work was found to be more than the maximum permissible limits in gill and liver tissues of fish, *Harpodon nehereus* during the monsoon season. During the pre-monsoon season it was found to be higher than the acceptable values for human consumption set

by FAO in all the selected tissues. Highest concentration of lead in muscle, liver and gill tissue was obtained during the post monsoon season. The increase in the concentration of lead in different tissues of fish during specific season may be due the process of Bioaccumulation and Bio-magnification. Further study has to be conducted to understand the extent of pollution stress in the marine ecosystem.

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