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Short Communication

STUDY OF CORRELATION BETWEEN DOWNSTREAM STRETCHES AS STUDY SITES IN HOOGHLY RIVER AND LEAD CONTENT IN SEDIMENT AND MUSCLE OF FISH SPECIMEN (*Mystus gulio* HAM. - BUCH.)

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ABSTRACT

The present study was conducted to detect a correlation between Pb content in sediment and muscle of fish (*Mystus gulio* Ham. - Buch.) and downstream stretches (three study sites) of the of the river Hooghly, West Bengal, India. The study sites were selected at Batanagar (Bt), Budge Budge (Bg) and Birlapur (Br) sites. The samples viz. sediment and muscle of fish were collected and estimated by using atomic absorption spectrophotometer. The Pearson correlation coefficient analysis was performed to know the association between these sites and sediment as well as muscle during pre-monsoon season. The study sites observed both significant positive ($P<0.05$) and negative correlation with sediment of river Hooghly at downstream while significant ($P<0.05$) positive correlation was observed between the study sites and muscle of the fish specimen (*Mystus gulio*). The findings pose the risk of accumulation may be lower in fish muscle due to positive correlation, but negative correlation may lead to harmful impact in the study site for sediment. In future, this study may be beneficial to determine the water and sediment quality status in different stations of river Hooghly as well as other metals content in different fish species.

Keywords: Pb metal; Bioaccumulation; Pearson's correlation; Habitat pollution; Estuarine fish; *Mystus gulio*.

1. INTRODUCTION

The lower stretch of river Ganga known as river Hooghly, which is a seasonal river, and it was reported that 80% of drainage discharge occurred during the monsoon (July to October) of Southwest Indian monsoon [1]. After reaching Diamond Harbour, it attains a southward direction and is splitting into two streams before reaching the Bay of Bengal [2, 3].

Several studies have already been reported the discharges of untreated effluents, inputs of agricultural chemicals, discharge of organic matter and chemicals from aquaculture farms, etc. in the different sites of Ganges [1, 2, 4, 5]. Moreover, these may create water and sediment pollution by the presence of inorganic elements, which ultimately accumulate in the vital organs [6-10]. Among several metals, lead (Pb) is well known toxin and genotoxin, causes cancer in different tissues [11]. Many studies have revealed that Pb was accumulated in the vital organs of different fish species [6-10] but no one was attempted to study the bioaccumulation of Pb in *Mystus gulio*, which is consumed by local people as low-cost fish specimen.

The present study was attempted to know the correlation of Pb content in sediment and muscle of fish (*Mystus gulio* Ham. - Buch.) between habitat (study sites) of the downstream of river Hooghly, West Bengal, India.

2. MATERIAL AND METHODS

2.1. Selection of study sites

The study sites were selected at Batanagar (Bt), Budge Budge (Bg) and Birlapur (Br) sites in the downstream of river Hooghly, West Bengal, India. Each study area was further divided into two sites (1 and 2). The study sites are the part of suburban area near Kolkata and located at 22°30′N and 88°13′E, 22°29′N and 88°11′E, and 22° 24′N and 88°08′E latitude and longitude, respectively.

2.2. Selection of fish specimen

The fish species was selected commonly known as *Gulse tangra* and scientific name *Mystus gulio* (Hamilton -

Buchanan, 1822) is a catfish under family Bagridae of order Siluriformes (Fig 2). It is known as *Gulse tengra* in Bengali, which has been reported to be distributed in India, other parts of Southeast Asia. This fish specimen is an eryphagous feeding behaviour with wide range of food preference [12].

2.3. Sediment sampling

The sediment samples were collected from the three different zones of study sites. After collection, it was transported to the laboratory for analysis of lead (Pb).

2.4. Fish muscle sampling

The fish specimen *Mystus gulio* were collected from nearby fish catcher/seller along the bank of river Hooghly. The fishes were ranging from 17-25 cm in length and weighing between 80-100 gm. All the fishes were collected just died and muscles were dissected out as per earlier study for Pb analysis [9].

2.5. Pb estimation

The method of Pb analysis in sediment and fish muscle was done as per earlier study by using AAS [9].

2.6. Analysis of correlation coefficient

The Pearson correlation coefficient was analyzed to determine significant association between different parameters of habitat (study sites) and sediment as well as muscle of test specimen during pre-monsoon. All the data were considered the significance level at $P<0.05$ by using statistical software, PAST (PAleontological STatistics) software (version 3.26) developed by Hammer et al. [13].

3. RESULTS

The associations with the Pb content of sediment and different study sites by analyzing Pearson's correlation coefficient during pre-monsoon (Table 1). In the case of Pb content in the sediment vs. study sites, the site Bt1 is negatively significantly ($P<0.05$) correlated with the sediment of site Bg1 (-0.9509). The site Bt2 is negatively significantly ($P<0.05$) correlated with the sediment of sites Bg1 (-0.9942), Bg2 (-0.9996), Br1 (-0.9945) and Br2 (-0.9973), respectively. The site Bg1 is positively significantly ($P<0.05$) correlated with the sediment of sites Bg2 (0.9907), Br1 (0.9991) and Br2 (0.9929), respectively. The site Bg2 is positively significantly ($P<0.05$) correlated with the sediment of sites Br1 (0.9918) and Br2 (0.9972), respectively. The site Br1 is positively significantly ($P<0.05$) correlated with the sediment of site Br2 (0.9961).

The associations with the Pb content in the muscle of fish specimens and different study sites by analyzing Pearson's correlation coefficient during pre-monsoon is presented in Table 2. In the case of Pb content in the muscle vs. study sites, the site Bt1 is positively significantly ($P<0.05$) correlated with the muscle of fish specimens of Bt2 (-0.9999). The site Bg1 is positively significantly ($P<0.05$) correlated with the muscle of fish specimens of Bg2 (0.9995). The site Br1 is positively significantly ($P<0.05$) correlated with the muscle of fish specimens of Br2 (0.9956).

Table 1: Correlation matrix between habitat and sediment for Pb during pre-monsoon

	Bt1	Bt2	Bg1	Bg2	Br1	Br2
Bt1	1					
Bt2	0.9152	1				
Bg1	-0.9509*	-0.9942*	1			
Bg2	-0.9029	-0.9996*	0.9907*	1		
Br1	-0.9413	-0.9945*	0.9991*	0.9918*	1	
Br2	-0.9082	-0.9973*	0.9929*	0.9972*	0.9961*	1

**P<0.05*

Table 2: Correlation matrix between habitat and muscle of fish for Pb during pre-monsoon

	Bt1	Bt2	Bg1	Bg2	Br1	Br2
Bt1	1					
Bt2	0.9999*	1				
Bg1	-0.7251	-0.7437	1			
Bg2	-0.7241	-0.7435	0.9995*	1		
Br1	0.2354	0.2105	0.1828	0.1892	1	
Br2	0.1759	0.1486	0.2559	0.2637	0.9956*	1

**P<0.05*

4. DISCUSSION

The river Hooghly harbours many fish species, which are edible for human beings and many investigators have already been established Pb metal accumulation in vital organs of fish [1, 3-10].

The studied fish specimen feeds on wide range of food items such as phytoplankton, zooplankton, insects, and their larvae, etc. [12] in which major food items are adhered with the sediment. Due to the feeding habit of studied fish specimen, there is a possibility of continuous topical exposure of Pb in the skin, muscle, gills, etc., which has close similarities with other fish species reported [6-8]. Thus, present study was conducted to know the correlation between study sites and Pb in sediment as well as in muscle. An earlier study indicated that correlations between sites and sediment, and also accumulation of metals in fish provides the knowledge of the distribution of metals in sediments and fish related to anthropogenic pollution and threat to the environment and the high correlation could be described about the geology of the area [14]. In the present findings, the Pb content for the study sites are negatively correlated related to the sediment except Bg1, Bg2 and Br1 showed positive correlation while the Pb content for the study sites are positively correlated with muscle. According to Klake et al. [14], higher value of correlation known minimum chance of anthropogenic activities. It was also described that significant positive correlation is confirmed the existence of homogeneity between the presence of metals in sediments as well as fish muscle [15]. A recent study found a significant negative correlation between the Pb content and body length of the different fish species [16].

5. CONCLUSIONS

The study sites observed both significant positive and negative correlation with sediment of river Hooghly at downstream while significant positive correlation was observed between the study sites and muscle of the fish specimen (*Mystus gulio*). The findings pose the risk of accumulation may be lower in fish muscle due to positive correlation, but negative correlation may lead to harmful impact in the study site for sediment. In future, this study may be beneficial to detect the water and sediment quality status in different stations of river Hooghly as well as other metals content in different fish species.

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Conflict of interest

No conflict of interest in the present study.

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