

# Toxicity of Cadmium and Lead on Biochemical Constituents of Estuarine Clam *Anadara rhombea*

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## ARTICLE DETAILS

### Article History

Published Online: 10 December 2018

### Keywords

*Anadara rhombea*, Cadmium, Lead, Free Sugar, Proteins and Lipids

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## ABSTRACT

In the present investigation the impact of heavy metals cadmium and lead on the biochemical constituents like free sugar, proteins and lipids were studied. The amount of free sugar in mantle, gill and foot muscle was found to be increased, whereas the digestive gland had decreased amount of free sugar. The amount of protein was observed to be increased in all the organs of cadmium and lead exposed clams. Lipid concentration was decreased in all the organs of *Anadara rhombea* including the digestive gland. It is suggested that the slashed down of lipid could be due to its mobilization to resist the metal toxicity.

## 1. Introduction

Heavy metals pose a serious threat to the aquatic environment because of their toxicity, persistence, tendency to accumulate in organisms and undergo food-chain amplification. They cause severe damage to the aquatic fauna, including fishes, thereby tilting upon their health and population. They affect the activity of biologically active molecules such as lipids, amino acids, co-enzymes and other protein containing sulphur, phosphorus, nitrogen or oxygen (Ghosh and Chatterjee, 1985) Lead, one of the heavy metals widely used by industries has become a subject of biological interest due to its potential pollutional properties (Jha, 1991).

Chemical manufacturing industries, food, beverage and pharmaceutical industries, textile industries, materials industries, energy and power related industries, services industries and agricultural runoff. Water pollution may also be from industrial effluent, domestic sewage, drainage and pesticides, which polluted the rivers and major water sources. The United States Environmental protection Agency (EPA) has listed 129 toxic substances for immediate hazard assessment, which now proves to be threatening to the aquatic organisms (Ramakrishnan, 1993). In this perspective that the present work was undertaken to evaluate the toxicological effect of cadmium and lead on the biochemical composition of selected tissues of *Anadara rhombea*.

## 2. Materials and Methods

### Collection of sample

The experimental animal *Anadara rhombea* was collected from Muthupet estuary and was allowed to acclimatize in the laboratory condition for two days.

### Preparation of solution

Test solutions of 10%, 25% sub-lethal concentrations, cadmium and lead were prepared by using 96 hours LC<sub>50</sub> concentration as stock solution (100%).

### Experimental designs

Ten healthy clams were introduced into a plastic tub containing 5 liters of the test concentrations of cadmium and lead. Simultaneously a control was maintained with habitat water. After 96 hours of exposure, treated and control clams were sacrificed. The dissected tissues mantle, gill, digestive gland and Foot muscle were used for their bio-chemical compositions.

### Bio-chemical estimation

The estimation of free sugars was done by following the method of (Roe, 1955). The colorimetric procedure of Lowry et al., (1957) was suitably adopted for protein estimation. The extraction of lipid was done as per the method of Folch et al., (1957) and the estimation was followed as described by Branes and Black stock, (1973).

## 3. Results

The results of the effect of cadmium and lead on the biochemical constituents of mantle, gill, digestive gland and foot muscle of *Anadara rhombea* were presented in the Tables - 1, 2 and 3. Free sugar was found to be increased in the mantle, gill and foot muscle.

The increase in the amount of free sugar increased with the concentration of heavy metal. In cadmium exposed clams, increase in free sugar level was much higher than the lead exposed clams. (Table-1) on the other hand the free sugar content in the digestive gland decreased with increase in metal concentration.

**Table 1: Mean value of free sugars (mg % in different organs of *Anadara rhombea* exposed to 10 %, 25 % sub lethal concentration of cadmium and lead.**

Organs	Control	Cadmium		Lead	
		10%	25%	10%	25%
Mantle	*6.44 ± 0.01	8.76 ± 0.046	7.92 ± 0.041	8.06 ± 0.062	7.12 ± 0.11
Gill	6.14 ± 0.32	8.54 ± 0.02	7.38 ± 0.023	7.85 ± 0.118	7.03 ± 0.016
Digestive gland	8.42 ± 0.018	7.23 ± 0.042	7.68 ± 0.017	7.44 ± 0.076	7.86 ± 0.034
Foot muscle	7.26 ± 0.027	8.68 ± 0.024	7.59 ± 0.036	8.02 ± 0.022	7.21 ± 0.014

\* Mean of 5 replicates ± Standard deviation

The amount of protein in all the organs increased with increase in concentration of metal when compared to control

clams (Table-2). Cadmium exposed clams have increased level of protein than the lead exposed ones.

**Table 2: Mean value of protein (mg %) in different organs of *Anadara rhombea* exposure to 10% 25% sub-lethal concentration of cadmium and lead.**

Organ	Control	Cadmium		Lead	
		10%	25%	10%	25%
Mantle	*9.78 ± 0.032	11.62 ± 0.027	12.73 ± 0.059	10.87 ± 0.063	12.24 ± 0.014
Gill	9.42 ± 0.033	11.92 ± 0.024	13.08 ± 0.063	11.37 ± 0.1025	12.68 ± 0.036
Digestive gland	12.57 ± 0.026	13.56 ± 0.016	16.53 ± 0.023	12.98 ± 0.173	14.92 ± 0.022
Foot muscle	10.32 ± 0.083	11.89 ± 0.023	14.17 ± 0.048	11.08 ± 0.043	13.86 ± 0.029

\* Mean of 5 replicates ± Standard deviation

Concentration of lipid in all the selected organs decreased with increase in metal concentration. The decrease in lipid

concentration was much higher in cadmium-exposed clam when compared to lead exposed ones (Table-3).

**Table 3: Mean value of lipid (mg %) present in different organs of *Anadara rhombea* exposure to 10%, sub-lethal concentration of 25% cadmium and lead.**

Organs	Control	Cadmium		Lead	
		10%	25%	10%	25%
Mantle	*4.06 ± 0.023	3.72 ± 0.061	3.21 ± 0.014	3.89 ± 0.039	3.48 ± 0.104
Gill	3.51 ± 0.037	3.34 ± 0.019	3.03 ± 0.031	3.39 ± 0.025	3.21 ± 0.047
Digestive gland	4.85 ± 0.032	4.06 ± 0.023	3.73 ± 0.043	4.12 ± 0.322	3.86 ± 0.061
Foot muscle	3.62 ± 0.014	3.32 ± 0.094	3.13 ± 0.058	3.36 ± 0.033	3.29 ± 0.026

\* Mean of 5 replicates ± Standard deviation

#### 4. Discussion

In the present investigation the impact of heavy metals cadmium and lead on the biochemical constituents like free sugar, proteins and lipids were studied. The amount of free sugar in mantle, gill and foot muscle was found to be increased, whereas the digestive gland had decreased amount of free sugar. Significant increase in the free sugar value could be to tolerate the metal stress and might have been mobilized from the digestive gland. The increase in free sugar level is in accordance with the work of Ramalingam, (1988); Kannan, (1996); Kumarasamy and Karthikeyan, (1999); and Periyasamy, (1999). In the present investigation, depletion of free sugar was noticed in the digestive gland and could be attributed towards the mobilization of stored form to counteract the stress caused by metal. The above observations have been favored by Shankar et al., (1992); Samitta Rani and Dua, (1999).

The amount of protein was observed to be increased in all the organs of cadmium and lead exposed clams (Table-4). Bhakthavatchalam (1980) made an observation of high protein content in *Anabas testudineus* exposed to sublethal concentration of Disastrous liver and explain that the high protein was due to greater amount of enzymes in the liver to defy the heavy metal stress. Similar observation was made by (Subramanian and Chellappa, 1988) in the fish *Sarotherodon*

*mossambicus* exposed to chromium. Kumarasamy and Karthikeyan (1999) have observed elevated level of protein in the digestive gland of *M. casta* subjected to synergistic stress of cadmium and salinity.

Lipid concentration was decreased in all the organs of *Anadara rhombea* including the digestive gland. It is suggested that the slashed down of lipid could be due to its mobilization to resist the metal toxicity. Trivedy and Goel (1986) have attributed the decreased level of lipid towards stress, which has been mobilized to meet the energy need and also due to lipolysis or the toxic compounds, in mitochondria would have impaired the functions of TCA cycles and fatty acid metabolism.

#### 5. Conclusion

The impact of the heavy metals showed a significant effect in the biochemical composition of the tissues in mantle, gill, digestive gland and foot muscle. The amount of free sugar and lipid increased with the increase in concentration of metals. But the protein level decreased with increase metal concentration. The effect was high in the cadmium exposed clams than the lead exposed ones.

**Acknowledgements**

Authors are grateful thanks to the UGC New Delhi, Principal, Head of the Department and other staff of Zoology,

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Rajah Serfoji Govt. College, Thanjavur, India for providing necessary facilities.