Role of phytoextract (*C.Sativum*) on Mercury Chloride ($Hgcl_2$) induced alterations, on Catalase content of fresh water Bivalve *Lamellidens consobrinus*

Dr. Mayura S. Patil

Department of Zoology K.S.K.W Art Science & Commerce College CIDCO Nashik

Abstract

The salts of heavy metal, released from commercial, industrial sources passes into aquatic ecosystem. Heavy metals are most hazardous pollutants because of their non-degradable nature. The heavy metals enter into body of aquatic animals and reaches up to non target animal i.e. man through the food chain. Oxygen consumption of animal is a very sensitive physiological process and changes in respiratory activity indicate the stress in pollutant exposed animals. The present work conducted, to study the effect of coriander extract on Mercury induced toxicity on Catalase activity in the fresh water Bivalve *Lamellidens consobrinus*. The effect was studied under five groups. Bivalves of Group 'A' was maintained as Control, group 'B' Bivalves were exposed to chronic $LC_{50/10}$ dose of Mercury chloride (0.170 ppm) ,while group 'C' Bivalves were exposed to respective chronic concentration of Mercury chloride along with 5 ml/lit of coriander extract for 18 days. Catalase content in Bivalves from all groups were estimated after 6, 12 and 18 days. After 18 days exposure to Mercury chloride Bivalves from 'B' group was divided into two groups into 'D'&'E' groups. Bivalves of 'D' group were allowed to cure naturally while those of 'E' were cured with coriander extract (5 ml/lit). Catalase content in bivalves from these D & E groups was studied after 6, 12& 18 days. Significant decrease in Catalase content was observed in 'B' group bivalves as compared to group 'A' (control). The group 'C' bivalves showed more Catalase content than those group 'B' bivalves. The group 'E' bivalves showed fast recovery and more Catalase content with coriander extract than those of group 'D' bivalves which were allowed to cure naturally. Catalase content was estimated by Aebi (1974) et.al method.

Key words: - *Lamellidens consobrinus*, toxicity, ppm, Mercury chloride Coriander extract, Catalase content

Introduction

The excess contamination of organic and inorganic contaminants creates aquatic pollution, which has altered its water quality and adversely affected the biodiversity of the river (Adeyeye, 2004). Pollution is the global problem in front of mankind, amongst which heavy metal pollution is a major concern. The heavy metals have prolonged persistence i.e. non-biodegradability in nature. Excess deposition of heavy metals and its accumulation in organism causes the toxic effect on the body (Kaur, 2012 and Kwon, 2001). The major source of contaminants is untreated or partially treated effluents of the industries, which directly discharged into the

river streams (Sehgal, 2012). Under the normal physiological condition, a balance maintained between generation and neutralization of reactive oxygen species (ROS). However, when organisms are subjected to xenobiotic compounds, the rate of production of ROS, such as superoxide anion radicals (O2 •−), hydrogen peroxide (H2O2), hydroxyl radicals (•OH) and peroxyl radicals (ROO−) exceeds their scavenging capacity (Halliwell and Gutteridge, 2007). All organisms have their own cellular antioxidative defense system (ADS), with both enzymatic as well as nonenzymatic components. An enzymatic pathway consists of the main enzyme, catalase (CAT). CAT catalyzes the molecular O2− molecules to H2O2 which is reduced to water. The enzyme which is a scavenger of ROS, as well as a substrate for other enzymes. Some of these parameters could serve as stress indicators in animals exposed to environmental contaminants. Antioxidant defence enzymes (ADS) assume an essential part of keeping up cell homeostasis. Advertisements might be prompted after the presentation of poisons, this reaction mirroring an adjustment of the species to their condition.This framework may likewise be repressed, which may prompt cell reinforcement interceded toxicities (Winston and Di Giulio, 1996; Doyotte et al., 1997; Cossu et al., 1997). Antioxidative barrier proteins and non-enzymatic parts of ADS have been proposed as a biomarker. Freshwater bivalves are an environmentally critical fauna since they are utilized as delicate biomarkers of oceanic biological communities' contamination. Hence, bivalve such as *Lamellidens consobrinus* fulfill the requirements which make them useful bioindicators of chemical pollution. CAT is very important enzymes of the ADS in freshwater organisms. Many studies have shown positive correlations between levels of antioxidant defenses and the influence of environmental conditions (Orbea et al., 2002). The digestive gland was selected according to their function in the regulation of body metabolism. The body possesses several defense systems comprising enzymes and radical scavengers.

MATERIALS AND METHODS

Preparation of heavy metal and plant extract- mercury chloride stock solution of 200 ppm was prepared. Coriander extract-Preparation of aqueous extract of *Coriandrum* Soxhlet technique. Treatment with heavy metal salt - The selected model animals, the freshwater Bivalves, *Lamellidens consobrinus* were collected from Darana River, Nasik. After collection, the bivalves were acclimatized in the laboratory condition at roomtemperature for 2-3 days. The active acclimatized bivalves of around same size and weight were selected for the experiment. Before starting the experiment, these bivalves were divided into group 'A' animals were maintained as control, group 'B' animals were exposed to the chronic doses of heavy metal salts Mercuric chloride (0.179 ppm), up to 18 days while group 'C' bivalves were exposed to the chronic dose of Mercuric chloride (0.179 ppm), with coriander extract (5 ml/lit) separately up to 18 days. After exposure of 18 days to Mercuric chloride (0.179 ppm) the bivalves from group 'B' were divided into two subgroups 'D'and 'E' group respectively. Bivalves from group 'A','B','C', D'and 'E' of heavy metal salt, at 6 days interval were removed and were dissected on the ice after 6, 12 and 18 days. The hepatopancreas tissues were removed. The removed wet tissue of hepatopancreas was homogenate in the blender with M/150 phosphate buffer at 1-40c

and centrifuge. Stir sediment with cold phosphate buffer and allows standing in the cold with shaking occasional then repeating the extraction once or twice and using the supernatant for assay of catalase. Catalase (CAT) movement was resolved by Aebi (1974) by observing the reduction in absorbance of H_2O_2 at 240 nm and catalase action was communicated as nkat/mg protein (1kat=1mol sec-1).The digestive gland was selected by their function in the regulation of general body metabolism

OBSERVATION AND RESULT

The catalase content data from table 1.1 and Fig. 1.1 indicate that the catalase content in presence of Mercuric chloride (0.179 ppm) in group 'B' animals was found to be decreased with increased in exposure period as compared to the controlled group 'A'. The Catalase Content of the controlled group 'A' bivalves was in the range of 50.2 to 49.6 nkat/mg protein. Catalase content data from table 1.1and Fig. 1.1indicates that in presence of mercuric chloride was in the range of 46.1 to 45.4 nkat/mg protein. The catalase content was more in mercuric chloride with Coriandrum sativum extract exposed bivalves of group 'C' as compared to those exposed to only mercuric chloride at the respective period of exposure. It was noted in the range 47.4 to 47.01 nkat/mg protein. The bivalves, pre-exposed to mercuric chloride showed fast recovery in presence of *Coriandrum sativum* extract than those were allowed to cure naturally in normal water. The catalase content of pre-exposed bivalves of group 'E' with 5 ml/lit of *Coriandrum sativum* extract was in the range of 45.6 to 46.9 nkat/mg proteins. And those allowed to cure naturally in normal water in group 'D' animal was in the range of 45.5 to 45.9 nkat/mg protein.

TABLE 1

Catalase content in *Lamellidens consobrinus* , after chronic exposure to heavy metal salts Mercury chloride without & with Coriander extract.

Table 1.1:- Catalase in *Lamellidens consobrinus*, after chronic exposure to heavy metal salts mercury chloride without & with Coriander extract.

Sr. no.	Tissue	Catalase content					
Treatment		**6 days**	**12 days**	**18 days**	**24 days**	**30 days**	**36 days**
(A) Control	H	50.2(± 0.002)**	49.8(±0.005)**	49.6(±0.0041)**	--	--	--
(B) 0.170 ppm mercury	H	46.1(±0.003)**	45.9(±0.0014)**	45.4(±0.0022)**			

chloride			(-8.1673%)• (-2.7624%)•	(-7.8313%)• (-3.06230)•	(-8.4677%)• (+3.4238%)•	--	--	--
(C) 0.170 ppm mercury chloride +coriander extract 5 ml/lit		H	47.4(±0.042)* (-5.5776%)• (+2.7426%)Δ	47.35(±0.005)** (-4.9196%)• (+3.06230%)Δ	47.01(±0.004)** (-5.2217%)• (+3.4248%)Δ	--	--	--
Bivalves Pre-exposed to HgCl2 (0.170ppm) for 18 days	**(D)**Normal water (recovery)	H	--	--	--	45.5(±0.006)** (-9.3625%)• [+0.22026]□	45.6(±0.007)** (-8.4337%)• [+0.4405]□	45.9(±0.005)** (-7.4596%)• [+1.1013]□
	(E) Water +coriander extract (5 ml/lit)	H	--	--	--	45.6(±0.0048)** (-9.1633%)• [+0.4405]□	45.8(±0.049)* (-8.03212)• [+0.8810]□	45.9(±0.003)** (-7.4596)• [+1.1013]□

H. - Hepatopancreas

N.S. Non-Significant

●- Compared with respective A

* - P < 0.005

Δ - Compared with respective B

** - P < 0.01

□ - Compared with respective 18 days of 'B'

*** - P < 0.001

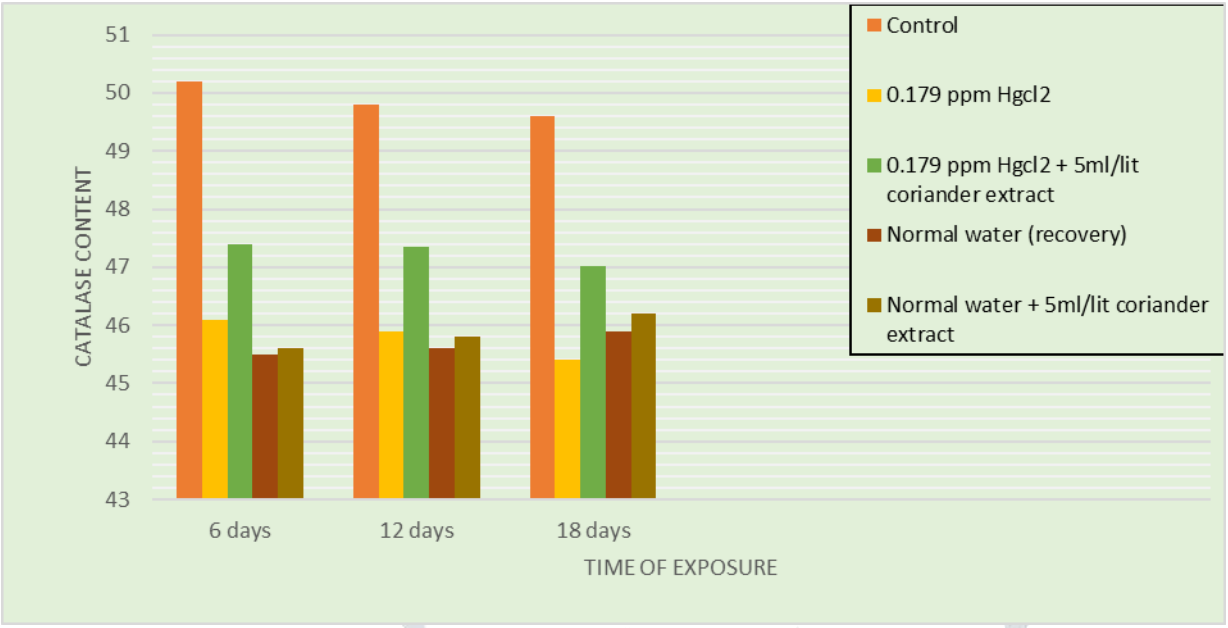
Each value represents a mean of three observations ± standard deviation, The values in () Brackets indicate percent change over with respective days controlvalue. Second ( ) brackets indicate compared with respect to B.Values in [ ] brackets compared with respective 18 days of 'B'.

Graphical representation of table no 1

Catalase content after chronic exposure Scale –on X-axis values time of exposure

Y-axis 1 unit= nkat/mg protein

Fig.1.1 Catalase in *Lamellidens consobrinus*, after chronic exposure to heavy metal salts Mercury chloride without and with Coriander extract.



Discussion

Oxidative stress causes when the balance between prooxidant and antioxidants disturb when prooxidant is more than antioxidant. DNA damage, lipid peroxidation can be induced by reactive oxygen species and leading to chronic health problem such as aging cancer Alzheimers and Parkinsons disease reported by (Floyd R.A. Shetgiri P.P. 2005) studied that though oxygen is essential for life of animal but it is injurious when its percentage is more than 21% in the body. Free radicals attack and induce damage to protein, lipids, and DNA. Free radicals attacks and damage repair systems of the body; which consists of Enzymes and radical scavengers (part of defense system). Antioxidants are compounds which act as inhibitors of the oxidation process that eliminates the threat of pathological process. Phenolic compounds present in the medicinal plant possess strong antioxidant activity flavonoids are known to possess antioxidant antiallergic, hepatoprotective, neuroprotective and anticarcinogenic activities (Aracelis 2003 and Rajanarayana 2001and Nasik S.R. 2003) studied during oxidation free oxygen produces reactive oxygen species (ROS) such as hydrogen peroxide, hydroxyl radicals, and superoxides. ROS are involved in many pathological as well as physiological processes eg. Cell proliferation, differentiation, signal transduction, and apoptosis as well as ischemia inflammation neurodegenerative disorders. (Bland J.S. 1995) reported that ROS production is continuously balanced by natural antioxidative defense system in healthy individuals. Therefore in the recent years the search for natural antioxidants of plant origin. The plant *Coriandrum sativum* extract contains oil linalool which consists of flavonoids, quercetin, monoterpene critrollol camphor, geraniol analyzed by (Karlsen. J. 1971). The

phytochemical analysis of *Coriandrum sativum* showed that it contained essential oil, tannins, and terpenoids, reducing sugars, alkaloids, phenolics, flavonoids, fatty acids, sterols and glycosides (Dr. Ali Esmail Al-Snafi 2016). Coriander has been extensively used in folk medicine for its anti-anxiety, anticonvulsant, antifertility, carminative and antiasthmatic activity (Shyamapada Mandal, Manisha Mandal 2015). Reported the antifungal activity of *Coriandrum sativum*. The present study was done for investigation of the role of coriander extract as the antioxidant (Irlan de Almeida Freires, et.al.2014). The extract of *Coriandrum sativum* contain antioxidants and bioactive compounds.

Research References.

1. Adeyeye E .I. Abulude F .O. (2004). Analytical assessment of some surface and ground water resources in Ile-Ife, Nigeria,Journal of Chemical So ciety , Nigeria.: 39:93.
2. Aebi H. (1982). In Bergmeter HU(ed) Methods in Enzymatic Analysis, Weinheim, Verlag Chemie 3, 273-282
3. Araceli S, Camen RM, et.al. (2003) Assessment of the anti-inflammatory activity and free radical scavenger activity of tiliroside. Eur J Pharmacol; 461: 53-61.
4. Bland JS. (1995)Oxidants and antioxidants in clinical medicine: Past, present and future potential. Journal of Nutritional and Environment Medicine; 5: 255–280.
5. Cossu, c., Doyotte, A.and P. Vasseur (1997) Glutathione reductase, selenium dependent glutathione peroxidase, glutathione levels and lipid peroxidation in freshwater bivalves, Unio tumidus, as biomarkers of aquatic contamination in field studies. Ecotoxicol. Environ. Saf. 38, 122-131.
6. Dr Ali Esmail Al-Snafi (2016) A review on chemical constituents and pharmacological activities of Coriandrum sativum Volume 6, Issue 7 Version. 3 (July 2016), PP. 17-42
7. Floyd RA. (2005) Antioxidants, oxidative stress, and degenerative neurological disorders. Proceedings of the Society for Experimental Biology and Medicine; 222: 236–245
8. Halliwell B, Gutteridge JMC (1990) Role of free radicals and catalytic metal ions in human disease: An overview. Methods in Enzymology; 186: 1–85
9. Irlande AlmeidaFreires, Ramiro Mendonça Murata, et.al. (2014) Coriandrum sativum L. (Coriander) Essential Oil: Antifungal Activity and Mode of Action on Candida spp., and Molecular Targets Affected in Human Whole-Genome Expression .https://doi.org/10.1371/journal.pone.0099086 June 5,
10. Karlsen J, Chingova B, Zwetkov R, Baerheim-Svendsren A(1971) Studies on the essential oil of the fruits of Coriandrum sativum L. by means of gas liquid chromatography XI. Studies on terpens and related compounds. Pharmaceut Weekbl; 106: 296-300.
11. Kaur C, Kapoor HC(2002) Antioxidant activity and total phenolic content of some Asian vegetables. Int J Food Sci Technol.; 37(2): 153–61.

12. Kaur S. and Mehra P. (2012) Assessment of Heavy metals in summer and winter season in river Yamuna segment flowing through Delhi, India. Journal of Environment and Ecology, vol. 3; 1: 149-165.
13. Kwon Y.T. and Lee C. W. (2001) Ecological risk assessment of sediments in wastewater discharging area by means of metal speciation. Microchemical Journal, 70: 255-264.
14. Nasik SR.(2003) Antioxidants and their role in biological functions: An overview. Indian Drugs; 40: 501-15.
15. Orbea, A., ortiz-Zarragoitia, m., and m. cajaraville (2002) Antioxidant enzymes and peroxisome proliferation in relation contaminant body burdens of PAHs and PcBs in bivalvia molluscs, crabs and fish from Urdiabai and Plentzia estuaries (Bay of Biscay). Aquat. toxicol. 58, 75-98
16. Rajnaryana K, Sripalreddy M, et.al.(2001) Bioflavonoids classification, pharmacological, Biochemical effects and therapeutic potential. Indian J Pharmacol; 33:2-16.
17. Sehgal M., Garg A., R. Suresh and Priya Dagar (2012). Heavy metal contamination in the Delhi segment of Yamuna basin. Environmental Monitoring Assessment, 184, 1181-1196
18. Shetgiri PP, D′Mello PM(2003) Antioxidant activity of flavanoids-A comparitive study. Indian Drugs; 40: 567-9.
19. Shyamapada Mandal,et.al.(2015)Coriander (Coriandrum sativum L.) essential oil: Chemistry and biological activity Asian Pacific Journal of Tropical Biomedicine Volume 5, Issue 6, Pages 421–428
20. Winston GW, Moore MN, Kirchin MA, Soverchia C (1996) Production of reactive oxygen species by hemocytes from the marine mussel, Mytilus edulis: lysosomal localization and effect of xenobiotics. Comp Biochem Physiol 113C:221–229