Role of Coriander (*Coriandrum sativium L.*) on Accumulation and Depuration of Mercury in *Bellamya bengalensis(L.*)

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Abstract:

Present study aimed to examine the usefulness of Coriander (*Coriandrum sativium L.*) extract for elimination of heavy metal bioaccumulated in the whole body tissue of the experimental model animal gastropod snail *Bellamya bengalensis (L.)* The accumulation and elimination of mercury (Hg) was examined by exposing the snail *Bellamya bengalensis(L.)* to 0.173ppm ($HgCl_2$) mercuric chloride with and without Coriander (*Coriandrum sativium L.)* extract for 7, 14, 21 days. After 21 days treatment the snails were allowed to cure naturally in normal water and with coriander extract up to 21 days separately. The whole body tissue samples were taken out after every 7 days for metal analysis. There was a gradual increase in heavy metal content with increase in exposure period for mercury. The concentration of mercury during depuration was found to be decreased with increase in period. However the recovery was faster in those which are treated with coriander extract as compaired to those which are allowed to cure naturally in normal water. The aim of present study was to highlight the antioxidation, heavy metal detoxification, elimination and chelating aspects of coriander.

Key words:

Coriander, Heavy Metal, Mercury, Bioaccumulation, Depuration, Gastropod, *Bellamya bengalensis L.*).

Introduction:

Heavy metal pollution in aquatic ecosystem has been recognized as a serious environmental problem .In many cases heavy metals occurs in natural water bodies at levels bellow their toxic threshold, however due to their non degradable nature, such low concentrations may still pose risk of damage via uptake and subsequent bioaccumulation

by organisms, which cannot effectively metabolized and excrete the absorbed metals (Wayker et al. 2013). Metal bioaccumulation can be of importance of public health point of view, especially when a human consumes the accumulators. Secondly, this phenomenon is now being exploited in assessment of environmental quality, in addition to chemical survey of water and sediments (Javanshir and Shapoori 2011).Heavy metals are persistent and non biodegradable and may pose high toxicity on the aquatic organisms. Mercury is considered as toxic metal that causes environmental problems and can be very harmful even at low concentration (Devagi Kanakraj et al. 2009).

As the concentration of metal increases, the accumulation of metal and its damage effect increases (Cain and Louma 1986; Buschiazzoa et al. 2004). Cumulative effects of metals or chronic poisoning may occur as a result of long term exposure.

The gastropod snail Bellamya bengalensis (L.) was chosen to determine the ability for the bioaccumulation of Mercuric chloride ($Hgcl_2$) in their soft parts and to show the extent of their tolerance towards these pollutants in the fresh water ecosystem.

Coriander is a well known herb for its antioxidant properties and contains compounds that are free radical scavengers .Coriander contains the active phenolic acid compounds like caffic acid, chlorogenic acid, vanillic acid, p-coumatic acid, ferulic acid (cis and trans forms) (Rajeshwari et al., 2010, Nambir *et al.*,2010). The flavonoids in coriander leaves have been identified as quercetin (an important free radical scavenger), kaemferol and acaetin (Rajeshwari et al., 2011, Nambir *et al.*, 2010, Deepa *et al.*, 2011). The research of Dr.Yashiki Omura showed that consumption of clientro lowered the level of Mercury in patients via chelation mechanism(Omura,1996).Coriander's antioxidant properties are seen as treatment with SOD, CAT, GPx levels in the tissue of liver and kidney (Sharma , 2011).

In the light of above mentioned medical properties of coriander, this study was carried out investigate the possible protective properties of coriander extract against heavy metal bioaccumulation and elimination from the whole body tissue of model animal Bellamya bengalensis during chronic toxicity treatment of Mercuric chloride.

Material and Methods:

Selection and collection of experimental animals:

The gastropod snail *Bellamya bengalensis* (Viviparus) were collected from the suki dam near Garbardi village Tal.Raver Dist.Jalgaon (M.S.). The gastropods were acclimatized to laboratory condition for 2 to 3 days, before setting the experiments. Water was changed after every twelve hours. Healthy and active animals of approximately same size (25 to 30 mm) and weight were chosen.

Preparation of aqueous leaves extract:

The fresh green leves of *Coriandrum sativium (L)* (1kg) were collected from a local market in Raver. The leaves were dried at atmospheric temperature .After complete drying the leaves were ground to a fine powder of which 100 gm powder was added to 500 ml distilled water After 24 hours maceration was done at room temperature , the mixture was then heated for 30 min. in the water bath at 65^{o}c. The extract was filtered, concentrated by heating over the water bath at (65^{o}c). The extract was stored at 4^{o}c and used to treat animals as needed.

Experimental design:

Healthy and active animals of approximately equal size (25 to 33mm) and weight were selected to avoid the experimental bias during the research work. The acclimatized active gastropods were divided in to three groups as A, B and C. The group 'A' gastropods was maintained as control. The group 'B' gastropods was exposed to chronic concentration of heavy metal salt Mercuric chloride 0.173ppm $HgCl_2$ up to 21 days treatment, The group 'C' gastropod was exposed to chronic concentrations of respective heavy metal and 5 ml/lit. of *coriandrum* extract up to 21 days.

After 21 day's exposure, the gastropod snails from group 'B' were divided in to two sub groups as group 'D' and group 'E'. The snails of group 'D' were allowed to self cure naturally in normal water. The snails of group 'E' were allowed to cure in 5 ml/lit extract of *Coriandrum sativium (L.)* up to 21 days. During experimentation the snails were fed on fresh water algae.

Collection and processing of tissue samples:

The tissue mass of whole body of the gastropod snail, *Bellamya bengalensis* (L.) were collected after every seven days and were dried at 80^{oc} in an oven till constant weight was obtained and stored in air tight specimen bottles by waxing the cork outside. The 50 mg sample was taken for digestion. The tissue was digested in 10 ml of acid mixture of Hcl: HNO_3 in (3:1) ratio on hot plate till dryness. The digested mixture was kept in water bath for 5-7 hour until the samples were cooled. Cool digested samples were filtered (Whatman grade 541). The samples were analyzed on the instrument atomic absorption spectrophotometer (A.S.).

Observation table:

Bioaccumulation of Mercury (Hg) in the whole body tissue mass of the gastropod snail, *Bellamya bengalensis* (L.) after chronic exposure to mercuric chloride 0.173ppm with and without coriander extract and recovery in normal water and in coriander extract has been summarized in table 1.1 and 1.2

Table 1.1. Mercury content (□gm /Kg dry weight) in whole body tissue of *Bellamya bengalensis (Lamark)* after chronic treatment .

Treatment			Hgcontent □gm/Kg dry weight		
			7 days	14 days	21 days
During 21 days exposer0.173ppm Hg Cl_2	A	Control	307	316	309
	B	0.173ppm Hg Cl_2	928 +66.918•	1794 +82.385•	2157 +85.674•
	C	0.173ppm Hg Cl_2+5 ml coriander extract	749 +59.012• -23.898 ®	1057 +70.104• -69.725 ®	1662 +81.295• -30.569 ®

Table 1.2. Mercury content (□gm /Kg dry weight) in whole body tissue of *Bellamya bengalensis (Lamark)* after chronic treatment during recovery.

Treatment			Hg content □gm/Kg dry weight		
			287days	35 days	42days
After21days exposer to 0.173ppm Hg Cl_2	D	Normal water(recovery)	210 +84.726• -7.313 #	1967 +83.934• -9.659 #	1948 +84.137• -10.728 #
	E	Normal water+5 ml/|lit coriander extract (recovery)	1751 +82.467• -23.186 #	1281 +75.331• -68.384 #	1176 +73.724• -83.418 #

•-Compaired with respect to A

Δ - Compaired with respect to B.

*-Compaired with respect to 21 days of B.

Result:

The bioaccumulation data from Table no. 1.1 and 1.2 indicates that the amount of mercury (Hg) accumulated in whole body tissue of animals on exposure to mercury chloride (0.173ppm $HgCl_2$), gets increased with increase in exposure period from 7, 14 and 21 days as compaired to control group 'A'. The mercury (Hg) contents are expressed in µgm/kg dry weight. The control groups of animals showed minute quantity of mercury (Hg) as compaired to the experimental group 'B' and 'C'.

The control group of animals 'A' showed 307.0 µgm/kg mercury in whole body tissue, while the amount of accumulation of mercury in presence of mercuric chloride (0.173 ppm) in the snails group 'B' for 7 days was 928.0µgm/kg. The concentration in the tissue was raised after 14 days which was 1794.0µgm/kg. While after 21 days the rate of accumulation was 2157.0µgm/kg. There was a minute change in the accumulation in control group animals. The rate of accumulation was lower in $Hgcl_2$ and coriandrum sativium extract (5 mg/lit) exposed snail groups 'C' as compaired to those exposed to only $Hgcl_2$ treated group 'B' in respective period of exposure and for 7 days it was 749.0 µgm/kg, after 14 days it was 1057.0 µgm/kg, while after 21 days it was 1652 .0 µgm/kg.

The gastropod snail, Bellamya bengalensis pre exposed to mercuric chloride (0.173 ppm), showed fast detoxification and recovery in presence of coriandrum sativium extract (5 mg/lit.) than those allowed to cure naturally in normal water. The accumulation as observed after 28 days was 1751.0µgm/kg., after 35 days was 1281.0µgm/kg., while after 42 days the amount of mercury was 1176.0µgm/kg. and those allowed to cure naturally in normal water , the rate of accumulation observed for 28 days was 2010.0 µgm/kg., after 35 days , it was 1967.0 µgm/kg. While after 42 days the concentration of accumulated Hg was 1948.0µgm/kg.

Discussion:

Many workers found that the accumulation patterns of heavy metals are dependent on both uptake and elimination rates (Hakman 1984, Goma *et.al.* 1995).The accumulation of metals in aquatic invertebrates can be divided in to three phases 1) Metal intake, 2) Metal transport, distribution , and sequestration (detoxification) with the organism and 3) Metal excretion (present/ absent).Accumulation strategies of invertebrates vary intra specifically between metals and inter specifically for the same metal in closely related organisms (Rainbow; 2002).

High cost modern medicines and many side effects of these medicines lead people to switch around from modern medicines to herbal medicines for the treatment of many infectiocious diseases (Ambuja s.k.s.; 2012). Mitra et.al (2012) reported that the coriander leaves are rich in photochemical such as poly phenol, carotinoids and essential oils like linalool which shows higher free radical scavenging activity.

In present study the accumulation of heavy metal mercury in the whole body tissue of *Bellamya bengalensis (L.)* was found to have similar pattern to that report previously for several gastropod species exposed to various concentrations of heavy metals. In response to increased concentrations of mercury chloride, high level of mercury was observed as compaired to control group of animals. The gastropod snail *Bellamya bengalensis (L.)* pre exposed to chronic concentration of mercury chloride along with 5 ml/lit *Coriandrum sativium (L.)* extract showed the poor bioaccumulation as compaired to exposure of chronic concentration of respective heavy metal only. *Bellamya bengalensis (L.)* pre exposed to mercury chloride showed fast detoxification recovery in presence of *Coriandrum sativium (L.)* than those allowed to cure naturally in normal water.

Significance of study:

The present proposed research work would be useful as, to provide protective and curative measures against heavy metal toxicosis, to provide the knowledge about interaction of coriander extract with heavy metals in to the body, to provide the knowledge about importance of coriander in preparation of food, to provide the safe remedy to the peoples living in heavy metals affected areas. In city's automobile exhaust

release lead and hence content in air is high. This study may give protective and curative use of coriander.

Conclusion:

The coriandrum sativium extract shows free radical scavenging and chelating activity against heavy metal bioaccumulation and removes the heavy metal bioaccumulated in the body.

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References:

1. *Ambuja S.S., Shah R.K. (2012*): Int. J. Pharm. Inn*, 2(2):17-18.
   Buschiazzoa E, Metian M, Borne V, and Warnu M (2004):Influence of ambient dissolved metal concentration on their bioaccumulation in two trophical oysters . International conference on isotope in environmental studies. Monte Carlo (Monaco), 25-29.
2. Bhat S., Kaushal P,. Kaur M,. and Sharma H.K. (2014) Coriander (Coriandrum sativium L.):Processing , nutritional and functional aspects. African journal of plant science 8(1) 25-33.
3. Cain D.J. and Louma S.N.(1986): Effect ofseasonally changing tissue weight on trace metal concentrations inn the bivalve Macoma balthica in San Rrancisco Bay . Mar. Ecol. Prog. Ser, 28: 209-217.
4. Devaji Kanakaraju and Arfiziah Anur (2009): Accumulation and depuration of lead and chromium using *Nerita Lineata*. *World Appl. Sci. J*. 6 (9): 1205-1208.
5. Deepa B. and Anuradha C.V. (2011): Antioxidants potential of *coriandrum savium (L)*. Seed extract. *Ind. J. of experimental biology*, Vol.49:30-38.
6. Gomma M.N.E., Badawy A.E.and Nagnib K. (1995): Level of some heavy metals in different Egyptian fishes from fresh and marine environments. J. *Envoiron. Arab Biol.* 3(4): 177-195.
7. Hakanson L. (1984): Metals in fish and sediment from the river Kolbackson water system Sweden Ach, *Hydrobiol.* 101:173-400.

8. JavanshirA and ShappooriM (2011): Influence of water hardness(Calcium concentration)on the absorption of cadmium by mangrove oyster Crassostrea. J. Food ,Agriculture and environment .9(2):725-727.
9. Mistra E., Ghosh A.K., Ghosh D., Datta S. (20112): *Food Chem. Toxicology*, 50:1340-1353.
10. Leena Kansal , Arti Sharma ,Sweta lodhi (2012): Remidial effect of Coriandrum sativium (coriander) extract on lead indused oxidative damage in soft tissues of swiss albino mice . Int. Jar. Pharmaceutical Science .4(3)729-737.
11. Omura Y. , Shimotsuura Y. , Fukuoka A. , Fukuoka H. and Nomoto T.(1996): Significant mercury deposites in internal organs following the removal of dental amulgum and development of pre-cancer on the gingiva and the sides of tongue and their represented organs as a result of invedertent exposure to strong curing light (used to solidify synthetic dental filling material) and effective treatment: A clinical case report, along with the organ representation areas for each tooth ., *Acupunct Electrothr Res*. , 21(2): 133-160.
12. Rainbow P.S. (2002): Trace metal concentrations in aquatic invertebrates: Why and so what, *Environ. Polut*, 120:497-507.
13. Sharma V., Sharma A, Kansal L., Lodhi S. (2011): Protective role of coriandrum sativium extract against lead nitrate indused oxidative damage in the liver and kidney in malle mice .Intr Appl Bio Pharma Tech .2:21 -24
14. Wayakar Bhalchandra and Petare Ram (2013): Bioaccumulation of heavy metals in fresh water snail Bellamya bengalensis and Lymnea accuminata from Malegaon wet land of dhule district (M.S.) India.The bioscan, 8(3): 1043-1047.

* Indicates original is not referred.