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Research Article

CURE OF HEAVY METAL NICKEL INDUCED ALTERATIONS, IN AN EXPERIMENTAL MODEL, LAMELLIDENS CONSOBRINUS BY EXTRACT OF CAPSICUM-ANNUM LINN

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ABSTRACT
The present study describes the antioxidant role of *Capsicum annum L.* extract against nickel chloride induced toxicity in an experimental model, the freshwater mussels, *Lamellidens consobrinus.* The effect of mussels was studied under five groups. Group A was maintained as control, Group B mussels were exposed to chronic $LC_{50/10}$ doses of Nickel Chloride (0.34 ppm) for 21 days, while group C mussels were exposed to respective chronic concentrations of heavy metals with 5 ml/lit of extract from C*apsicum annum L.* Rates of O_2 consumption from all groups were estimated after 7,14, and 21 days. Mussels from group B were divided into two groups after 21 days exposure to heavy metal into D & E group. Mussels of D groups were allowed to cure naturally while those of E were exposed to extract from *Capsicum annum L.* (5 ml/lit) and their rates of O_2 consumption were studied after 7, 14 and 21 days. Remarkable decrease in rate of O_2 consumption was observed in Nickel exposed mussels. The group exposed to heavy metal along with extract from *Capsicum annum L.* showed more rates of oxygen consumption than those exposed to heavy metals. Pre exposed mussels to heavy metals showed fast recovery and higher rate of oxygen consumption than those which were allowed to cure naturally. The probable antioxidant role of extract from *Capsicum annum L.* is discussed in the present paper.

Keywords: *Nickel, Capsicum Annum L, Antioxidant Activity, and Oxygen Consumption*

INTRODUCTION
Bivalve *Lamellidens consobrinus* (Molluscs; Pelecypoda; Eulamellibranchiata has bio-importance in the animal kingdom. Molluscs serve as important prey for mammals, birds and to number of invertebrates (Symondson and Lidell, 1993; Graveland *et al.,* 1994) Molluscs are known for their higher protein content and serve as delicious food material in the community (Chakraborty *et al.,* 2008) *Lamellidens* species used as a common dietary items in human population and also as poultry feed in India. Heavy metals create adverse effects on the environment and human health in various environmental components. Dering last three decades number of studies has been carried out to assess the behaviour of various heavy metals in the environment as well as their environmental effects (Pacyna *et al.,* 2009).
Diffuse pollution of the environment by heavy metals is a major environmental problem. Due to wide spread use, the heavy metals are widely released in the environment which ultimately finds their way in the aquatic ecosystem, contaminates the drinking water and enters in the food chain. Generally the potential impact of pollutants is greater for aquatic organisms (Murty, 1986). The pollutants alter the physicochemical properties of water (Richardson, 1988). A different type of water pollutants causes hazards to several organisms such as fish's frogs, prawns and mussels. Mostly toxicants are released into water through anthropogenic activities such as industry and agriculture (Saygdeger, 2000). Toxicants like heavy metal ions and most pesticides are non degradable, resulting into bio accumulations within the ecosystem.
Nickel constitutes about 0.008% of earth crust. It is present in the air and in tobacco smoke. Nickel compounds are also applied in agriculture; Nickel is often present in agricultural soil situated near the fossil-fuel industries. Nickel is exposed by battery (Ni- Cd), Nickel miners, Ceramic makers, Coal

gasification, Nickel smelters, Paint markers, Electroplaters, Spark plug makers, Spray painters, Ink markers, Stainless steel markers, Jewelers, Textile dyers, Varnish makers, Nickel refineries, etc.

All industries discharge their solid and liquid wastes on the land without any recommended treatment (PHEEO, 2006). The presence of various metals in waste water like Fe, Cr, Ni, Pb, Cu are used in metal processing industries were analyzed. *Capsicum* is the genus of plants from the solanaceae family, the common peeper name is chilli or peeper. The *Capsicum* has high concentrations of antioxidant such as polyphenols, Carotenoids, Ascorbic acid and flavanoids which fight against hazardous oxidative damage of the cell (Odukoya, 2007; Karandenz *et al.*, 2005; El-Qudah, 2008). Our body is exposed to large number of foreign chemicals. This chemicals because of our inability to metabolize them properly, generate the production of free radicals, (Carmen and Florin, 2009; Ghaseme *et al.*, 2009) highly active free radicals and their uncontrolled production are responsible for many degenerative diseases like cardiovascular diseases, cell tumours (Prostate and Colon cancers) (Barros *et al.*, 2007; Jagdish *et al.*, 2009). Antioxidants have the action that can scavenge free radicals and inhibits the oxidation of lipids [slow down the rate of oxidation] (Temraz and Hel –Tantawy, 2008). Banerjee *et al.*, (2005) reported that, the phenolics of green peeper have higher DPPH radical scavenging activity. This study was carried out to investigate probable antioxidant role of extract from *Capsicum annum L*. extracts on physiology of oxygen consumption of Nickel chloride intoxicated in an experimental model, the fresh water mussels, *Lamellidens consobrinus.*

MATERIALS AND METHODS

**Preparation of Aqueous Extract of Capsicum Annum*

The plant *Capsicum annum Linn*. (1Kg) was collected from a local market in Bhusawal (M.S.), India. The dried green chillis were ground to a fine powder and were extracted with boiling water (5 Lit) for 30 min, by soxhlet technique.

The filtrate was evaporated at $<70^0$C in a vacuum dryer to give a final yield of 128.69 gm was stored at 4^0C. It was dissolved in distilled water whenever needed for experiments.

***Treatment of heavy metal salt:-** The fresh water mussels *Lamellidens consobrinus* were collected from Hartala lake near Muktainagar Dist Jalgaon, (M.S.). Bivalves of similar size (40-50mm long, and average Wt. 60-65gm with shell) were collected and washed in order to remove the algal biomass and other waste. They are acclimatized for 4-5 days at laboratory conditions medium sized healthy and active bivalves were used for experiment.

They are divided into three groups, such as group A, B and C. The group A of acclimatized mussels as kept as control set. The group B of acclimatized mussels was exposed to chronic concentration. (LC 50 value of 96 hrs/10) of heavy metal salt Nickel (0.34 ppm) as chronic doses up to 21 days, while group 'C' of acclimatized bivalves was exposed to chronic concentration (LC 50 value of 96 hrs/10) with 5ml/lit extract from *Capsicum annum* upto 21 days. After exposure to heavy metal for mussels from group B were divided into two subgroups, such as D & E groups. The mussels of group 'D' were allowed to self cure naturally in normal water and the mussels of group 'E' were exposed to 5 ml/lit extract from *Capsicum annum* up to 21 days. During experimentation, mussels were fed on fresh water algae. O_2 consumption by mussels from all groups was determined by Wrinkler's method after every 7 days.

RESULTS AND DISCUSSION

Observation and Results

Lamellidens consobrinus after exposure to concentration of Nickel chloride (0.34 ppm) along with extract from *Capsicum annum* and during recovery have been summarized in table.

It was observed that after chronic treatment of Nickel chloride up to 21 days to *Lamellidens consobrinus.* The rate of oxygen consumption decreased significantly. In the mussels, the rate of oxygen consumption is measured after 7, 14 and 21 days exposure to (0.34 ppm) of Nickel chloride as chronic treatment. It was observed that after chronic exposure there was significant decrease in the rate of Oxygen consumption, as compared to that of control bivalves, summarized in the table.

Oxygen consumption data from table indicates that, the rate of oxygen consumption in presence of Nickel chloride (0.34 ppm) decreased with increase in exposure period.) The rate of O_2 consumption was more in Nickel and extract from *Capsicum annum* exposed mussels as compare to those exposed to only Nickel in respective period of exposure. The mussels, Pre-exposed to $Nicl_2$ showed fast recovery of rate of O_2 consumption in presence of extract from *Capsicum annum* than those allowed to cure naturally.

Table 1: (A) The rate of oxygen consumption of *Lamellidens consobrinus* after chronic exposure to heavy metal salt/$Nicl_2$ and $Nicl_2$ with 5ml/lit extract of *Capsicum annum*

		Average O_2 consumed ml/gm/hr/lit + S.D.		
Treatment		**7 Days**	**14 Days**	**21 Days**
(A)	Control	0.0889 ± 0.0173	0.0884 ± 0.0283	0.0883 ± 0.0245
(B)	0.34ppm Nickel	0.0862 ± 0.0141 (-3.04%)	0.0850 ± 0.0374 (-3.85%)	0.0832 ± 0.0412 (-5.78%)
(C)	0.34 ppm Nicl2 + 5ml/lit extract from *Capsicum annum*	0.0879 ± 0.0332 (-1.12%)	0.0875 ± 0.0424 (-1.02%)	0.0865 ± 0.0224 (-2.04%)

(B) The rate of oxygen consumption of pre exposed *Lamellidens consobrinus* to Nickel chloride for 21 days during recovery.

Treatment		Average O_2 consumed ml/gm/hr/lit + S.D.		
		28 Days	**35 Days**	**42 Days**
Bivalves Pre-exposed to Nicl2 (0.34 ppm) For 21 days	(D) Normal Water	0.0844 ± 0.0361 (-5.06%)	0.0847 ± 0.0173 (-4.19%)	0.0853 ± 0.0332 (-3.40%)
	(E)Normal water +5ml/lit extract of *Capsicum annu*m	0.0856 ± 0.0245 (-3.71%)	0.0857 ± 0.0458 (-3.05%)	0.0864 ± 0.0141 (-2.15%)

Figure in bracket indicates percent variation in the rate of O_2 consumption

Discussion

In the present study on fresh water bivalve molluscs *Lamellidens consobrinus* revealed that, there is significant decrease in rate of oxygen consumption in the bivalves exposed to Nickel chloride ($LC_{50/10}$) as compared to control. The decline in oxygen consumption was greater in higher concentration which might be the result of reduced state of metabolism owing to toxicant stress (Marigoudar *et al.*, 2009). The rate of oxygen consumption is decreased in the Bivalve *Lamellidens marginalis* affected by nickel chloride. Respiration of Bivalve is considered to be an indicator of their metabolic index (Wlovekamp & Waterman, 1960) and used to evaluate the effect of stress (Krishnarao, 1982) or toxic substances in the environment (Thurberg *et al.*, 1977). The toxic substances like Copper sulphate, Potassium ferrocynide, Potassium oxalate, Oxalic acid, Zinc sulphate, etc. decreases the rate of oxygen consumption (Wath *et al.*, 1992) oxygen consumption is a measure of the metabolic state of the animal. Hence it is considered as vital parameters and indicates the physiological and metabolic alterations in the animal. The alteration in the normal respiratory metabolism is due to its intimate contact with polluted water which decreases the oxygen diffusing capacity of the gills (Jadhav *et al.*, 2011). The copious mucus secretion was observed in

pesticide exposed bivalves which might have caused decreased level of oxygen consumption (Rane *et al.,* 2013). The variation in the rate of oxygen consumption according to different seasons due to pesticide stress of Thiodan (Endosulfan 35% E.C). Jadhav *et al.,* (2012) showed that size dependent variations are observed in oxygen consumption i.e. rate of oxygen uptake was increased in small sized bivalves as compared to large sized ones. In conclusion we determine the toxicity of Ni in the form of LC_{50} values. After short term acute exposure and up to 7^{th}, 14^{th}, and 21^{st} day, the effect of heavy metal Ni on oxygen consumption in the Bivalve *Lamellidens consobrinus*. The significant decrease in oxygen consumption observed up to 21 days. This result will clearly indicate that the different contents of *Capsicum* like Carotene, Flavinoids, probably reduces the different respiratory stress and enhances the different pathways involve in the respiratory cycles.

Conclusion

In conclusion, the current study suggests that aqueous extract of *Capsicum annum* can prevent or slow down the oxidative damage induced by Nickel chloride in *Lamellidens consobrinus*. The effect of Nickel on Oxygen consumption is variables were decrease by treatment with chilli extracts. This indicates that, the *Capsicum annum* extract possess antioxidant activity.

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