Journal of Experimental Sciences Vol. 2, Issue 3, Pages 12-14 [2011]
www.jexpsciences.com

Regular Article

Alterations in the Biochemical Content in the Foot of a Freshwater Snail, *Indoplanorbis exustus* Exposed to Heavy Metals

H.Z. Patil[1], P.N. Mahale[1*] and A.B. Kulkarni[2]

1Postgraduate Department of Zoology, S.S.V.P.S `s. Late Karmveer Dr. P.R.Ghogrey Science, College, Dhule-424005, Maharashtra state, India; 2Dr. Babasaheb Ambedkar Marathwada University, Aurangabad-431004, Maharashtra state, India

ABSTRACT: On exposure to sub lethal concentration (0.1 ppm) of Mercuric chloride & (2.00 ppm) of Zinc sulphate for 1, 7 & 14 days, *Indoplanorbis exustus* showed significant decrease in the level of glycogen, significant rise in the level of protein & in-significant decline in the level of lipids. The effect was more pronounced in Mercuric chloride exposure than Zinc sulphate exposure.

Key words: Glycogen, proteins, lipids, foot, *Indoplanorbis exustus* Mercuric chloride, Zinc sulphate

Introduction

Amongst different environment aquatic environment is the serious sufferer of the damage caused by the input of man made & natural chemicals. The pollution of the aquatic environment by heavy metals is a subject of great concern. Heavy metals pose a serious threat to the aquatic environment because of their toxicity, persistence, tendency to accumulate in organism & undergo food chain amplification (Weis & Weis 1977 a, b).They cause severe damage to the aquatic fauna, including molluscs, fishes etc, thereby telling up on their health & population. They affect the activity of biologically active molecule such as glycogen, protein & lipid (Ghosh & Chatterjee 1985; Devaraj & Devaraj 1987). Rao Ramana & Ramamurthi (1980) have observed the effects of Sumithion on biochemical constituents in *Pila globosa.* Carbohydrate metabolism in fresh water snail *Viviparous bengalensis* was studied by Kulkarni & Utkar (1981). Reddy *et al.* (1986) studied the effect of Mercuric chloride Carbohydrate metabolism of fresh water mussel Parreysia rugosa. The effect of Zinc sulphate & Copper sulphate on snail *Bellamya dissimilis* in relation to biochemical changes were studied by Rao & Jayashree (1990). Mercury & Zinc are the heavy metals widely used by industry & have become a subject of biological interest due to their potential pollution properties. It is in this perspective that the present work was under taken to evaluate the toxicological action of Mercuric chloride & Zinc sulphate on the foot of *Indoplanarbis exustus.*

Materials and Methods

Fresh specimens of *Indoplanorbis exustus* were collected from Godavari river at Paithan & local ponds near Aurangabad. The snails were fed once in a day on potato, Hydrilla or Spirogyra. Perior to experiments they were cleaned to remove the fouling algal biomass & mud. Healthy & mature snails of approximately equal size were selected.

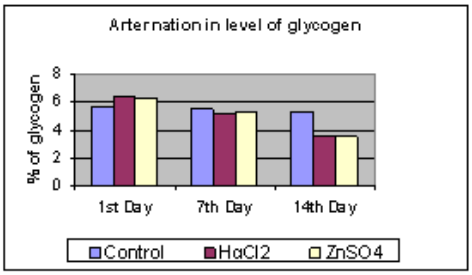
A group of 35 snails was released independently in 0.1ppm Mercuric chloride (LC 50 0.501 ppm for 24 hrs) and in 2.00 ppm Zinc sulphate (LC 50 70.79 ppm for 24 hrs) concentration in water. The animals were sacrificed after 1,7 &14 days and tissues of foot was taken out and dried at 80°C for 48 hrs for estimating the glycogen by colorimetric method of Kemp *et al.,* 1954; proteins by Classic Biuret Method of Gornall *et al.,* 1949 and lipids by Vanillin reagent methods of Barnes & Blackstock, 1973, using statistical analysis (Bailey,1965).

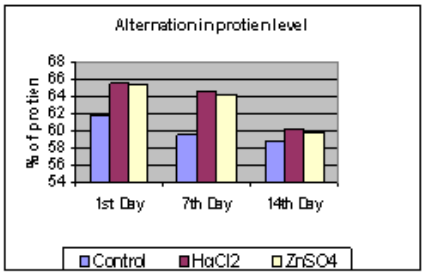
Table 1: Effect of Mercuric chloride (0.1ppm) & Zinc sulphate (2.00ppm) on the foot glycogen, protein & lipid levels of *I. exustus*. (Glycogen, protein & lipid expressed as mg/100 mg of dry tissue powder)

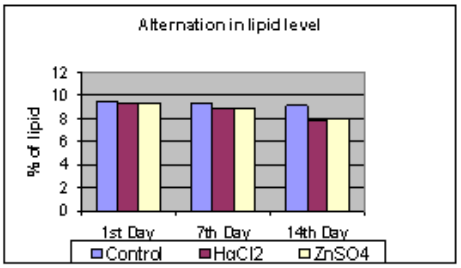
Heavy metal salt & time of exposure in days	Glycogen		Protein		Lipid	
Mercuric Chloride ($HgCl_2$)	**Cont.**	**Expt.**	**Cont.**	**Expt.**	**Cont.**	**Expt.**
1Day	5.5818 ±0.1298	6.4320 ±0.2596 #	61.6162 ±1.4004	65.5738 ±0.3500 **	9.5503 ±0.9627	9.4308 ±1.1148
%V		+15.2316		+6.4230		-1.2513
7Days	5.5206 ±0.2506	5.2146 ±0.1200 #	59.4675 ±0.3501	64.4185 ±1.0503 #	9.3353 ±1.2669	8.9294 ±0.7091
%V		-5.5429		+8.3256		-4.3480
14Days	5.2758 ±0.6490	3.5012 ±0.5192 *	58.6424 ±2.1005	60.1275 ±3.5009	9.1442 ±1.2161	7.8304 ±0.7601
%V		-33.6366		+2.5325		-14.3676
Zinc Sulphate $ZnSO_4$						
1Day	5.5818 ±0.1298	6.3773 ±0.3895 *	61.6162 ±1.4004	65.4087 ±0.7002 *	9.5503 ±0.9627	9.4786 ±0.9121
%V		+14.2517		+6.1550		-0.7508
7Days	5.1206 ±0.2506	5.2758 ±1.8280	59.4675 ±0.3501	64.0885 ±0.6001 #	9.3353 ±1.2669	8.9531 ±1.4180
%V		-4.4343		+7.7706		-4.0941
14Days	5.2758 ±0.6490	3.5514 ±0.3662 *	58.6424 ±2.1005	59.7976 ±3.8509	9.1442 ±1.2161	8.1409 ±1.5202
%V		-32.6851		+1.9699		-10.9720

Note : ±=S.D. Statistical Signifacance: *=P<0.05;**=P<0.02;#=P<0.01; %V=Percent variation from control; +ve=% stimulation and –ve =%inhibition.

** Corresponding Author, Email: drpnmahale@rediffmail.com*







Results

Alterations in the levels of glycogen, proteins & Lipids of foot of *Indoplanorbis exustus* exposed to sub-lethal dose (0.1 ppm) of Mercuric chloride & (2.00 ppm) of Zinc sulphate are represented in Table 1 and Figure 1, 2 and 3..

After one day of exposure to Mercuric chloride significant increase of glycogen was observed where as on 7 days & 14 days exposure a significant depletion of glycogen in foot was observed. In Zinc sulphate exposure after one day significant increase, after 7 days insignificant decrease & after 14 days significant decrease of glycogen was noticed.

The protein content in foot was found to be increased significantly after 1 & 7 days of exposure while insignificantly after 14 days of exposure in Mercuric chloride & Zinc sulphate.

The lipid contents were found to be depleted insignificantly in over all exposure periods in both the heavy metals intoxication.

Discussion

The effect of heavy metals on the alterations in the biochemical substances of the body is profusely studied by many investigators in fishes. Metal intoxication in fishes usually results in glycogen depletion & is reported in several species of fishes, such as *Heteropneustes fossilis* (Qayyam & Shaffi, 1977); *Sarotheradon mossamibicus* (Akhilender Naidu, 1982); *Channa punctatus* (Sastry & Sunita, 1983) and *Labeo rohita* (Bengery & Patil, 1986).

Shukla & Sastry (1990) studied the effects of Cadmium on some biochemical & physiological parameters in fish *Channa punctatus* .They showed that these fishes were, hypoglycemic,hypolactemic & the total plasma proteins, the levels of glycogen, lactic acid,pyruvic acid and total proteins in liver & muscles decreased significantly in both acute and chronic exposure. Exposure to sumithion caused depletion of glycogen & elevation of proteins in foot & hepatopancreas of the gastropod *Pila globosa* (Rao Ramana & Ramamurthi, 1980).The changes in the glucose, glycogen, total lipid & total protein levels in foot, mantle & digestive gland of the adult *Bellamya dissimilis* exposed to 96 hrs. LC 50 concentrations Of Copper sulphate & Zinc sulphate were investigated by Rao & Jayashree(1990).They showed a marked decrease in all the four biochemical constituents in the treated animals.

In the present investigation the tissue glycogen was found to be increased significantly after 1day of exposure and depleted significantly after 7 & 14 days of exposure in foot after both the heavy metals intoxication. The protein content of foot showed the progressive rise in all exposure spans but the rise was significant after 1 & 7 days of exposure to both the heavy metals. The lipid contents did not change significantly over all exposure spans.

From these observations it was clear that glycogen was the main source of energy for counteracting the heavy metal stress, while the proteins & lipids were spared .Thus the biochemical metabolites such as Glycogen, proteins & lipids underwent alterations due to heavy metal intoxication stress on the foot. The magnitude of the stress was more in Mercuric chloride treatment than Zinc sulphate indicating that Zinc sulphate was less toxic compared to Mercuric chloride.

Acknowledgement

We are greatful to Dr. S.N. Nandan Principle, S.S.V.P.S`s Late Karmverr Dr. P.R. Ghogrey Science College, Dhule, India for providing all necessary research facilities.

References

Akhilender Naidu, K. 1982. Physiological studies on freshwater teleost *Sarotherodon mossambicus* in relation to Mercury toxicity, *Ph.D.Thesis, S.V.University, Tirupathi India.*

Bailey, N.T.J. (1965): Statistical methods in Biology. The English language book society and English University press Ltd., Great Britain.

Barnes, H. and Black Stock, J. 1973. Estimation of lipids in marine animals & tissues. Detailed investigation of the Sulphophosphovanillin method for total lipids *J.Expt. Mar.Biol.* 12:103-118

Bengeri, K.V. & H.S. Patil 1986. Respiration, liver glycogen & bioaccumulation in *Labeo rohita* exposed to Zinc. *Indian J. Com. Physiol.*, 4:79-84.

Devaraj H.& Devaraj N. 1987. Rat intestinal lipid changes in Patuline Toxicity. *Ind.J.Exp.Biol.*25: 637-638.

Ghosh T.K. and Chatterjee S.K. 1985. Effect of Chromium on Tissue Energy Reserve in freshwater fish *Sarotherodon mossambicus*. *Environ. Eco.* 3(2): 178-179.

Gornall, A.B., Baodwell, C.J.and David M.M. 1949. Determination of serum proteins by means of the biuret reaction.*J.Biol.Chem.* 177: 751-766

Kemp, A., Kits Van and Haijningen, A.J.M. 1954. A colorimetric method for the determination of glycogen in tissues. *Bichem J.* 57: 645-648.

Kulkami A.B. and Utkar, V.N. 1981. Corbohydrate metabolism in freshwater prosobranch snail, *Viviparous bengalensis. J.Sci.Rec.*3 (2): 75-78.

Qayyam.M.A. and Shaffi, S.A. 1977. Changes in tissue glycogen on fresh water catfish *Heteropneustes fossilis* due to Mercury intoxication.*Curr.Sci.* 46: 652-653.

Rao P. M. and Jayshree N. 1990. Copper sulphate & Zinc sulphate induced biochemical changes in the fresh water snail *Bellamya dissimilis* (Muller).Abstracts 11th Ann. Sess. Acad. *Environ. Bio.* Aurangabad, India.

Rao Ramana, M.V. and Ramamurthi, R. 1980. Effect of sublethal concentration of Sumithion on some biochemical constituents

of the freshwater snail *Pila globosa* (Swainson).*Geobios.* 7(6): 247-250.

Reddy, T. Ravindra; Vijaya Kumar N. and Chari, N. 1986. Effect of Mercuric Chloride on carbohydrate metabolism of mantle,foot and gill of a freshwater mussel, *Parreysia rugosa* (Gmelin).*J.Environ. Biol.* 7(4): 225-230.

Sastry, K.V. and Sunita K. 1983. Enzymological and biochemical changes produced by chronic Chromium exposure in a teleost fish *Channa punctatus.Toxicol.Lett.*14:45-55.

Shukla V. and Sastry, K.V. 1990. Toxic effect of Cadmium on same biochemical physiological parameters in the teleost fish *Channa punctatus*. Abstracts 11th Ann. Sess. *Acad. Environ. Bio.* Aurangabad, India.

Weis J.S.and Weis P. 1977. a. Effect of heavy metals on embryonic development of the Killifish, *Fundulus heteroclitus. J.Fish Biol.11: 49-54.*

Weis J.S. and Weis P. 1977 b. Methyl mercury teratogenesis in the Killifish, *Fundulus heteroclitus. Teratology,* 7:326.