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ROLE OF VITAMIN A IN THE REGULATION OF SOME ASPECTS OF CADMIUM TOXICITY IN *Clarias batrachus*

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ABSTRACT

Heavy metals have been causing havoc to the environment and recently there has been an exponential increase in the casualty of life due to these pollutants. In today's industrial society there is no escape from exposure to toxic chemicals and metals, hence there is a constant increase in demand for more information and monitoring the effects of heavy metals on plants, animals and human beings. In the present study effects of cadmium chloride on certain parameters of *Clarias batrachus* such as body weight, serum cholesterol, behavioral activities, GSI and HSI have been investigated in order to find out the possible protective role of vitamin A in attenuating the heavy metal toxicity. It has been found that vitamin A clearly blocks the toxic effects of cadmium in *Clarias batrachus*. The paper discuses some aspects of vitamin A in counteracting the toxicological effects of cadmium.

Key words: Cadmium chloride, gonado somatic index, Hepato somatic index, cholestrol concentration, body weight, *Clarias batrachus*.

INTRODUCTION

Human beings, plants and animals all are now living under constant ecological crisis and stress. While on one hand technological development has improved the quality and standard of life. On the other hand it has created a number of health hazards. Heavy metals are considered as major toxicants causing adverse effects on organisms (De 1980, Samandiou *et al.,* 1990, Das 1992, Suresh *et al.,* 1993 Woo *et al.,* 1993, Vincet S. 1994 Das 2000, Shukla *et al.,* 2002, Medesani *et al.,* 2004 and Risso-de Favereny *et al.,* 2004, One of the heavy metals cadmium came into lime light in 1947 when it caused "Itai' or" ouch-ouch disease in human beings in which the bones become fragile. Since then cadmium has been placed on the black list of most international pollution conventions by virtue of its toxicity. Potential for bioaccumulation and enumerate persistence (Taylor 1983), In India trace metals: have been detected in low to alarming concentrations in many aquatic animals (Das and Kavirj 1992, Sinha 1999). Cadmium is accumulated either through food or directly by absorption from water (Pentreath 1977). In areas not affected by cadmium utilizing or generating industries, the normal concentration of cadmium in water is less than 1 nanogram/L, although values as high as 10 mg/L have been reported in both natural and drinking water (Friberg *et al.* 1974). An increase in the amount of cadmium contaminations in water may be due to either industrial discharge of untreated waster or leaching from the metal and plastic pipes used for distribution. The accepted upper limit of cadmium concentration in drinking water is 5mg/L (De Vooge *et al.,* 1980) Normally the cadmium concentration of surface water is below 1.0/µg/L and when it is above this level it becomes toxic.

Most of the studies are based on toxic effects of cadmium on the physiology and histology of different animals and few studies have been made on the remedial measures of cadmium toxicity by using chelating agents (Das and Kaviraj 2000, Sinha 1999, Shukla *et al.,* 2002). The role of some other common drugs such as thyroid hormones (Bhide, 1992) has been studied as toxicological regulating agents. Similarly among the vitamins, vitamin B complex (Verma 1992) has been attempted. In other species of animals such as rats and mice of some vitamins have been implicated, like vitamin E in swiss mice (Sethi 1995, Gupta *et al.,* 1999) Vitamin C in rat (Kumar 2004). However, there are very few reports with regard to the possible role of vitamin A in regulating cadmium toxicity of

aquatic animals like fishes. In the present work we have tried to study the effect of vitamin A on some aspects of cadmium chloride toxicity in *Clarias batrachus*.

MATERIAL AND METHODS

Adult fishes were purchased from local supplier and were acclimatized in clean aquaria (43x23x29 cm) containing 20 litres of stored tap water for 8 days. Four grps, each with 10 fishes were used in the present work. Initial body wt. of all the fishes were noted and following treatments were then given to different groups. Fishes of group no. 1 were taken as control. Group no. 2 was treated with Vitamin A acetate (10mg/id). group no. 3 was treated with cadmium chloride only (2.5 mg/l/d and group no. 4 was treated with cadmium chloride along with vitamin A. Doses were added in the water of different aquaria and every alternate day water of each aquaria was changed and chopped liver was provided to all the fishes *ad libitum* as food. The experiment was continued for 30 days. In the last weak of experimentation behavioural studies (Surface activity; (No./hr. and locomotor activity (min/hr.)] was noted between 16.00 to 17.00 hr. of the day for each group. On last day of experimentation final body weights of all animal were also noted. Blood from each fish was collected and centrifuged and serum was used for cholesterol estimation as per the method of Jayaraman (1988). The liver and gonads were removed, cleaned and then weighted for calculation of HSI and GSI values were presented separately for male and female animals. Student 't' test was used forstatistical evaluation of data.

Table - 1: Effects of $CdCl_2$ (2.5 gm/l/d) for 30 days on body wt, hepato somatic index (HSI) and serum cholesterol concentrations (µg/ml)(*C. batrachus*)

Groups	Initial Body wt. (gm)	Final Body wt. (gm)	HSI	Cholesterol Conc. (µg.)
Control	11.64 ±1.92	11.84 ±1.91	0.83 ±0.05	86.65 ±7.52
Vit.A Treated	11.11 ±0.54	11.41 c ±0.69	0.71 a ±0.01	76.11 d ±1.55
$CdCl_2$ Treated	10.55 ±0.83	7.36c ± 0.67	0.67c ± 0. 08	28.51d ± 2.13
$CdCl_2$ ± Vit.A Treated	12.33 ±0.80	13.49 a ±0.69	0.89c,C ±0. 04	55.92 d ±2. 22

Note:

- a, P<00.5; c, P<0.01: d, <0.001 compared to the respective value of the control group
- C, P<0.01: D, P<0.001 compared to the respective value of the vit. A group

RESULTS AND DISCUSSION

From the results of the present study as shown in Table -1 it is clear that animals of all the groups except those treated with cadmium chloride were found to be healthy and active throughout the experiment. They gained body weight in an identical manner during the experimentation. On the other hand the data show that cadmium chloride in dose of 2.5 mg/l/d decreased the body weight of all the fishes significantly form a control 11.84 gm (±1.19) to 7.36 gm (±0.67). In the present study this significant body weight, decrease probaly by cadmium chloride perse is due to interference in the general body metabolism by cadmium chloride involving liver, and pancreas particularly their metabolic pathways being significantly affected by effects of cadmium chloride. These findings can be correlated with inhibition of growth of body wt. in different fishes in response to toxic substance according to Huax *et al.,* (1984) and Recard *et al.,* (1998) 30 weeks of cadmium chloride treament in the laboratory decreased growth and body wt. in rainbow trout when compared to fishes of control group There are few more repots in where cadmium chloride has been found to considerably reduce body weight of fishes *i.e.* tilapia (Pratap *et al.,* 1990) and yellow perch (Lovesque *et al.,* 2002).

On the other hand the group of fishes which were exposed to cadmium chloride (2.5g/l/d) and vitamin A (10 mg/l/d) showed a slight increase in body weight after a period of 30 days of cadmium cotreatment the body weight change from 12.33 to 13.94 Thus these data clearly demonstrate that vitamin A counteracts weight reduction induced by cadmium chloride perse in the expermental fishes.

With gegard to HSI it was observed that cadmium perse significantly decreased the HSI of all the expermental fishes but along with vitamin A the decrease in HSI was significantly blocked by vitamin A being 75.30% Recently it has been reported by Lovesque *et al.,* (2002) that cadmium perse reduced the HSI of yellow perch. However, there are no reports where mitamin A in fishes can block the HSI reduction as found in the present study. As important biochemical factor the determination of cholesterol was done and it was found that the value got reduced in reponse to alone cadmium treatment. It was found that cadmium

Table - 2: Effect of Cadmium Chloride (2.5 mg/l/d) and or vit. A acetate (10mg/l/d) for 30 days on Locomotion and Surfacing activities in *C. batrachus* during 16 to 17 hr. of the day

Groups	Surfacing activity (No./hr. of observation)	Locomotion (Min. /hr of observation)
Control	61.66 ±2.10	30.62 ±0.39
Vit. A Treated	68.22 ±2.87	25.51 d ±0.31
$CdCl_2$ Treated	79.78 d ±2.61	22.79. d ±0.85
$CdCl_2$ ±Vit. A Treated	40.00d, D** ±3.89	29.64 A* ±0.42 A*

Note :

- d. P<0.001 compared to the respective value of the control group.
- A, P<0.05: D. P<0.001 compared to the respective value of the vit. A** group.
- P < 0.01; *<0. 001 compared to the respecitve value of the $CdCl_2$ rgoup.

alone in dose of 2.5 mg/l/d decreased the cholesterol values of all the experimental fishes the decrease being 28.55 (±2.13) from the control value of 86.65 (±7.52). However, the cotreatment of the cadmium chloride with vitamin A significantly attenuated the decrease of cholesterol by cadmium plain. Regarding the literature it becomes it becomes clear that are few reports on cholesterol decrease due to cadmium chloride treament in fishes Shukla *et al.,* (2002) reported that 60 days of cadmium exposure decrease total lipid content in *Channa punctaus* but references on attenuation of toxic effect of cadmium using vitamin A in fishes could not be found.

In the present study behavioural response such as locomotor activity of fishes were also reduced by cadmium chloride exposure. Reduction in locomotion, drinking and learning activities has also been reported in rat (Mohammad *et al.,* 1999) after cadmium treatment. Surfacing activity stimulated by cadmium chloride this is probably to get rid of cadmium chloride stress has been reported in lake white fish (Mechanical and Scherer 1991), locomotion inhibition by cadmium chloride might have also resulted because of the alteration in thyroid in function since thyroid hormones are directly involved in the regulation of these behavioural phenomena because cadmium is known to inhibit thyroid function as observed in Rehesus monkey (Mehta and Chopra 1986). Thus this is probably the first report showing the attenuation of toxic effect of cadmium chloride using vitamin A with reference to body weight. HSI, cholesterol and behavioural aspects in *C. batrachus.*

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