EFFECT OF CADMIUM CHLORIDE ON THE BIOCHEMICAL CHARECTERISTICS OF FRESH WATER FISH, *CYPRINUS CARPIO*

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A B S T R A C T

In the present investigation, the study was carried out on pollution, fish mortality and water born human diseases have revealed severe pollution in the fresh water ecosystem. The fish *Cyprinus carpio* collected from Tapi river at Bhusawal region was exposed to heavy metal *i.e*. Cadmium chloride. The 24h acute toxicity test yielded a LC_{50} of the 0.2% from which $1/3^{rd}$ and $1/6^{th}$ submittal concentrations 0.1 and 0.05% respectively. The experimental work was carried out for 120h after 120h of exposure the measure proximate constituents *i.e.* protein, carbohydrate and lipid level were quantified. The accumulation of cadmium in the soft tissue of *Cyprinus carpio* was also analysed. The control group of animals showed minute quantity of cadmium as compared to the experimental group.

Keywords: *Carbohydrate, Protein, Lipid and Fish Cyprinus Carpio Effects.*

INTRODUCTION

The natural water bodies having several sources of input of heavy and non-heavy metals and other chemicals particularly inorganic nutrients elements like phosphate, nitrates and silicates which is very small quantities is required for rapid growth of plants and animals (Maruthanayagam *et al.,* 2000). When this is reached in higher concentration it causes pollution to aquatic life through the food chain to terrestrial animal and man. Beside this there are thousands of synthetic organic compounds produced by man which find their way to aquatic ecosystem and cause serious pollution problems. The industrial wastes effluent contain an increase amount of toxic heavy metals like *Cadmium, chromium, nickel, copper* and *lead* which affect the people with most of the common disease like *bronchitis, emphysema* and *cardiovascular* problem. Fish is good bio-indicator because it is easy to be obtained in large quantity and potential to accumulate metals for analysis and easy to be sample (Batvari *et al.,* 2007) Fish accumulates metals in its tissues through absorption and human can be exposed to metals *via* food web. This cause acute and chronic effect to human (Yilmaz and Dogan, 2007; Fidan *et al.,* 2007.) So, the present study was undertaken to investigate toxic level which affect the survival and biochemical variations of fresh water fish *Cyprinus carpio* exposed to cadmium chloride.

MATERIAL AND METHODS

Cyprinus carpio used in the present experiment were collected from the Tapi river near Bhusawal. (Dist. Jalgaon, M.S. India) and the uniform size of fresh water fish were maintain in glass aquaria, acclimatize for five days in laboratory condition at $28^0C \pm 2^0C$. The acclimatize fish were used in the present experiments. The LC_{50} values was assessed for 24,48,72,and 96h exposure. The sub lethal concentrations such as $1/3^{rd}$ (0.133 mg/100ml) and $1/6^{th}$ (0.066mg/100ml) level were derived from the 24h LC_{50} value. The acclimatize fish, *Cyprinus carpio* were expose to sub lethal concentration for 120h. After 120h fish were sacrificed and the samples for the protein content in muscles, liver and kidney was estimated by method of Lowery *et al.,* 1954, similarly carbohydrate by Anthrone method and total lipid content by the method of Folch *et al.,* 1957. The digestion of samples was carried out as per procedure given in APHA(1985)

RESULT AND DISCUSSION

The cadmium chloride on survival and mortality rate of fresh water fish, *Cyprinus carpio* is quoted in table 1. The concentration of cadmium were exposed in mg/lit dry weight. The mortality percentage value of fish exposed to different concentration of cadmium chloride shows in the end of 24h 0.2 mg/100ml of cadmium treated fishes cause 30% mortality while 48h with 0.4 mg/100ml shows 50% mortality (LC_{50}). The higher concentration i.e. of 0.6 mg/100ml and 0.8mg/100ml of cadmium expose fishes attain 90 and 100% of mortality in respective concentration were recorded at the end of 96h. In the present investigation, it has been observed that the mortality rate due to cadmium treated increases with the higher concentration of cadmium over a short period of time i.e. 24h, 48h,72h and 96h respectively. The diminishes with decreasing concentrations during subsequent hours of treatment is shown in table 1.

The acute toxicity test reveals that LC_{50} was as 0.4mg/100ml and $1/3^{rd}$ and $1/6^{th}$ LC_{50} were calculated as 0.133mg/100ml and 0.066mg/100ml respectively. The experiment specimen were sampled and sacrificed at the end of 96h and the analysed the biochemical constituents of protein, carbohydrate and lipid in different tissues such as muscle, liver and kidney as shown in table 2. The rate of accumulation of cadmium was increased with the increase in exposure period and it is also proportional to the concentration of cadmium in water. The values recorded in acute treatment are high up to some exposure period. The cadmium values in tissues are directly proportional to the exposure period. The initial protein content in the fish, *Cyprinus carpio* before the commencement of the experiment was 135.15, 147.00 and 160.00 mg/grams in the muscle, liver and kidney was noted respectively. During the exposure of cadmium chloride the protein content gradually decreases ratio of muscle, liver and kidney respectively in both $1/3^{rd}$ and $1/6^{th}$ sub-lethal

concentrations. From our result it shows that high protein loss in the liver followed by kidney and muscle. It may be due to interference of cadmium with the physiology of the organism. The similar results has been observed by Fung *et al.,* 2004 and Fidan *et al.,* 2007. Fish are the major bottom feeders in the ecosystem which also have tremendous capacity to accumulate all the microelements present in their food. Fish are considered as the main bio accumulators of pesticides, heavy metals, toxic chemicals etc. Heavy metals are the class of highly toxic elements, causing great health problem to human life through bioaccumulation from the fish. Copper bioaccumulation and depuration by red, swamp crayfish, procambarus clarkia was observed by Nagvi *et al.,*1998. In the conclusion crayfish has a great potential for rapid accumulation and depuration of copper in freshwater as reported by Kargin, 1998. The another result regarding metal concentration in tissues of the freshwater fish, *Capoeta barroisi* from the sehan river was reported by Kargin, 1998. Fung *et al*., 2004 also reported that due to industrial activity the heavy metal concentration such as As, Cd, Cr, Ni, Pb, Se, Zn, Fe, and Hg, were increased in the body of *Perna viridis* and *Mytilus edulis* in the east coast of China. Among the three tissues heavy loss of biochemical content in liver followed by kidney and muscle. Generally, the liver is the largest and metabolically the most complex organ in the body, it also concerned in the metabolism of nutrients as well as many drugs and toxicants, which can usually be detoxified but many of them can be bio-activated and become more toxic. Many researchers indicated that it is the most consistently damaged organs (Thorat and Wagh, 2001; Gaikwad *et al.,* 2004; Gaikwad and Thorat, 2008; Sheejan *et al.,* 2012; Jogi *et al.,* 2012) hence, the abnormal conditions due to the loss of protein, carbohydrate and lipid content in the different tissues by the toxic activities of cadmium chloride.

Table 1: Effect of Cadmium Chloride on survival and mortality rate of fresh water fish, *Cyprinus carpio*

Sr. No.	Concentration of cadmium chloride (mg/100ml)	No. of Fishes exposed	Survival number of fishes				Cumulative percentage of mortality
			24h	48h	72h	96h	
1	Control	10	10	10	10	10	0%
2	0.2	10	10	08	07	07	30%
3	0.4	10	10	08	06	05	50%
4	0.6	10	09	07	05	01	90%
5	0.8	10	08	04	04	01	100%

Table 2: Showing the variations in the loss of protein, carbohydrate and lipid content in fresh water fish, *Cyprinus carpio* at 1/3rd and 1/6th of LC_{50} expose to Cadmium chloride.

Sr. No.	Biochemical Parameters	Muscle		Liver		Kidney	
		1/3rd (0.133 mg/100ml)	1/6th (0.066mg/ 100ml)	1/3rd (0.133 mg/100ml)	1/6th (0.066mg/ 100ml)	1/3rd (0.133 mg/100ml)	1/6th (0.066mg/ 100ml)
1	Protein	20	10	29	22	28	08
2	Carbohydrate	18	05	22	13	13	09
3	Lipid	18	08	19	09	14	09

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REFERENCES

1. APHA (American Public Health Association) American Water Works Association and Water Pollution Control Federation(1985). Standard methods for the examination of water and Waste water 16th Ed., *American Public Health Association Washington.*

2. Batvari, B.P.D(2007). Heavy metals in two fish species (carangoidel malabaricus and Belon stronglurus) from pulicat Lake, North of Chennai, Southeast Coast of India. *Environ. Monit. Assess.,* 145(1-3), 167-175.

3. Fidan, A.F.,Cigerci, I.H, Konuk, M.,kucukkurt , I, Aslan, R and Dundar Y. (2007). Determination of some heavy metal levels and oxidative status in *Carassius carrasius L*., 1758 from Eber Lake. *Environ. Monit. Assess.,* 147 (1-3), 35-41.

4. Fung C.N., Lam J.C.W., zhen G.L ., Connel D.W., Monirith I.,Tanabe S., Richardson B.J., Lam P.K.(2004). Mussel based monitoring of trace metal and organic contaminants along the east coast of china using Perna viridis and Mytilus edulis . *Environ. Pollu.* 127(2), 203-216.

5. Gaikwad S.R. Thorat, S. R. and T.P. Chavan (2004) "Phytoplankton and zooplankton diversity with respect to pollution starts of river Tapi in North Maharashtra Region *J. of Current sciences. 5 (2): 749-754.*

6. Jogi R.D., Wani P.P. and S. R. Throat (2012): Hydrobiological Study with Water Quality Index of Nashik City Area (M.S.) India, *International J. of Chem. Sci.* Vol. III, pp 37-43.

7. Kargin R.(1998). Metal concentration in tissues of thefreshwater fish, Capoeta barroisi from the Seyhan River (Tukey). *Bull. Environ. Contam. Toxical.,* 60:822-828.

8. Maruthanayagam C., R. Prema, Shanti K. and E. Sirajnisa (2000) : Impact of detergent on the biochemistry of the fresh water fish *Channa Punctatus. Indian J. Environ. and Ecoplan.* 3. (3) , 637-642.

9. Nagvi S.M., Devalraju I. and Nagvi N.H.(1998) copper Bioaccumulation and depuration by Red swamp Crayfish, Procambarus clarkia. Bull. *Environ. Contam. Toxicol*.61:65-71.

10. Gaikwad and S. R. Thorat (2008): "Study of Zooplankton emergence pattern and resting egg diversity of recently dried water bodies in North Maharashtra Region". *J. Environmental Biology.* Vol. 29(3), 353-356.

11. Sheejan P. G. Kulkarni M. N. and S. R. Thorat (2012): Study of Zooplankton of River Tapi Relation to Pollution from Bhusawal Taluka Dist. Jalgaon, MS, India, ISSN0976-4534 *International J. of Environmental Sciences* Vol.III (3rd issue) Pp. 317-322.

12. Thorat, S. R. and Wagh, S.B. (2001) "Effect of tannery effluent on protein metabolism of freshwater fish, *Channa Gachua*." *Bull. Envi. Sci*, Vol. 19, Pp. 1-5.

13. Yilmaz, A.B. and Dogan, M.(2007). Heavy metals in water and in tissues of himri(Carasobarbas luteus) from Orontes (Asi) River Turkey. *Environ. Monit. Assess*., 144 (1-3), 437-444.

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