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EFFCT OF $HgCl_2$ ON THE PROTEIN CONTENT OF *MOZAMBIQUE TILAPIA* (*OREOCHOMES MOSSAMBICUS*)

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ABSTRACT

In our study fresh water *Mozambique tilapia*, live and health were collected from private farm at Nanikakrad, near Navsari in south Gujarat (India). Prawns were acclimatized to laboratory conditions for 24 to 36 hrs prior to experiments. LD was decided and after that *M. tilapia* were exposed to different doses of 5, 10 and 15 ppm of $HgCl_2$ for 8,16 and 24 days duration. The effect of $HgCl_2$ on protein content of muscle tissue was studied. The results clearly indicated that as duration and dose increased, there was a drastic reducation in protein content of prawn muscle tissue. It was in turn an indication of toxic effect of $HgCl_2$

Figures : 03 References : 15 Table : 01

KEY WORDS : Mercury Chloride, *Mozambique tilapia,* Protein.

Introduction

One of the most serious problems faced by mankind today is the problem of water pollution. Billions of gallons of waste water from cities and housing settlements, industries and agriculture are thrown into fresh water everyday. The heavy metals and salts of heavy metals constitute the most widely distributed group of highly toxic and long retained substances from the effluent. Aquatic pollution by heavy metals and salts of heavy metals get wide recognition with the Minamata disaster in Japan between 1953 and 1960. Thousands of people suffered from mercury poisoning by eating fishes caught from Minamata bays, which was receiving mercury from vinyl chloride plants. Minamata disease involved progressive loss of nervous coordination, vision and hearing. Water, like air is one of the most important natural resource of human beings, without which life cannot exist. Due to industrialization and technological development, construction of new buildings dams *etc.,* the environment has been affected and damaged.

A wide variety of pollutants-physical, chemical, biological and radiological alongwith the waste water have been identified as detrimental to human health and also to the all living organisms affecting the ecosystem. These substances are called pollutants when they are present in sufficient concentrations and quantity in the environment. Heavy metals belong to this category of pollutants. The metallic solutions are toxic and inhibit self purification of water systems and in addition to that aquatic plants and animals are also affected and in some cases killed. In case of discharge of industrial waste water to the sewer, the metals are more likely to be settled down. Heavy metals are natural coystituents of marine environment. Some of them are biologically essential but others like cadmium, lead, and mercury are highly hazardous to marine biota and normally occur in low concentrations but the estuaries receiving industrial wastes, they are often found in high concentration of metal ions. Metal industries keep a wide array of contaminants in their waste water. Metals found in this effluent have been Hg, Cd, Ni, Cu and Co[11]. Heavy metals like lead, cadmium, mercury and arsenic were estimated in variety of food items including fishes by AAS to assess levels of heavy metals contaminations and nutritive quality[12]. Heavy metals can be accumulated over a period of time, along food chain, at very high proportion in organisms from very low concentration in water

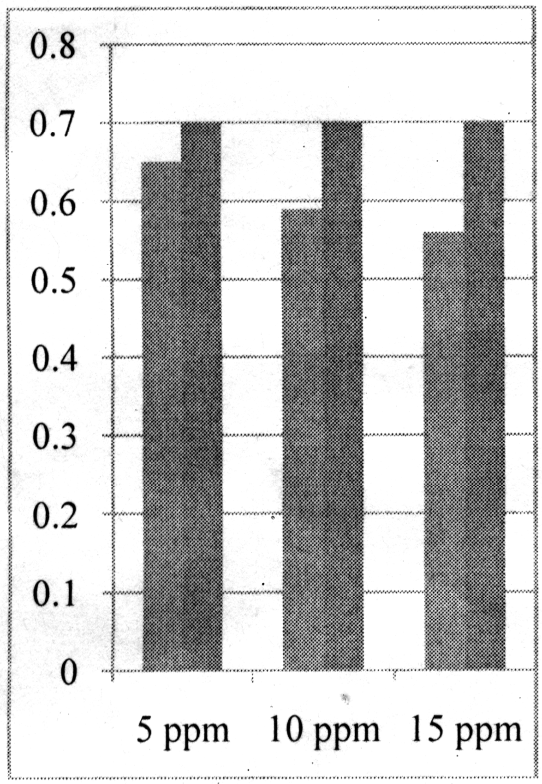

Fig. 1 : 8 days

(biomagnifications) and sediments. Next to pesticide heavy metals like mercury and cadimium metals head the list of environmental hazards. These metals are continuously released into the environment by natural processes, like volcanic eruption and weathering of rocks. Enhance levels of heavy metals in the aquatic environment cause concern because of its chronic and sub-lethal effect to the organism at low concentrations. Sub-lethal effect of Hg on the gaemocytes-mediated function in juveniles of the economically important freshwater *Mozambique tilapia* were investigated and the number of total haemocytes, percentilephagocytosis and superoxide onion production found to increase in test prawns exposed to the lowest sub-lethal concentration. This indicated the fact that a mechanism of host defence was in an active state to encounter metal toxicity[15]. When sewage is allowed to flow in natural body contains about 13 mg of Hg, about 70% of which is present in fat and muscle tissue. In human body kidney retains maximum concentration of Hg and it was also found in brain, liver and serum proteins. The toxic action is due to crowding of Hg^{2+} ions around the immediately available thiol groups of protein and delay in distribution of these ions among rest of thiol group throughout body. Excess of Hg (more than 1.00ug/l) may cause headache, abdominal pain diarrhea, haemolyses and tremors. Hg vapours cause acute tightness and pain inchest causing great difficulty in breathing. It also observed decrease in oxygen consumption with increase in the test concentration of $HgCl_2$ in *Donax cuneata*[1] in case of *Corbicula striatella* the effect of mercury on oxygen consumption was reduced on acute and chronic exposure[9]. Mercury and metals of mercury are toxic to aquatic life when concentration of mercury is 0.77 ug/l continuous exposures and maximum limet is 1.44 ug/l[3]. The Jintsu river, [Japan], victims died after eating methyl mercury contaminated fish polluted by an industrial effluent discharge into the river[8]. In our study it was sbserved that, when *M. tilapia* were exposed to different concentration of $HgCl_2$ for different duration, there was drastic change in protein content of prawn muscle which is consumed as delicacy by human. It was reported that when prawn exposed to $CdCl_2$ there was drastic decrease in muscle protein content of *M. Rosenbergil*[5]

TABLE-1 : Concentration of protein from fish muscles after exposing to $HgCl_2$ (mg/g)

Dose (PPM)	Exposure Duration (Days)		
	8	**16**	**24**
Control	0.70	0.67	0.65
5 ppm	0.65	0.60	0.44
10 ppm	0.59	0.54	0.42
15 ppm	0.56	0.52	0.39

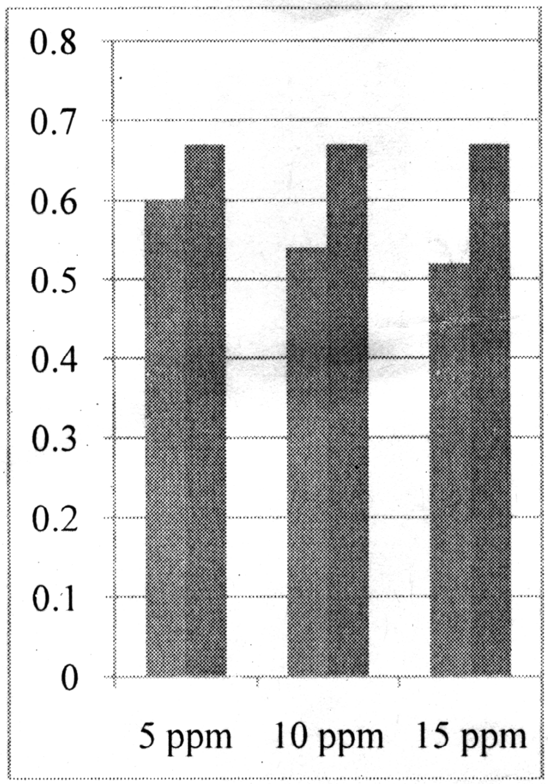

Fig. 2 : 16 days

Material and Methods

For experimental study, freshwater *Mozambique tilapia,* live and healthy were colleceted from a private farm at Nanikakrad, near Navsari in South Gujarat (India). Fishes were transported in container filled with O_2 saturated water and continuously supplied with fresh air and buought to the aquarium containing normal freshwater. The level of pH and dissolved oxygen were maintained in the laboratory and the fishes were fed with commercial feed twice a day. Prior to study, the fishes were acclimatized to the laboratory conditions for a period of 2 to3 days. LD_{50} was decided and after that different concentrations of mercury were made by dissolving suitable/ appropriate amount of analytical grade mercury chloride in the freshwater. Sets of three different concentrations of mercury chloride (5.10 and 15 ppm) were made for treatment. Acclimatized prawns were exposed to it. The *Mozambique tilapia* were exposed to three different concentrations of heavy metal mercury chloride. Good quality commercially available fish feed was supplied twice a day. The medium of water containing mercury chloride were changed on every alternate day. After an interval of 8, 16 and 24 days 4-5 fishes were sacrificed from each of the container and muscles tissues were used for estimation of total proteins[7].

Results and Discussion

Protein content of muscles were analyzed to find concentration of protein after exposure of fishes to 5,10 ans 15 ppm concentration of $HgCl_2$. Results are recorded in Table-1 and presented by fig.1, fig.2 and fig.3 for comparative idea of protein content.

With a view to investigate the effects of heavy metal-$HgCl_2$ on protein content from prawn muscles, the study was carried out. Proteins are building blocks of animals tissues and in general prawn muscles are consumed as delicacy by human. It was observed that on 8^{th} day of exposure to 5ppm protein content reduced to 0.70 to 0.65 mg/g and 0.60 to 0.44 on 16th and 24^{th} day respectively. In case of 10 ppm exposure protein content was reduced to 0.11 mg/g on 8th day 0.16 mg/g on 16th day and 0.28 mg/g on 24^{th} day. Reduction of protein content in 5 and 10 ppm exposure on 8^{th} day, almost same refuction fo protein was observed on 8^{th} day in 15 ppm exposure. Highest protein decline was 0.31 mg/g in 15ppm on 24^{th} day. Decline in protein content in control fish [0ppm] was only 0.05 mg/g. If we consider this factor highest reduction of protein content was 0.005 mg/ g on 24^{th} day at 15 ppm concentration. It is obvious from our result that there was damage to nutritive quality of prawn muscle protein. Accumulation of this metal was also observed in muscle tissues[8].

Reduction in glycogen content of *Parreysia favidens* was observed in whole digestive glands and mantle when exposed to mercury[2]. It was also observed $HgCl_2$ could increase in total haemocytes percentile phagoytosis and super oxide anion production. This was that host-defense mechanism was in an active state to encounter metal toxicity. In our results reduction in protein content might be due to toxicity of $HgCl_2$ on the basic metabolism of prawn. Heavy metal like $HgCl_2$ could definitely reduce expiration mobility, digestion and feeding in prawns[1].

Utmost care was taken to maintain constant temperature. This implies that there is a degree of metabolic control over toxic effect which may be due to low molecular beight of Hg binding protein.

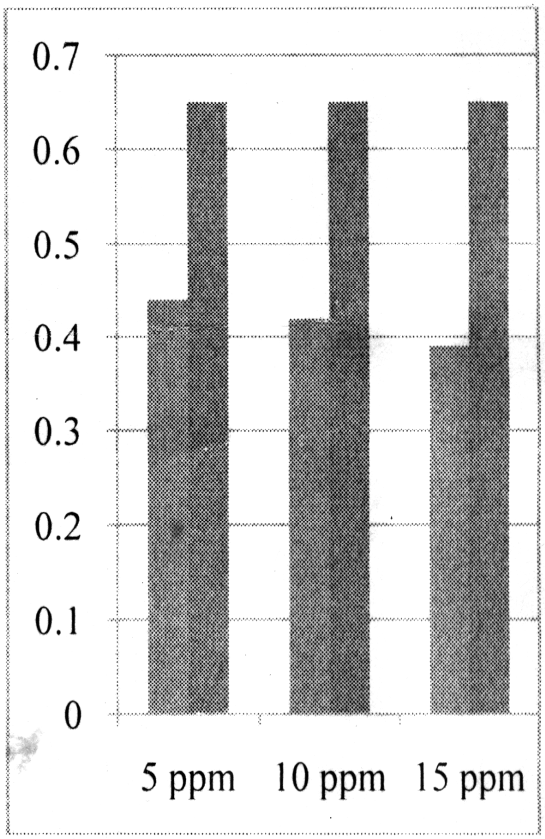

Fig. 3 : 24 days

When concentrations of metals are higher, it may kill aquatic animals in large[13]. Branch chain amino acids are catabolised in liver, kidney, muscles, akipose tissues and heart. Reduction in protein might be due to catabolism of lucine to B-hydroxy, B-methyl glutaryl co-A, (HMG Co-A)[6]. Histidine when catabolised, the pathway is histidine-glutamate-a-ketoglutarate. This is due to metal toxicity. It is catabolised further and converted to a-ketoglutarate[4]. This may be the factor which might be playing vital role in protein content reduction in prawn muscles. Exposed to Hg, it is important that how long the substance remain in environment, the rate of biological decay and how aquatic organism accumulates metals[14]. Our study shows that $HgCl_2$ affect the quantity of protein content of muscles and thereby nutritive quality of *M. Tilapia.*

Conclusion

Aquaculture is having vast potential in south Gujarat region. With a view to study effect of $HgCl_2$ of fish this work was carried out. In our study it was observed that protein content of fish muscle were depleted due to $HgCl_2$. It was observed that when duration of exposure was increased, there was drastic reduction in protein content of fish muscles. It was also observed that, higher the concentration of $HgCl_2$ there was also more depletion of protein content as shown in Table 1 and Fig. 1 Fig. 2 and Fig.3. From this we can conclude that protein content of fish muscles are depleted when exposed to $HgCl_2$ for different duration and concentrations.

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