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COMPARATIVE STUDY OF CHOLESTEROL ALTERATIONS INDUCED BY CERTAIN HEAVY METALS IN A FRESHWATER TELEOST FISH, *AMBLYPHARYNGODON MOLA*

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ABSTRACT
The toxic chemicals (pollutants) act as one kind of stress to fishes and respond to it by developing necessary potential to counter act that stress. The biochemical changes occurring in the body give first indication of stress. During the stress organisms need sufficient energy which is supplied from reserve material (glycogen, lipid and protein), if the stress is mild then only stored glycogen is used as a source of energy, but when stress is strong then the energy stored in lipids and protein may be used. The heavy metals cause metabolic rearrangement in the living system. Due to their potential toxicity, biochemical changes occur in the organs of animals. Effect of mercuric chloride, arsenic trioxide & cadmium chloride on total cholesterol alteration in liver and gonads of a freshwater teleost fish, *Amblypharyngodon mola* were studied. The fishes were exposed to 0.2291 ppm. mercuric chloride, 1.4557 ppm. arsenic trioxide and 3.1395 ppm. cadmium chloride as a acute treatment. Progressive decreases in total cholesterol content were found with respect to exposure period in liver and gonads after acute exposure to mercuric chloride, arsenic trioxide and cadmium chloride.

KEY WORDS: Mercuric chloride, Arsenic trioxide and Cadmium chloride, Cholesterol content and *Amblypharyngodon mola.*

INTRODUCTION

Polluted water from heavy metals not only pose a threat to the aquatic species inhabiting them but also to humans, who often come in contact with the water either directly or indirectly by consuming fish. Every chemical released into ecosystem has the potential of getting in to the human diet food chain and for most people; diet is the primary means of exposure to environmental contaminants (Chen, C.Y. and Folt, C.L., 2000). Important organic constituent of animal tissue is the lipid, which play an important role in energy metabolism, and provide energy to metabolic processes, fat reserves in animal's acts as a store house of energy which contains a large number of fatty acids. It helps the animals to survive for several days without food and also supplies energy at the time of environmental stress. In general lipid generates more heat and energy than carbohydrate and proteins. The essential nutrient is drastically affected and altered by various environmental pollutants like heavy metal and pesticides. After glycogen, lipids were used as an energy source (Ganesan *et al*., 1989). Jha, B.S. (1991), studied the alteration in the protein and lipid contents of intestine, liver and gonads in the lead exposed freshwater fish, *Channa punctatus*. (Katti S. R. and Sathyanesan A. G., 1983), studied the lead nitrate induced changes in lipid an cholesterol level of freshwater fish, *Clarius batrachu.* Therefore in the present study, attempt has been made to explore the comparative study of acute exposure of mercuric chloride, arsenic trioxide and cadmium chloride on cholesterol changes in the liver and gonads of the freshwater teleost fish, *Amblypharyngodon mola.*

MATERIALS & METHODS

Live specimens of *Amblypharyngodon mola* were collected from Girna river dams of Chalisgaon, Dist. Jalgaon (M. S.), stored in 50 litre glass aquarium containing dechlorinated water with aeration system. Animals were acclimatized to laboratory conditions for 10 days. During the experiment healthy fishes of uniform size and weight were selected for the experiment. Fishes were divided in two groups; one group was maintained as control while the remaining one was separately exposed to the acute treatment. For acute treatments experimental fishes were exposed to 0.2291 ppm. mercuric chloride, 1.4557 ppm. arsenic trioxide and 3.1395 ppm. cadmium chloride. ($Lc^{50}/_2$ ppm.values of 96 hours), up to 96 hours. After 24, 48, 72, 96 hours of treatment, experimental and control animals were sacrificed by decapitation method, liver and gonads were gently separated; used for estimation of their cholesterol in contents. The total cholesterol contents were estimated by using Knobil method. (Knobil *et al*., 1954). The amount of cholesterol contents was expressed in terms of cholesterol /100 mg. of wet wt. of tissue, each observation was confirmed by taking at least five replicates. The differences in control and experimental animals groups was tested for significance by 't' test (Bailey, 1965) and the percentage decreased or increased over control was calculated for each value.

RESULTS

In the present investigation, the cholesterol of liver and gonads was found to be decreased after acute exposure by mercuric chloride, arsenic trioxide and cadmium chloride and the results are summarized in (Table 1).

The depletion in cholesterol contents in all tissues after acute heavy metals stress were increased as the period of exposure increased. The maximum depletion occurred in the liver followed by gonads. A comparative study shows that the gradual decrease in cholesterol content in various tissues of freshwater teleost fish, *Amblypharyngodon mola* after acute treatment of heavy metals for various periods of exposure. The order of heavy metal effect in liver and gonads after acute exposure were decreasing manner $HgCl_2 > As_2O_3 > CdCl_2$ to *Amblypharyngodon mola.*

TABLE 1: Effect of heavy metals mercuric chloride, arsenic trioxide and cadmium chloride on cholesterol contents of *Amblypharyngodon mola* after acute exposure

Tissue	Treatment	Acute			
		24 hours	48 hours	72 hours	96 hours
	Control	24.2113 ±0.004***	24.1399 ±0.004898***	24.0685 ±0.004898***	23.9971 ±0.004***
Liver	$HgCl_2$	20.7832 ±0.007483*** -14.1590	20.3547 ±0.009544*** -15.8026	19.9976 ±0.006345*** -16.9138	19.7119 ±0.007483*** -17.8571
Gonads	$HgCl_2$	21.6402 ±0.004898*** -10.6194	21.2831 ±0.008*** -11.8343	20.7832 ±0.004*** -13.6497	20.4261 ±0.007483*** -14.8809
Liver	As_2O_3	21.7116 ±0.004*** -10.3245	21.2117 ±0.001019*** -12.1301	20.9974 ±0.007483*** -12.7598	20.4975 ±0.004898*** -14.5834
Gonads	As_2O_3	22.3544 ±0.004898 -7.6669	22.0687 ±0.007483*** -8.5799	21.4974 ±0.007483*** -10.6824	20.9260 ±0.008*** -12.7977
Liver	$CdCl_2$	23.3047 ±0.007483*** -9.1938	21.6402 ±0.004898*** -10.3550	21.4974 ±0.006324*** -10.6824	21.0668 ±0.006324*** -12.2110
Gonads	$CdCl_2$	23.1400 ±0.004898*** -4.6154	22.7829 ±0.007483*** -5.6213	22.2830 ±0.004898*** -7.4184	22.0687 ±0.008*** -8.0359

1) Values expressed as mg / 100 mg of wet wt. of tissue.
2) (+) or (-) indicate percent variation over control.
3) ± indicate S.D. of five observations.
4) Values are significant at P<0.001***

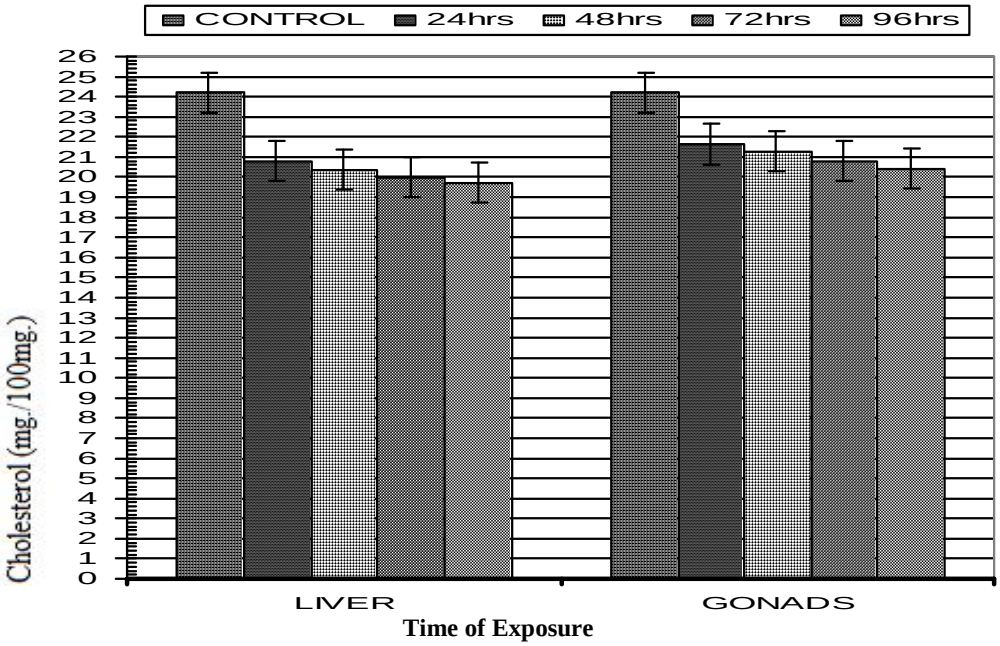

FIGURE1: Variations in Cholesterol content of Liver and Gonads of *Amblypharyngodon mola* after acute exposure to Mercuric Chloride.

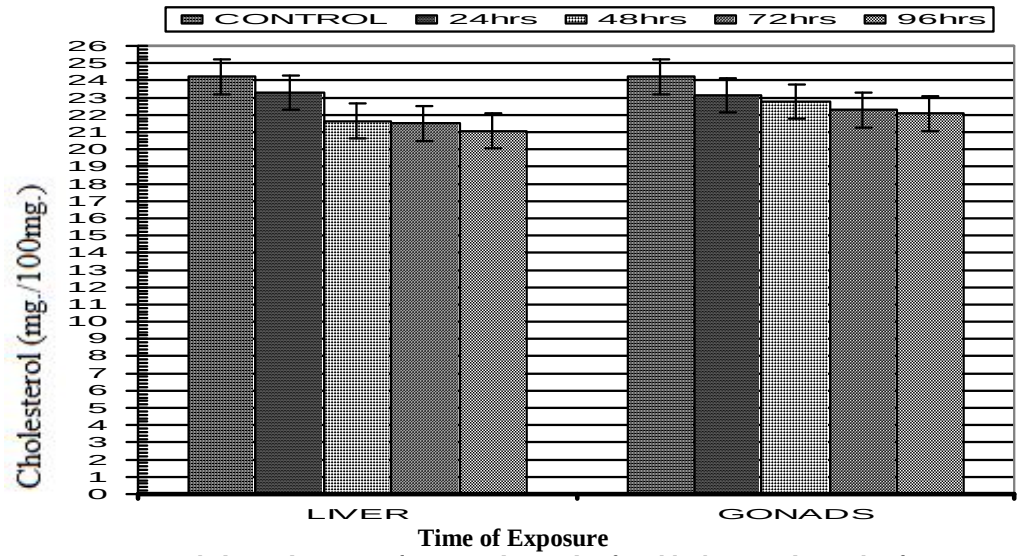

FIGURE 2: Variations in Cholesterol content of Liver and Gonads of *Amblypharyngodon mola* after acute exposure to Arsenic Trioxide

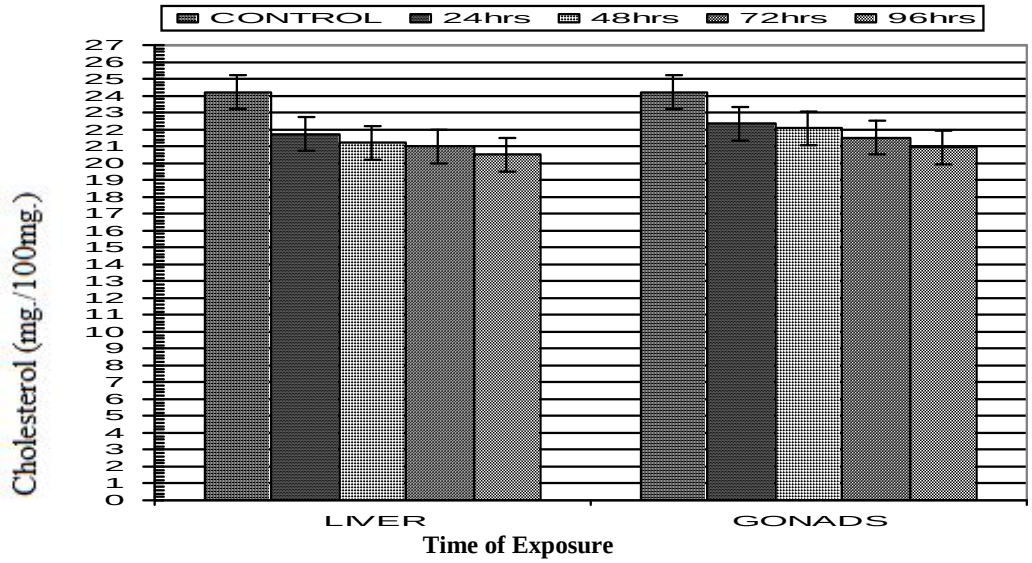

FIGURE 3: Variations in Cholesterol content of Liver and Gonads of *Amblypharyngodon mola* after acute exposure to Cadmium Chloride.

DISCUSSION:

Amudha *et al.* (2002), studied the dairy effluent induced alterations in the protein, carbohydrate and lipid metabolism of a freshwater teleost fish *Oreochromis massambicas*, who found that, these concentrations decrease depending on the dose of the effluent. According to Ramana Rao and Ramamurthi (1980), the increase in activity of enzymes lipase is for increasing lypolytic activity to meet the increased demand of energy during stress. Shivaprasad Rao and Ramana Rao (1979), studied that considerable decrease in total lipids in tissue might be due to drastic decrease in glycogen content in the same tissue which is an immediate source of energy during toxic stress condition. After glycogen, lipid content may be used for energy production to overcome toxic stress condition. Some workers support the results in which lipid content decreases. Copuzzo and Lanacaster (1981), reported significant decrease in lipid of post larval lobster when exposed to pollutants. A decrease in total lipid content in tissue reported by Ram and Sathyanesan (1984) on *Channa punctatus* intoxicated with mercuric chloride. The loss of the lipid may be a consequence of inhibition of lipid synthesis and mobilization of stored lipids, Mani and Saxena (1985). In the present investigation lowering in liver and gonads cholesterol in fresh water teleost fish, *Amblypharyngodon mola*, to an increase in lipid utilization to meet additional energy requirements under stress condition. Lipids may be mobilized to meet the energy requirement of fish either through oxidation or a process of gradual instauration of lipid molecules significant depletion in cholesterol contents was observed. The depletion in the metabolites indicates the fact that whole metabolic pool of the fish gets disturbed / altered under the toxic stress. Further, the change in the biochemical profile indicates their rapid utilization to provide excess energy to

cellular biochemical process in order to cope with the stressful condition

The investigatory results shows that decrease in cholesterol in liver and gonads were more in $HgCl_2$ treatment as compared to $CdCl_2$. The order of heavy metal stress were decreasing manner as $HgCl_2$ > As_2O_3> $CdCl_2$ to *Amblypharyngodon mola.*

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