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Influence of the detergent tide on enzyme activities of fresh water fish, *Labeo rohita*

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Abstract
Enzymes analysis is widely used for rapid detection to predict early warning of detergent toxicity. Assay of enzymes activities in fishes has recently emerged to be an important diagnostic tool in the field of environmental toxicology. Differential behavior with regard to tissue and fish biochemical parameters can be further examined to develop a more meaningful indicator or marker to assess or to characterize the particular pollutant and its potential for toxicity. Hence the present work was carried out in the tissues of a fresh water fish, *Labeo rohita* exposed to detergent tide. The enzymes like GOT and GPT in the tissues were analyzed in the fish exposed in sub lethal concentration of detergent for a period of different durations.

Keywords: Detergent tide, enzymes, *Labeo rohita*

1. Introduction
The ecosystem plays an important role in the lifetime of living organisms due to its physico-chemical properties and formation of food value. The activities like urbanization, industrialization, agricultural and other activities. These activities has exploited the environment and disturbed the delicate ecological balance between living and non-living component of the biosphere. The unfavorable conditions created by man, not only threatened these survival of humans but also the other living organisms. The number of species with time is likely to become rare.

Water bodies become the ultimate sink for the toxic chemicals used in laundries and industries, these detergents have been proved to be highly toxic to aquatic organisms, including plank toxic forms, invertebrate fauna and fish. Hence, there has been much emphasis on studying the toxicity of such detergents in fish and other aquatic organisms. Contamination of natural water by detergents has become a matter of concern in recent years because of their large scale use in home and industrial applications, such as, washing powders, dye tastners, formulation of shampoos, industrial and household cleaning agents, toothpaste, tooth powder, in dispersing oil spills etc. available reports indicate that entry of detergents into aquatic system build up in the food-chain and are responsible for many hazardous effects and even death of the aquatic organisms, including fishes (Summarwar and Lall, 2013) [9].

Synthetic detergents are a diverse group of compounds and part of a larger group known as surface-active agents or surfactants. In recent years there has been a rapid increase in the production of synthetic detergents which are used in industries and house hold purposes. These have become one of the important contributory substances that create pollution in natural water systems. Toxicological impacts of synthetic detergents have been well documented by many workers.

Fishes are very good biosensors of aquatic contaminants and as bio-indicator species respond with great sensitivity to changes in the aquatic environment. Scanning of pertinent literature reveals that detergent related works on fish are still very merge and limited to acute toxicity determination (Adewoye and Fawole, 2005) [1].

Enzyme analysis of organs such as muscles, kidney, liver, heart and gills in fish can provide important information about the internal environment of the organism Enzyme activities affect various chemical and biological reactions in the body of the fish. Enzymes are biochemical macromolecules that control metabolic processes of organisms, thus a slight variation in enzymes activities would affect the organism (Roy 2002) [7].

2. Materials and Methods

Rohu is a eurythermal species and does not thrive at temperatures below 14 °C. It is a fast growing species and attains about 35-45 cm total length and 700-800 g in one year under normal culture conditions. Appropriate narrow range of concentration 10-50 mg was used to find the median lethal concentration using a minimum of 10 fishes for each concentration and the mortality was recorded for every 24 hours up to 96 hours. It was found as 27mg for 96 hours, using Probit Analysis method (Finney 1971). Four groups of fishes were exposed to 2.7mg ($1/10^{th}$of 96 hours LC_{50} value) concentration of the detergent 'Tide' for 24, 48, 72, and 96 hours respectively. Another group was maintained as control. For each experimental study tissue samples were collected from the fish for the analysis of Enzymes parameters like GOT and GPT.

3. Results and Discussion

The gill tissue was found to contain 24.90IU/L of GOT in the control fish. The fishes which were maintained in 2.7mg detergent (tide) concentration for 24, 48, 72 and 96 hours period were found to contain 25.60IU/L,26.00IU/L,26.70 IU/L and 27.10 IU/L of GOT in their gill tissues. The control fish was found to show about 16.40 IU/L of GOT activity in liver tissue. But, when subjected to 24, 48, 72 and 96 hours exposure in 2.7mg detergent (tide) concentration the GOT levels more recorded as 17.82IU/L,18.70IU/L,19.50IU/Land22.40IU/L respectively. The mean continued value of GOT activity level in the fishes, which were maintain in short term exposure, was found to contain about 30.40IU/L in kidney tissues. The fishes which were subjected to 24, 48, 72 and 96 hours in 2.7mg detergent concentration were found to have 31.23IU/L, 32.40IU/L and 35.00IU/L respectively. The muscle tissues of the fish, *Labeorohita* in 2.7mg detergent concentration for shorter duration of 24, 48,72 and 96 hours contained 24.00IU/L, 25.50IU/L, 27.60IU/L and 28.20IU/L respectively. The mean control value was 22.48IU/L.

The gill tissue was found to contain 16.70 IU/L of GPT in the control fish. The levels of activity in the groups, which were maintained in 2.7mg detergent concentration for shorter durations. The fishes which were exposed to shorter periods of 24, 48, 72 and 96 hours, the activity levels of GPT were 17.20IU/L, 19.40IU/L, 21.30IU/L and 22.40IU/L respectively. The levels of activity of the enzyme GPT in liver were 35.00IU/L,35.60IU/L,36.78IU/L and 37.80IU/L after short exposures of 24, 48, 72 and 96 hours periods. The mean control value in the liver tissue was about 34.10IU/L. The kidney tissue was found to record 27.30IU/L, 27.93IU/L, 28.40IU/L and 29.10IU/L of GPT activity levels after shorter periods of exposure. The mean control value wad found as 26.00IU/L respectively. The levels of activity of the enzymes in the muscle tissues after short term exposure were 22.35, 23.43, 24.80 and 25.33IU/L However the mean value of the control group was 21.50IU/L.

In the present study, the significant increase in GOT and GPT activity in gill, liver and muscle during acute and sublethal treatment indicates that the damage of the organs due to drug toxicity or the organism tries to mitigate the drug induced stress by increased rate of metabolism. Increase in the activity of these enzymes (GOT and GPT) after the toxicity treatment is a sensitive indicator of cellular damage. Therefore, higher activities of these enzymes registered in the present investigation may be ascribed to damage caused to liver by exposure of toxicant. Serum GOT and GPT activity of *Catla catla*, during sublethal exposure to chromium toxicity observed overall increase in its activity than the control. Campbell, (1984) reported that these enzymes liberate to the blood stream when the hepatic parenchyma cells are damaged.

GOT, an enzyme involved in transamination reactions is present in most of the tissues which shift metabolic cycle from amino acids to alpha keto acids which enter into krebs cycle and hence cause the acceleration of the intermediary metabolism. The result of the present study showed increase in the GOT activity in all the tissues. This may be due to decreased metabolic activity by blocking the active sites and tissue damage (Bhatanagar and Tyagi, 1995) [2]. The increased GPT activity may indicate anaerobic nature of carbohydrate metabolism in fish, possibly to meet the increased energy demands under sustained and prolonged toxic stress as supported by Ramana Rao *et al*. (1990) [6]. On the other hand, increased activity of GPT indicates an increased rate of proteolysis in the tissue (Sasthri and Shukla, 1998) [8].

Enzyme analysis of organs such as mulces, kidney, liver and gills in fish can provide important information about the internal environment of the organisms. Enzymes activities affect various chemical and biological reactions in the body of the fish. According to (Gabrial and George 2005) [5], transamination is one principal pathway for synthesis and deamination of amino acids, enabling carbohydrate and protein metabolism during fluctuating energy demands of the organism under various adaptive conditions.

Table 1: GOT Level in Tissues of *Labeo Rohita* Exposed To the Detergent Tide

Sample Enzymes Activity	Exposure Period				
	Control	24 hrs	48 hrs	72 hrs	96 hrs
Gills	24.9±O.93	25.6±0.63	26±10.00	26.7±1.15	27.1±0.93
't' Value	46.37**	1.07**	1.39**	2.37**	2.57**
% Change		-77.91	-79.51	-82.32	-83.93
Liver	16.4±0.80	17.82±0.73	18.7±0.74	19.5±0.80	22.4±0.72
't' Value	35.50**	2.27**	3.65**	4.74**	9.65**
% Change		-92.25	-97.62	-102.50	-120.18
Kidney	30.4±0.94	31.23±1.54	32.4±0.69	34.6±0.45	35.0±1.19
't' Value	56.01**	0.79**	2.97**	6.98**	5.25**
% Change		-72.33	-76.17	-83.41	-84.73
Muscles	22.48±1.20	24.0±1.50	25.5±1.16	27.6±0.51	28.2±0.83
't' Value	32.44**	1.37**	3.13**	6.80**	6.79**
% Change		-84.28	-90.95	-100.29	-102.96

Values are mean ±SD, n = 5, figures in parenthesis are percentage Increase over control,
** = Significant at one percent level.* = Significant at five percent level. NS= Non significant

Table 2: GPT Level in Tissues of *Labeo Rohita* Exposed To the Detergent Tide

Sample Enzymes Activity	Exposure Period				
	Control	**24 hrs**	**48 hrs**	**72 hrs**	**96 hrs**
Gills	16.7±0.43	17.2±1.06	19.4±0.93	21.3±1.14	22.4±0.87
't' Value	67.26**	0.75**	4.56**	6.53**	10.17**
% Change		-86.29	-99.46	-110.84	-117.43
Liver	34.1±1.80	35±1.00	35.6±0.63	36.78±0.23	37.8±0.88
't' Value	32.81**	0.75**	1.36**	2.55**	3.19**
% Change		-68.53	-70.29	-73.75	-76.75
Kidney	26.0±1.55	27.3±0.94	27.93±1.06	28.4±0.68	29.1±1.67
't' Value	32.81**	1.24**	1.78**	2.45**	2.35**
% Change		-79	-81.42	-83.23	-85.92
Muscles	21.5±1.15	22.35±1.35	23.43±1.33	24.8±0.28	25.33±1.57
't' Value	32.38**	0.83**	1.90**	4.82**	3.40**
% Change		-82.45	-87.47	-93.84	-96.31

Values are mean ±SD, n = 5, figures in parenthesis are percentage Increase over control,
** = Significant at one percent level.* = Significant at five percent level. NS= Non significant

4. Conclusion

The use of detergent in homes cannot be discontinued. However, better method of disposing the 'after wash' needs to be worked out. There is a need of development of ecofriendly detergents and soaps, so that aquatic fauna of various water bodies will be preserved. If the present rate at which they are introduced into aquatic environment is not checked, then continuous existence of aquatic fauna is in serious threat.

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