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Haemato-biochemical variations induced by the aerial detergent in *Labeo Rohita* during the exposure and recovery period

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Abstract
The present study was observed that toxic effect of Ariel detergent and heanato biochemical variations induced by the detergent in *Labeo rohita*. The effect was observed during exposure (15 days) and recovery (15days) period. During the exposure period, there was a significant amount of increase in blood glucose and serum cholesterol due to increased glucogenesis and increased lipid content in blood respectively. However, the serum protein level decreased in fish due to inhibition of RNA synthesis or increased proteolytic activity. During recovery period, the restoration of glucose, protein and cholesterol level was found to be slow and gradual.

Keywords: Ariel Powder, *Labeo rohite*, haemato – biochemical Parameters, Exposure and Recovery Period

1. Introduction

Detergents have caused more concern during the past few years these compounds have caused much concern during the past few years owing to their tendency even in small amounts to cause from rivers. But there is considerable experimental evidence that low concentrations of synthetic detergents are toxic to fish. Thus, DEGENS and this coworkers have shown that contractions of only 5 ppm of some anionic and non-anionic synthetic detergents can kill certain fish in 5-100 hours though certain species to some extent become acclimatized have compared natural detergents with synthetic detergents as regards their toxicity towards fish and some their results are reproduced. The types of synthetic detergents found in sewage and rivers are mostly increasing in popularity and it is reported that together these two types represent 90 percent of the synthetic detergents used in the U. S. A. The increasing use of synthetic detergents in place of soap work authorities' river foam caused by the presence of even low concentrations of these detergents. Man-made activities like mining industrial discharge, sewage, sludge, disposal, fertilizers and pesticide application have been the major culprits for elevated levels of upper lend mercury and various heavy metals in various ecosystems. The term "synthetic detergent" is used throughout this study, for a material which cleans (or is used for cleansing), but in this definition soap is not included. Even so, this is still a wide definition, because, of course, it can refer to the active ingredient, or the solid, liquid, paste or powder compounded from this active matter. However, this should not lead to confusion, as the industry itself as yet makes no distinction in terminology between the basic material and the ready-for-use product.

The first synthetic detergent which fall into our definition of the term seem to have been developed by the Germans in the First World War period to allow fats to be utilized for other purposes. These detergents were of the short-chain alkyl naphthalene sulphonate type, made by coupling propel or butyl alcohols with naphthalene and subsequent sulphonation, and appeared under the general name of Nekal. These products proved to be only fair to moderately good detergents, but good wetting agents and are still being produced in large quantities for use as textile auxillaries.

Generally aquatic organisms are susceptible to pollution effects by pesticides as well as by industrial effluents. However, an organism tries to adapt itself to these changes by changing metabolic activities. But at higher concentration, these pollutants can cause damage to the physiological system by affecting the organisms either at organ and cellular levels or even at molecular level, which in turn cause changes in the biochemical composition, which can be used to study the different protective mechanisms of the body to resist toxic substances and detoxification. The pesticides cause a number of subsidiary problems like affecting the ecosystems, and the growth, reproduction and behavior by causing pathological and physiological changes (Meenakshi 1993, Holden 1973) [6], and alterations in biochemical constituents of fishes (Anon 1962) [2]. Besides, the pesticides also bring some changes in the blood parameters. The metabolic status in an organism is very much reflected in its milieu interior (Lu 1985) [5]. Blood being the medium of intercellular and intracellular transport, which comes in direct contact with various organs and tissues of the body, the physiological state of an animal at a particular time is reflected in its blood. Pesticides rapidly bind to the blood proteins and induce hematological changes such as changes in blood glucose, serum protein and serum cholesterol levels, which are of some value in assessing the impact of exposure under natural conditions and May also, serve as tools for biological monitoring. So the present investigation deals with the effect of very commonly used detergent i.e. Ariel detergent on survival and haemato-biological parameter variations are observed from the freshwater fish *Labeo rohita*.

2. Materials and Methods

The chlorine free water was used as test water in all the experiments. The condition of test water maintained at constant

characterization as recommended by Committee on water quality criteria (Rama Krishnan & Sivakumar 1993) [8] throughout the test in the present investigation, the commercial grade of Ariel detergent powder was selected and used by diluting it in required volume of water or any other organic solvents. This is in accordance with the method employed by the farmers who simply dilute the grade with water and apply in paddy fields.

Acute toxicity test were conducted to determine the impact of toxicant on aquatic animals within a short period of 24 hours. Simultaneously the toxicity of Ariel detergent on the test fish *Labeo rohita* for 3, 6, 12, 24, 48, 72, 96 and 120 hours were determined.

In the present study two circular tanks were used. One of the tank served as control (C) and other as experimental (E). Both the tanks were filled with 40 litres of bore water. To the experimental tank filled with sub lethal concentration (0.15 ppt), a group of 15 fish was introduced into each tank and the data was noted as zero day. The fish in the tanks marked as control and experiment were fed on alternate days and water was changed an hour after providing the food. After 15 days for exposure period. Similarly at end of the 15 days, *Labeo rohita* were transferred free from detergents medium i.e. 15 days for recovery period. A group of 7 fishes from both control and experimental tanks were collected individually and subjected to the analysis as given below. Nucleic acids were extracted from the tissues by the method of Schneider (1957). The DNA concentration was estimated by the method of Burdon (1957).

3. Result and Discussion

In the present investigation the presumable harmless concentration of Ariel detergent powder to *Labeo rohita* is calculated as 0.15 ppt (Table. 3). When the fish were exposed to presumable harmless concentration of 0.15 ppt, the blood glucose level and serum cholesterol level increased significantly, while serum protein level gradually decreased during the exposure period. But during recovery period, they attained almost the normal level as depicted in Table 4-6. Changes in selected haemato – biochemical parameters in *Labeo rohita* during exposure and recovery periods in the following table 4-6. Each value is mean ± S.D. After exposure to sublethal concentration an Ariel detergent powder, the *Labeo rohita* showed alterations in the blood parameters. It was observed that in the blood of the fish treated with sublethal concentration of the detergent, glucose level was increased to 122.5% than the control fish. The elevation of blood glucose in the *Labeo rohita* exposed to the toxicant may be attributed to physiological stress caused by Ariel detergent.

The elevation in blood glucose level gains support from the works of Meteler *et al.*, (1981) and Amudha (1986) [1, 7]. These authors have suggested that such elevation is due to increased glucogenesis as well as due to inhibition of glycogenolysis and glyconeogenolysis during stress.

In the toxicant medium the fish absorbs little oxygen from the environment. As their respiratory metabolism being depressed. The stored intracellular glycogen is utilized under such conditions the hyperglycogenic hormone is released for the degradation of glycogen. Thus, glucose leads into the blood causing hyperglycemia (Bhattacharya *et al.*, 1975) [3].

In general, any toxic substance like pesticide or heavy metal or any other toxic materials are known to depress blood protein in fish (Jana and Bandyopadhyaya 1987). In present study also, the decrease in protein content in blood was observed. The blood of *Labeo rohita*, treated with sublethal concentration of Ariel detergent, showed a decline in protein content (55.45 mg/g) when compared to that of the protein content 42.14 mg/g) of recovered fish, thereby indicating the occurrence of proteolytic activity in the tissues. Other workers have also reported the depletion in the level of plasma protein (Goel and Guptha 1985) [4]. The cholesterol level of the blood was found increased to 110.6% in *Labeo rohita* a sublethal treatment of Ariel detergent powder. Increase in cholesterol in Ariel exposed fish, indicates increased lipid content in blood and retardation of fat metabolism. Such an increase of lipid content on sublethal treatment may be related to the heavy stress imposed by the toxic materials (Ariel). The significant increase of cholesterol indicates lipid profile of blood; hyper lipid anaemia may be due to abnormal lipid metabolism which is probably the result of hepatic dysfunction and chronic hypoxic condition (Goel and Gupta 1985) [4]. The cholesterol level increased during exposure period whereas it decreased during recovery period. The significant decrease of cholesterol level in recovery period depicted the hypocholesterolamia, which frequently results in anaemia. During recovery period it was found that after short term exposure of 15 days restoration of protein, glucose and cholesterol level to their normal level was found to be slow and gradual which might be due to slow elimination of the toxicant (detergent) from the tissues and reduced proteolysis.

Table 1: Mortality of *Labeo rohita* exposed to different concentration of Ariel detergents at different hours of exposure.

Concentration (ppt)	No. of fishes exposed	3 hrs	6 hrs	12 hrs	24 hrs	48 hrs	72 hrs	96 hrs	120 hrs
0.10 *	30	-	-	-	-	-	-	-	-
0.15 *	30	-	-	-	-	-	-	-	-
0.20	30	-	-	-	3	4	6	7	9
0.25	30	-	-	3	6	7	9	10	11
0.30	30	-	-	5	9	10	13	15	19
0.35**	30	-	5	7	12	15	17	19	24
0.40	30	3	7	11	14	20	22	24	27
0.45***	30	5	10	15	19	22	26	28	30
0.50	30	10	12	19	22	25	25	30	-
0.55	30	12	17	21	25	28	30	-	-
0.60	30	15	20	24	28	30	-	-	-

* LC_0 Sublethal concentrations

** LC_{50} 50% of mortality

*** LC_{100} 100% of mortality (Lethal concentrations)

Table 2: Physico chemical parameters of normal water and sub lethal Concentration of Ariel detergent dissolved water

Parameters	Normal water (Control)	Sublethal concentration (Ariel detergent dissolved water)
Colour	Colourless	Light milky
Odour	Odourless	Unpleasant
Temperature °C	22±0.5	22.5±0.5
pH	7.5±0.05	8.1±0.03
DO mg/l	7.7±.01	5.5±0.01
Free CO_2	1.5±0.01	2.3±0.01
Total alkalinity mg/l	40.7±0.5	57.1±0.14
Salinity (ppt)	27.93±0.3	0.63±1.3

Table 3: Level of total free sugar (mg/100 ml) in blood of control and treated groups during exposure and recovery periods. Value ($\bar{X}$ ± SD)

Control		Treated	
Exposure Period (15 days)	Recovery Period (15 days)	Exposure Period (15 days)	Recovery Period (15 days)
34.00	36.00	40.00	32.14
32.00	32.10	38.14	31.13
31.00	31.23	37.16	29.88
29.00	30.40	38.13	30.10
29.00	29.00	40.00	32.14
31±1.01	31.74±2.36	38.68±1.26	31.07±0.97

Table 4: Level of total serum proteins (mg/100 ml) in blood of control and treated groups during exposure and recovery periods. Values ($\bar{X}$ ± SD)

Control		Treated	
Exposure Period (15 days)	Recovery Period (15 days)	Exposure Period (15 days)	Recovery Period (15 days)
512.00	523.14	463.14	480.15
520.34	510.13	463.15	473.14
484.11	521.34	454.13	480.15
489.14	525.41	430.12	480.10
512.33	524.31	430.14	480.10
503.58±14.25	520.86±3.16	448.13±3.97	478.72±0.91

Table 5: Level of total serum cholesterol (mg/100 ml) in blood of control and treated groups during exposure and recovery periods. Values ($\bar{X}$ ± SD)

Control		Treated	
Exposure Period (15 days)	Recovery Period (15 days)	Exposure Period (15 days)	Recovery Period (15 days)
280.16	285.15	314.15	290.13
285.14	280.10	310.00	298.14
274.14	274.15	285.00	285.15
243.15	275.14	284.15	288.14
280.13	285.15	314.16	243.14
272.54±6.96	279.93±4.71	301.49±13.9	280.94±13.25

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