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DETERGENT INDUCED PROTEIN ALTERATIONS IN FRESH WATER GASTROPOD *Bellamya bengalensis* (LAMARCK)

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ABSTRACT

The freshwater gastropod *Bellamya bengalensis* exposed to 69.18ppm concentration of detergent (Tide) on protein content in the tissue of foot, mantle and digestive glands for 96 hours exposure. Compare to control group there was significant change in protein contents from foot, mantle and digestive glands in detergent exposed groups. The percent decrease of total protein content was in the order of digestive gland, mantle and foot.The result showed that detergent (Tide) induces significant depletion in protein metabolic profiles in foot, mantle and digestive glands might be due to increased proteolysis and possible utilization of the products of their degradation for metabolic purpose.

KEYWORDS : *Bellamya bengalensis,* Tide Detergent, Protein Alteration

Freshwater ecosystem is under increasing threat due to rapidly expanding population and the subsequent modernization process resulted in inconspicuous exploitation of nature leading to the pollution crisis. Rivers are vulnerable, since waste effluents from industries, domestic and farms open directly into them. Industrial and domestic effluents which account for the pollution that endangers the aquatic life contain various toxic substances. To combat these toxic effects and stress conditions organisms develop the necessary potential by altering energy metabolism. This results in severe changes in the metabolic cycles involving the inter change of biochemical constituents of tissues. When cells are stressed by an extreme environmental condition, they undergo a series of often irreversible biochemical and cellular changes and their study can give indications of the degree of a stress of the organism.

Gastropods are among the best test organisms in eco toxicological investigations when assessing the effect of pollutants in an aquatic environment (Lam et al., 1997). There is paucity of information about the alteration of biochemical constituents in gastropods in relation to sub-lethal exposure to detergents. The effect of detergent (Tide) on proteins was studied in a freshwater gastropod, *Bellamya bengalensis*. Proteins found in almost every cell as they are fundamental for cell structure and function. They have a major role in the process of interaction between intra and extra cellular media, as a constituent of cell membrane. Protein metabolism involves interaction between amino acids, several enzymes and co-enzymes etc. (Harper and Mayers, 1978).

Paul et al., (1995) revealed the activity of acid phosphatases in the selected tissues of *Sarotherodon mossanbicus* exposed to synthetic detergent `Wheel'. Khan et al., (2001) observed the cadmium chloride toxicity in protein level from body parts and whole body of marine edible gastropod, *Babylonia spirata*. Padmaja and Balaparameswara Rao, (1994) investigated the effect of an organochlorine and three organophosphate pesticides on glucose and glycogen contents of the foot and mantle on the freshwater snail *Bellamya dissimilis*.

MATERIALS AND METHODS

The snails *Bellamya bengalensis* collected from river Godavari were acclimatized for two days to the laboratory conditions and fed prior to experimental study. The present experiment was designed to study the effect of detergent (Tide) on *B. bengalensis* on various tissue metabolites. The snails were exposed to sub lethal doses of toxicants for 96 hrs. The snails control and treated foot, mantle and digestive gland were taken into separate petridishes. Samples were dried with filter paper to avoid the outer water content. The wet weights of all the tissues were taken to the nearest milligram and they were immediately transferred to the hot air oven maintained at 90-100°C. The samples were dried for 3 to 4 days for the complete removal of their water content. Dry weight of all the tissues were taken when all the moisture was removed and no further change in the weight of the dried tissue was noticed. The dried material was powdered and used for

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analysis.

20mg of dried and powdered component of muscle, hepatopancreas and gonads were weighed separately and whole protein was estimated calorimetrically by Lowry et al., (1953) method. Sample was homogenized in 1N NaoH and centrifuged at 3000 rpm for 15 min. The supernatant was discarded and to this, 5ml of alkaline copper sulphate reagent was added and allowed to stand at room temperature for about 10 min. After that 0.5ml of folin-phenol reagent (1:1, folinphenol: distilled water) was added. The solution was mixed thoroughly and incubated at room temperature for about 30 min. The colour developed was measured at 650 nm. The values were calculated against Bovine Serum Albumin (BSA) used as standard and were represented as % dry weight of the sample powder.

RESULTS

The changes in biochemical composition of foot, mantle and digestive gland of freshwater gastropod, *Bellamya bengalensis* exposed to acute concentrations of detergent (Tide) was studied along with control animals. The data was supported by various statistical analysis and the standard deviation and standard error of the mean were calculated. Student 't' test was used to find out significance. The level of significance was used in the present study ($P<0.05$, $P<0.01$, $P<0.001$).

Table 1 and figure 1 show alterations in the protein level. The protein depletion occurred due to detergent (Tide) toxicity has been compared with control group of snails. Significant decrease in protein level was observed in all the three organs. The concentration of protein in the foot of control group of snails was 7.429 mg/100 mg, but it was significantly reduced after 96 hrs as 5.993 mg/100 mg. The mantle of the snail showed 5.636 mg/100 mg of protein in control group of snails, but after 96 hrs it was decreased up to 4.653 mg/100 mg respectively. The digestive gland of controlled snail showed 8.057 mg /100 mg of protein in it, but it was depleted after 96 hrs as 6.146mg/100.

The present findings indicated decrease of protein in foot, mantle and digestive gland of *B. bengalensis* exposed to detergent Tide for 96 hours might be due to more utilization of these constituents under stress from detergent contamination. Total proteins in digestive gland, mantle and foot tissues were significantly lower when compared to control snails after a period of 96 hrs of exposure to detergent.

Table 1: Total Protein content in the Foot, Mantle and Digestive gland of B. bengalensis exposed to Detergent (Tide) (Mean ± S.D; n = 3)

	96 hrs. Control	96 hrs. Treated	% variation
Foot	7.429 ± 0.278	5.993 ± 0.145*	-19.32
Mantle	5.636 ± 0.345	4.653 ± 0.14*	-17.44
Digestive gland	8.057 ± 0.137	6.146±0.142***	-23.71

*p<0.05 **p<0.01 ***P<0.001 NS Not significant

DISCUSSION

Any stressful condition alters the biochemical composition. The change in metabolic rate leads towards the change in biochemical composition hence, the change in biochemical composition is an indicator of stress of chemical or physical nature in the surrounding which mainly affects protein contents. There is paucity of information related to effects of detergents of aquatic invertebrate organisms. The biochemical changes occurring in the body gives important indication of stress. During stress an organism needs sufficient energy which is supplied from reserve materials i.e. carbohydrate, protein and lipid etc.

Vast literature is available on the toxicity of heavy metals, organ pesticides and insecticides etc. in different aquatic animals related to effect on biochemical constituent levels in different tissues of animals. Literature is not available on the toxicity of detergents on molluscs which directly affects the biochemical constituents. Hence the present study was carryout to evaluate the impact of detergent on protein content in different tissues of freshwater snail, *Bellamya bengalensis*. The present investigation also shows that these gastropods exhibit a differential preference in the utilization of total proteins on exposure to detergent (Tide).

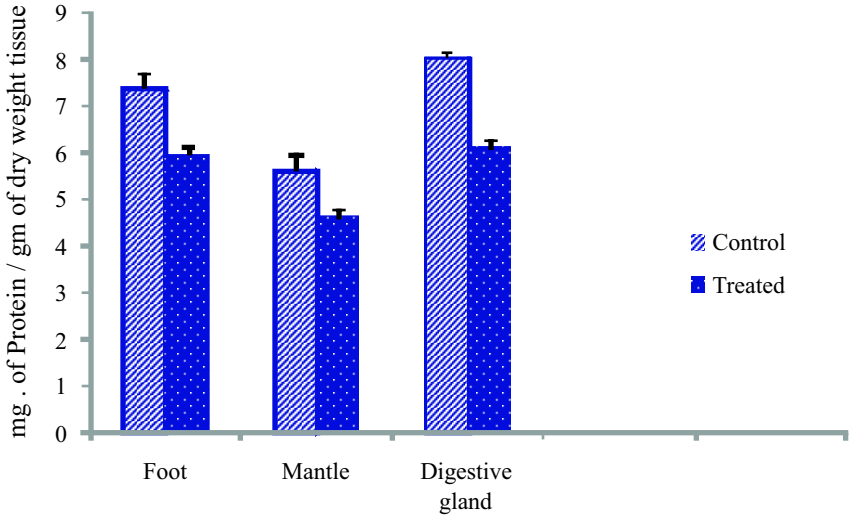

Figure 1: Protein Alteration In The Foot, Mantle And Digestive Gland of B. Bengalensis Exposed To Detergent (Tide) Compared With Control Groups

Proteins occupy a unique position in the metabolism of cell because of the proteinaceous nature of all the enzymes which mediate at various metabolic pathways. It is known that structural proteins are used as energy source under stressful conditions (Claybrook, 1983). Under stress conditions, the snails needed more energy to detoxify the toxicants and to overcome the induced stress. In the present study, significant decrease in total proteins was recorded in the snails exposed to detergent (Tide). The results of total protein contents in all tissues clearly indicated that the digestive gland was the most affected organ followed by mantle and foot in *Bellamya bengalensis*. The higher depletion of protein in the digestive gland of bivalve, *Lamellidens marginalis* might be due to high metabolic potency and efficiency of the gland under pollutant stress (Jagtap et al., 2011). The digestive gland seems to be the main site of degradation and detoxification of toxicants and hence has the largest demand of energy for the metabolic processes resulting in increasing utilization of protein to meet energy demand. The maximum decrease of protein was observed in hepatopancreas after 10 days of exposure to the pyrethroids in crab, *Barytelphusa cunicularis*. This may be because of more utilization of protein in stressful environment conditions and attributed to the inhibition of protein synthesis (Joshil and Kulkarni, 2011).

Lomte and Alam, (1982) reported depletion of protein content in various body tissues of snails, B. bengalensis after Malathion treatment. Bhide et al., (2006) reported the sub-lethal concentrations of baygon and nuvan induced depletion in the protein fractions of the freshwater snail, *Lymnaea stagnalis*. A marked reduction in the level and distribution of proteins were observed after 7 and 14 days in all digestive gland cells of land snail, *Eobania vermiculata* (Radwan et al., 2008).

There is lack of information available on the toxicity of detergent compounds on the biochemical constituents in freshwater molluscs, particularly gastropods, and it could be concluded that the biochemical alterations in the tissues of freshwater gastropod, *Bellamya bengalensis* caused by detergent reflected toxicity. The release of detergent compounds in aquatic environment especially in freshwater ecosystem could be controlled. The obtained results can motivate further investigations regarding molecular stress response in snails which is especially useful as a biomarker for sub-lethal effects of toxicants.

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