J. Ecophysiol. Occup. Hlth. 10 (2010) 173-176

Comparative Fluctuation in RNA Contents of *Barytelphusa Guerini* After Exposure to Zinc and Cadmium Sulphate Toxcity

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Abstract : *The fresh water female crab, Barytelphusa guerini was selected for experimentation. It is abundantly available in the paddy fields of Nanded district. The animals were collected and brought to the laboratory to acclimatize them with laboratory conditions. Alterations due to the effect of metallic pollutant on the RNA content of leg muscle, gill, hepatopancreas, heart and blood of freshwater female crab* Barytelphusa guerini, *after exposure to sublethal concentration of zinc sulphate and cadmium sulphate for 24, 48, 72 and 96 hours were studied. The values of RNA content were expressed in terms of mg RNA /gm wet weight and mg RNA /100 ml of blood.*

Key Words: RNA content, Barytrelphusa guerini, Toxicity

Introduction

Ribonucleic acid (RNA) is a biologically important type of molecule that consists of a long chain of nucleotide units. A nucleic acid is a macromolecule composed of chains of monomeric nucleotides. These molecules carry genetic information or form structures within cells. Nucleic acid are nitrogen containing compounds of high molecular complexes and are known to be in association with proteins in the cell. Very scanty reports are available pertaining to the action of toxicants on nucleic acid level as on ribonucleic acid (RNA) and deoxyribonucleic acid (DNA). Narayanram, and Sathyansen (1986) have reported the effects of two mercuric compounds on RNA content in the brain, liver and ovary of the fish Guna. Pawar, and Kulkarni (2000) have reported declined level in the study of hepatopancreatic FAA, RNA and DNA contents of the crab, *Baratelphusa jacquemonti* exposed to cythion. Effect of Cadmium and Copper in gonadal RNA of *Placopecten magellanicus* was reported by Gould *et al* (1988). Overall decrease in total protein, total DNA, total RNA, free sugar, glycogen, protein-bound sugars, neutral lipid, glycolipid, and phospholipid in the test samples was seen as compared to control after exposure to naphthalene toxicity (Vijayavel and Balasubramanian, 2006).

Materials and Methods

The *Barytelphusa guerini* were collected from paddy fields of Nanded district. The were collected from their natural habitat and brought to the laboratory. The crabs were fed with small pieces of goat muscle to enable the animals from overcoming effect of starvation. The temperature was about 25±3° C. Healthy female crabs weighing between 30-40 g were selected for present work to avoid effect of sex and size (Ambore, 1976).After acclimatization the crabs were treated to different sublethal concentrations of Zinc sulphate and Cadmium sulphate. Simultaneously for these experiments appropriate control groups were maintained. After the exposure to above mentioned two heavy metal salts for definite periods the tissues chelate leg muscle, gills, hepatopancreas and heart were dissected out and kept in clean watch glass and (wet) weighed and a sample of blood has been taken for the study of

biochemical tissue metabolism such as RNA. RNA content was estimated by Schmidt – Thanhauser Schneider procedure given by Volkin and Cohn (1967).

Results and Discussion

The RNA content was estimated and variations were found in total content of RNA during exposure exposure periods of 24, 48, 72 and 96 hours to heavy metal pollutants such as Copper sulphate, Zinc sulphate and Cadmium sulphate (Table 1 and 2).

The animals exposed to Zinc sulphate showed variation in amount of RNA which varied from

Table 1. Ribonucleic Acid (RNA) contents of *Barytelphusa guerini* after zinc sulphate toxicity.

Hours	LM	GM	HP	H	Blood
Control	0.725 ±0.15	0.930 ±0.10	0.925 ±0.11	0.78 ±0.15	0.50 ±0.01
24	0.824 ±0.10	0.900 ±0.12	0.841 ±0.06	0.713 ±0.12	0.583 ±0.06
48	0.539 ±0.02	0.785 ±0.4	0.342 ±0.14	0.209 ±0.05	0.052 ±0.00
72	0.658 ±0.02	0.700 ±0.06	0.509 ±0.04	0.395 ±0.10	0.120 ±0.01
96	0.792 ±0.03	0.972 ±0.04	0.624 ±0.30	0.358 ±0.04	0.124 ±0.00

(Mean values of Iodine Number of six samples and ± Standard Deviation)

0.539 to 0.824 in leg muscle, 0.700 to 0.972 in gills, 0.342 to 0.925 in hepatopancreas, 0.209 to 0.780 in heart and 0.052 to 0.583 in blood. The ribonucleic content was gradually decreased upto 48 hours and then increased in hepatopancreas and heart while it initially increased at 24 hours then sharply decreased at 48 hours and again increased upto 96 hours in leg muscle and blood as compared to control. Gill showed gradual decrease in RNA content upto 72 hours and then sharply increased at 96 hours as compared to control (Fig 1,2,3,4 and 5). The animal exposed to Cadmium sulphate showed the amount of RNA which varied from 0.085 to 0.159 in leg muscle, 0.057 to 0.236 in

Table 2. Ribonucleic Acid (RNA) contents of *Barytelphusa guerini* after cadmium sulphate toxicity.

Hours	LM	GM	HP	H	Blood
Control	0.085 ±0.01	0.057 ±0.00	0.012 ±0.08	0.058 ±0.00	0.096 ±0.01
24	0.102 ±0.00	0.76 ±0.01	0.190 ±0.01	0.081 ±0.00	0.109 ±0.01
48	0.056 ±0.00	0.093 ±0.02	0.130 ±0.01	0.101 ±0.00	0.113 ±0.01
72	0.159 ±0.01	0.236 ±0.02	0.294 ±0.04	0.194 ±0.00	0.170 ±0.01
96	0.115 ±0.01	0.129 ±0.01	0.176 ±0.00	0.123 ±0.00	0.129 ±0.01

(Mean values of Iodine Number of six samples and ± Standard Deviation)

Abbreviations: LM = Leg Muscle, GM = Gill Muscle, HP = Hepatopancreas, H = Heart Muscle, BL = Blood

gills, 0.12 to 0.294 in hepatopancreas, 0.058 to 0.194 in heart and 0.096 to 0.17 in blood. There was initially increase in RNA content at 24 hours while decrease at 48 hours and again increase and decrease at 72 and 96 hours respectively as compared to control in leg muscle. The gills showed continuous increase in RNA content upto 72 hours and then decrease at 96 hours as compared to control. The similar trend was also observed in hepatopancreas, heart and blood as compared to control (Fig 6,7,8,9 and 10). Scanty reports are available pertaining to the action of toxicants on the nucleic acid levels. Nucleic acid play the key role in protein synthesis. It is well known that a relationship exist between nucleic acid level and the rate of protein synthesis. Nucleic acid content is considered as an index of capacity of an organism for protein synthesis. Extensive heavy metal pollution bring about changes in the nucleic contents of aquatic fauna, particularly crustaceans. Pawar and Kulkarni (2000) reported gradual decrease in ribonucleic acid and deoxyribonucleic acid levels in the hepatopancreatic tissue of freshwater crab, *Baratelphusa jacquemonti* exposed to cython

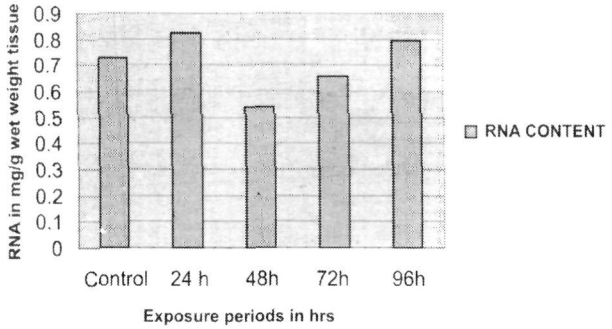

Fig. 1 RNA content of zinc sulphate exposed Leg muscle of *Barytelphusa guerini*

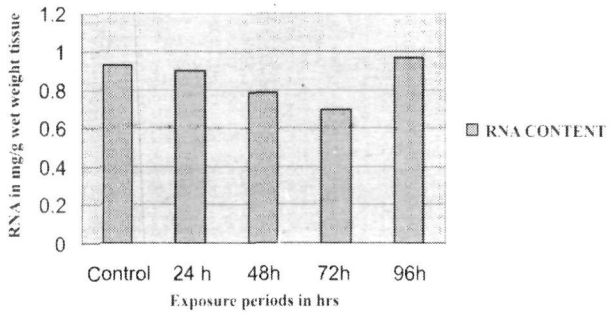

Fig. 2 RNA content of zinc sulphate exposed Gill muscle of *Barytelphusa guerini*

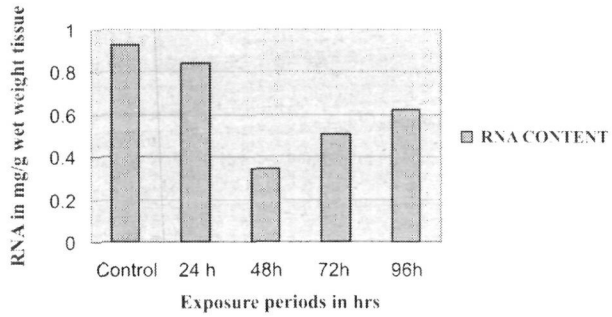

Fig. 3 RNA content of zinc sulphate exposed Hepatopancreas of *Barytelphusa guerini*

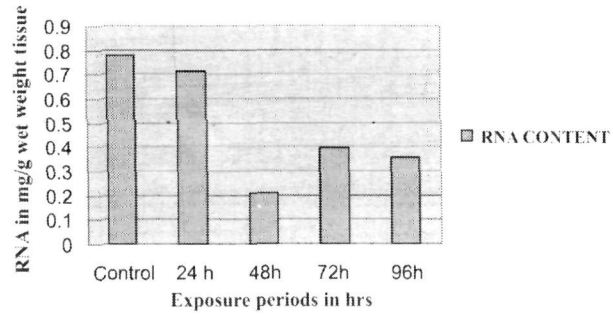

Fig. 4 RNA content of zinc sulphate exposed Heart of *Barytelphusa guerini.*

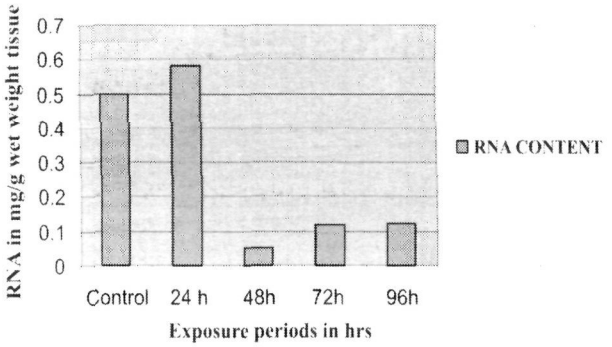

Fig. 5 RNA content of zinc sulphate exposed Blood of *Barytelphusa guerini.*

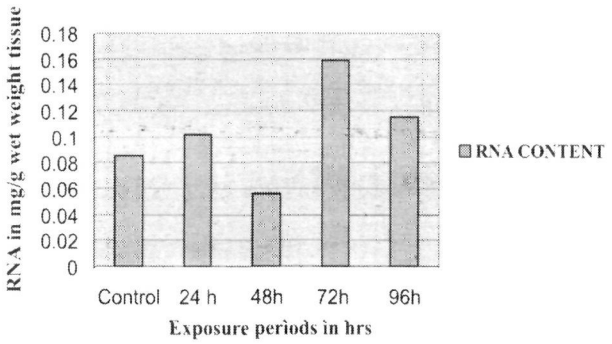

Fig. 6 RNA content of cadmium sulphate exposed Leg muscle of *Barytelphusa guerini*

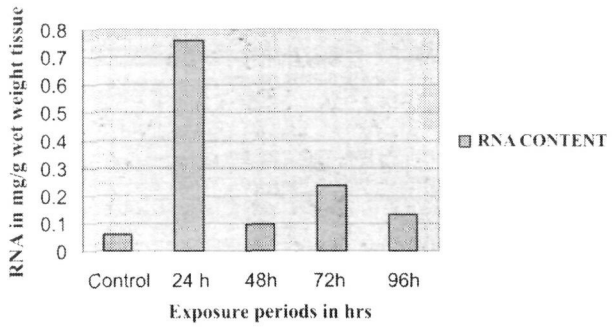

Fig. 7 RNA content of cadmium sulphate exposed Gill muscle of *Barytelphusa guerini*

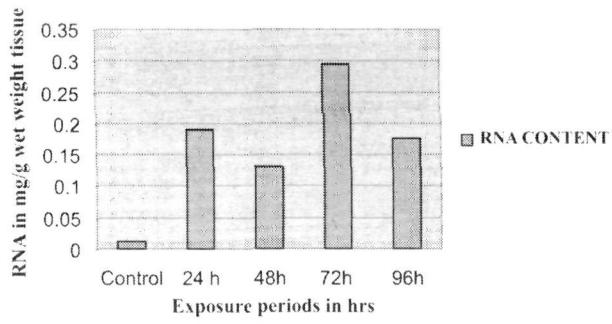

Fig. 8 RNA content of cadmium sulphate exposed Hepatopancreas of *Barytelphusa guerini*

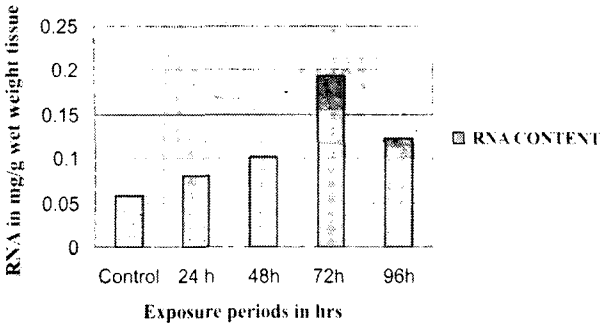

Fig. 9 RNA content of cadmium sulphate exposed Heart of *Barytelphusa guerini*

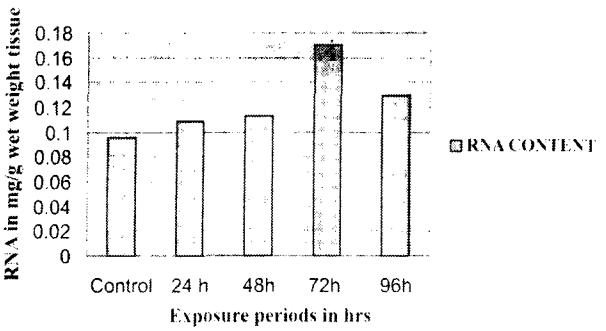

Fig. 10 RNA content of cadmium sulphate exposed Blood of *Barytelphusa guerini*

and suggested that the changes indicated the synthetic state of cells of the tissue. Cadmium can also inhibit calcium uptake and calcium channels, inhibit DNA repair, and cause lipid peroxidation (Strydom *et al.*, 2006). Hence any variation of DNA and RNA contents reflect on protein sysnthesis and thereby protein level in the body of an animals. Reduction of RNA has direct effect on protein level. *Uca inversa* may be more sensitive to sewage pollution (Amaral, *et al.*, 2009). The fall in RNA and DNA can be attributed to the reduced rate of protein synthesis due to stress. As animal needs extra energy to overcome the stress of pollutants exposure, metabolism is directed to gluco-neo-genesis rather than protein synthesis so as to make glucose available for energy generation. This may be the main reason for observed decreased levels of nucleic acids in the crab. RNA content is generally correlated with protein synthetic activity. More than 70% of cell have RNA complement of ribosomal character according to Grunberg Menago (1963) and hence variation in the RNA content would also reflect variation in the functional ribosomes of the cells. There is quite variation in RNA content of cell. It was in general found to be higher in hepatopancreas and in muscle but intermediate in gills and heart. This probably suggest variation in quantity of functional ribosome in various tissues and also differences in synthetic activity

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