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Effects of Fluoride on tissue respiratory metabolism of fresh water Crab, *Barytelphusa species*

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Abstract:

Fresh water crab was exposed in fluoride water at 96h the rate of oxygen uptake was higher in gills followed by hepatopancreas and muscle. On exposure to fluoride water, tissue respiratory rates decreased, effect on gill tissue appeared to be more pronounced than other tissues under the study. The rate of oxygen uptake in male was higher than that of female in control animal. Rate of oxygen consumption showed a significant decrease in both sexes with increase in duration of exposure to fluoride.

Key words: - Fluoride, hepatopancreas, gills, Oxygen consumption.

Introduction:

Fluorine is the thirteenth most abundant element making up approximately 0.06 to 0.09% of the earth's crust (Environment Canada 1976 and Smith, 1983)[1-2]. Fluoride is beneficial to health if the concentration in drinking water is less than 1.5mg/lit. Higher concentration causes serious health hazards. Fluorides are released into the environment naturally through the weathering of minerals in emission from volcanoes and marine aerosol. (Symonds *et al.*, 1988; ATSDR, 1993)[3-4]. Aquatic invertebrates and fish tend to accumulate fluoride in the exoskeleton and in bone, respectively. The respiratory potential or oxygen consumption of an animal is the important physiological parameters to assess the toxic stress, because it is a valuable indicator of energy expenditure in particular and

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metabolism in general (Prosser and Brown, 1977)[5]. It has been reported that the oxygen consumption represents the physiological state of metabolic activity and may be an indicator of metabolic stress; the pollutant may induce stress to exposed animals. Respiratory distress is recognized as one of the symptoms of pesticide toxicity (Holden, 1962; Premdas and Anderson, 1963; Ferguson and Good Year, 1967)[6-8]. Hence, an attempt has been made to investigate the effects of fluoride on fresh water crab, *Barytelphusa species* on respiratory tissues metabolism at different time interval.

Material and Methods:

Bore well water sample was collected and tested in Public Health Lab, Nanded for presence of fluoride. Content of fluoride was 3.5mg/lit. The animals were collected and adopted to the laboratory condition for four to five days by maintaining them in large jars with enough water to keep them partly submerged. Water was changed and animals were fed daily. They were not fed one day prior to exposures to fluoride water. Both male and female crabs ranging between 40-50gm were divided in four groups, each with eight animals, of these animals, two were of males and remaining two was of females. One groups of males served as control, while another was used as experimental. Same was true for female. One group of each, male and female was kept in ordinary tap water, while another group of male and female was treated with fluoride water. The exposure was continued upto96 hours. The rate of oxygen consumption was studied by Winkler's iodometric method as modified by Saroja (1959)[9].Tissues like gills, muscle & haepatopancreas were isolated and weighed for tissue respiration. Rate of oxygen consumption in these tissues was measured by Warburg's respirometer as per the procedure described by Umbreit *et al.*, (1959). The manometer and flask were calibrated by mercury; Brodie's fluid was used as manometric fluid. Ringer solution in phosphate buffer at pH 7.5 was used as suspension medium for the tissues. The values were expressed as µ1 of O_2/g wet weight/hr. The present paper deals with the effects of fluoride water on the changes induced by fluoride on various tissues respiratory metabolism.

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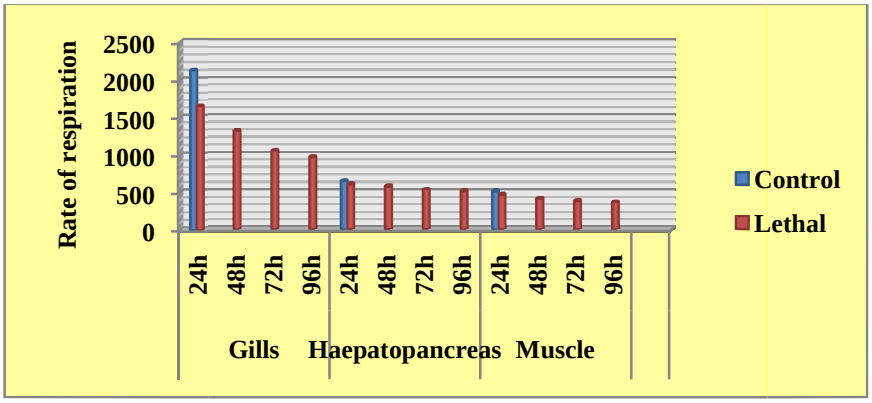
Results and Discussion:

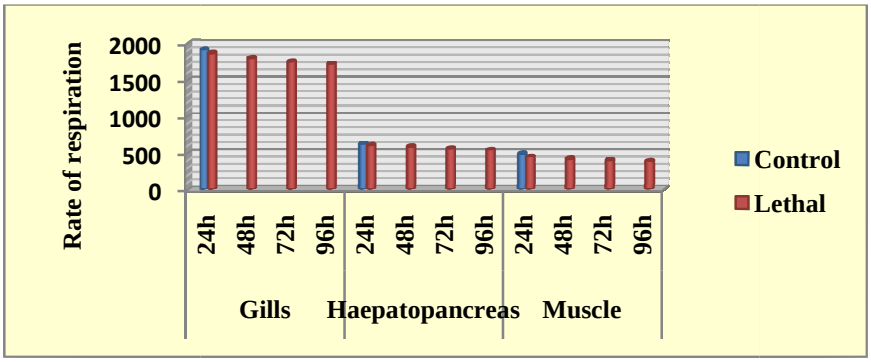
In the present investigation, in lethal, male crab tissue, gills hepatopancreas & muscle, tissue respiration rate was significantly decrease as compared to control while in female crab, gill tissue respiration increased significantly & represented in graph A & B.

Graph: Showing rate of tissue respiration (µ/O_2g. wet./hr) of Graph A - Male & B-female Crab, *Barytelphusa sp*. exposed in fluoride water for different duration. Values are expressed in Mean±SD, N=6, Significant at P>0.05%.

(A)



(B)



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Heavy metals discharged into water resources cause hazardous effects on aquatic life (Kaviraj, 1983 a & b)[10]. Differences in the biochemical architecture may also be responsible for the variation in metabolic rate of the two sexes. In the present investigation rate of gills respiration was higher in female crab while lower was in male crab these differences might also be due to differences in the growth rate (Ortan, 1936)[11], body shape (Ellenby, 1951)[12] and water content (Lockwood, 1968)[13]. Reports indicate that a difference in sex is also responsible for variation in respiratory rates of two sexes. Higher rate of oxygen uptake in gills than hepatopancreas and muscle revels that the gill tissue has higher respiratory capacity compared to other tissue in study this due to fact that the gill tissue has a structure meant for diffusion. The hepatopancreas is metabolically active tissue and hence it also showed a higher respiratory rate but only next to gill. A lower oxygen uptake rate by muscle tissue is involved more in locomotion and should have more requirement of oxygen. In this investigation decreased tissue uptake oxygen consumption was recorded. Similar observation has been made & reported decreased oxygen uptake can be due to tissue damage (Bhattacharya *et al.*, 1975 and Konar, 1977)[14-15]. The muscle tissue occupied the basal position among the tissues under the study similar observation has been made and reported decreased in oxygen uptake capacity of this tissue might be due to cell damage. Decreased the rate of oxygen uptake of hepatopancreas of female crab was higher as compared to male crab hepatopancreas was found in this study Continuous exposure might be resulting in cellular damage of the gill (Mathur *et al.*, 1981)[16] which decreases the rate of respiratory capacity of the gill tissue. There are also reports on the formation of thin film over the surface of gills. This could be protective device and may be causing a deduction in the oxygen uptake by the gill (Koundinya, 1978)[17].

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