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EFFECTS OF GROWTH IN *MUGIL CEPHALUS* EXPOSED TO CADMIUM

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ABSTRACT

In the present study the fingerlings of *Mugil cephalus* was exposed to 10, 20, 40, 80 and 160 µg/L concentrations of cadmium for 30 days. The growth of the fish was evaluated interms of gain in weight, length and condition factor. Gain in weight and length were significantly affected. The condition factor of the fingerlings was significantly reduced. Hence, the lower concentrations in the present study induced significant changes in the well being of the fish.

Key words: Mugil cephalus, Cadmium, Fingerlings.

INTRODUCTION

Aquatic organisms when exposed to heavy metals tend to accumulate in their body[1]. Essential and non-essential metals can produce toxic effects in fish by disturbing their growth, physiology, biochemistry, reproduction and mortality[2]. Hence, fishes are considered as one of the best indicators of heavy metal contamination in coastal environment[3]. Estuaries are the most stressed ecosystems because of their highly variable salinities[4]. Behaviour studies are useful for studying effects of environmental pollutants because it can provide a bioassay to determine an ecological death that may occur after much lower exposures to the toxicant[5]. Altered behaviours caused by exposure to pollutants may hence cause serious risks to the success of animal populations and disrupt aquatic communities[6].

EXPERIMENTAL

Fingerlings of *Mugil cephalus* of mean 1.5 ± 0.4 cm in length and 0.13 ± 0.02 g in weights were used. Collected juveniles were immediately transported to the laboratory in air

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filled plastic bags and acclimatized fish fingerlings in 200 L Fiberglass Reinforced Plastics (FRP) tanks with aerated natural filtered seawater. Stock solution of cadmium was freshly prepared by dissolving cadmium chloride hemi (pentahydrate) in deionized (doubly distilled) water. Fresh stock solution was prepared daily. This solution was serially diluted to get the experimental concentration for the toxicity test. The experimental method includes static renewal (24 hour renewal) test by following the method of USEPA[7]. Five concentrations in a geometric series including control were prepared for the test for 4 days in acute toxicity test (USEPA)[8]. Toxicant and seawater were replaced on daily basis. Test animals were fed with rice bran and oil cake. Maximum-allowable control mortality was 20 percent for 30 days for chronic (USEPA)[8]. Commencement of the introduction of test organisms to the chronic toxicity test all the test organisms were subjected to physical measurements in terms of length and weight. The Total Length (TL) of the test organism was measured from the tip of the anterior or part of the mouth to the caudal fin (fish) using meter rule calibrated in centimeters. Test organisms were measured to the nearest centimeter. Weighing was done with a tabletop digital weighing balance (Metller), to the nearest gram. The length measurements were converted into length frequencies with constant class intervals of 2 cm.

Condition factor (K)

Condition factor (K) of the experimental animal was calculated by Williams[9],

$$K = \frac{100\,W}{L^3}$$

Where, K = Condition factor, W = Weight of fish, L = Length of fish (cm)

RESULTS AND DISCUSSION

Significant ($P < 0.001$) reduction in weight was observed in *M.cephalus* exposed to 10 µg/L cadmium; changes were significant ($P < 0.05$) in weight at 80 µg/L cadmium; considerable changes ($P < 0.01$) in weight was also observed in 20 and 40 µg/L cadmium concentration while changes were significant ($P < 0.05$) in length in 10, 20, 40 and 80 µg/L cadmium. The weight was reduced in 160 µg/L cadmium significantly ($P < 0.01$). *M.cephalus* exposed to essential heavy metals showed significant gain in weight and gain in length with control, there was reduced growth induced by non-essential heavy metals and the condition factor also reduced significantly from control ($P < 0.001$ and $P < 0.01$).

Studies on non-salmonid species showed a similar relationship where a reduction in growth was observed at concentrations that were lethal, but no effect on growth was observed at sublethal exposures[10]. Reduced growth was observed in Atlantic salmon alevins exposed to 0.47 µg/L Cd[11]. The sensitivity of a species to growth effects caused by cadmium exposure may be influenced by the relative growth rate of the species. A possible mechanism for the behavioural effects of cadmium is disruption of the olfactory system which is known to play an important role in behaviour including foraging and social interactions[12]. Cadmium accumulates in the olfactory system and alters the ability of fish to respond to natural pheromones[13]. Social behaviour of individual fish may influence accumulation of trace metals.

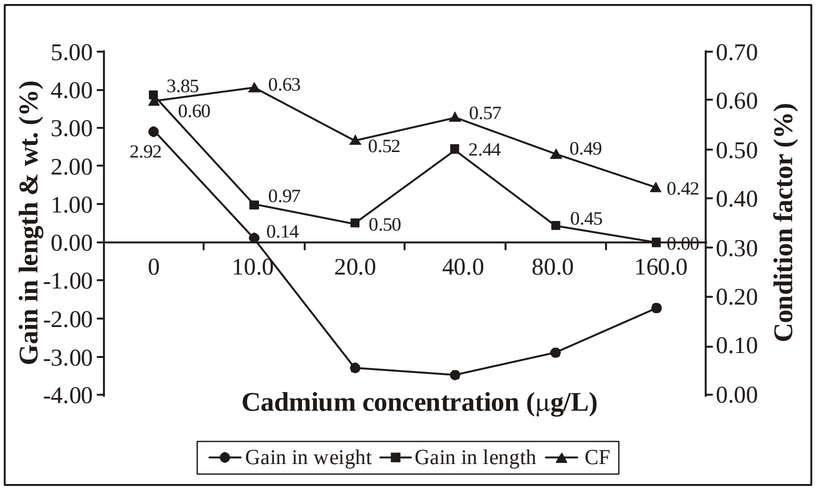

Fig. 1: Gain in weight, growth and condition factor of *M. cephalus* exposed to cadmium in long term toxicity test

In the present study, a significant decrease of growth rate as well as the decrease of the locomotion activity after exposure to even lower concentrations was observed. Similar results have been described already earlier[14]. Szczerbik et al.[15] reported the mean growth rate of fish in the group fed with a dose of 10,000 µg/g was significantly lower than in the other groups. The negative influence on growth is a well-known effect of cadmium action in fish and other aquatic organisms[16]. The growth inhibition in the group receiving the highest heavy metal concentration observed in our experiment could be due to the influence of heavy metals on food intake and assimilation. It was shown that cadmium decreased food intake and assimilation and led to the decrease of growth rate in fish[17].

Growth inhibition could also be an effect of cadmium on fish activity and food gaining ability[18]. Harkantra[19] showed that the young ones exhibit greater growth rate. General condition of the marine organisms were investigated through condition factor (K), which has often been used as an indication of general fitness of the organism[20] as well as to investigate the effects of contaminants[21]. Lett *et al.*[22] attributed the growth reduction in copper exposed *Salmo gairdneri* partly to increased metabolic cost and reduced food consumption.

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