



Studies on Influence of Sub-Lethal Concentrations of Cadmium Chloride on Gonado-Somatic Index (GSI) of Air-Breathing Fish *Heteropneustes fossilis*

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Received: 3 October 2012; **Revised:** 23 October 2012; **Accepted:** 7 November 2012

Abstract: Present study evaluates the sub lethal effect of cadmium chloride in the gonado-somatic indexes of the air-breathing fish, *Heteropneustes fossilis* which were kept in aqueous solution of cadmium chloride (sub-lethal concentration of 6 mg/l and 9 mg/l) for 15, 30, 45 and 60 days. Results showed significant reduction in the gonado-somatic index after long term exposure (45-60 days) exposure while a mild effect on short term (15-30 days) exposure of cadmium chloride to the fish was observed.

Keyword: Cadmium chloride, GSI, Sub-lethal concentration, *Heteropneustes fossilis*

1. INTRODUCTION

Heavy metals occur naturally in the environment and are found in varying levels in all ground and surface waters. Heavy metals are reported as pollutants which caused the metabolic, physiological and structural

alterations in fish Jiraungkoorskul¹⁻³. According to Jarup⁴, cadmium is considered to be a main threat to human health, together with other elements such as lead, mercury and arsenic. In fact kidney is the principle target organ of cadmium toxicity and chronic cadmium exposure in almost all animal species is characterized by varying degree of renal damage Romeo⁵, Shukla and Gautam⁶, Kumar⁷ and Vesey⁸.

Cadmium has been shown to be responsible for a number of reproductive abnormalities in fish. The ovaries show a series of cyclic changes in the morphology and histology which represents the various maturation stages and are related to the gonado-somatic index of fish. The present work, therefore, designated to study the toxicity of Cadmium chloride on the Gonado-somatic index of air-breathing fish, *Heteropneustes fossilis* (Bloch).

EXPERIMENTAL DESIGN AND SETUP

Fish Collection: Freshwater fish, *Heteropneustes fossilis*, of relatively same size ranging from (12-15cm) and weight (35-40gm) were procured from local fish markets of Bhopal, Madhya Pradesh.

Experimental Fish: Before introducing in the aquarium, fishes were treated with 0.1KMnO₄ solution to remove any dermal infection. Fishes were acclimatized in tap water for a week and during this period the fishes were fed with chopped meat and the medium were replaced daily. After acclimatization fishes were kept in different concentrations (6mg/l and 9mg/l) of Cadmium chloride in different aquaria.

Quantitative analysis of Gonads: At the end of experimental period, fish from control and treated groups were weighed and scarified. The gonads (testes and ovaries) were dissected out and weighed and Gonado-somatic Index was calculated using the formula:

$$\text{GSI} = \frac{\text{Weight of Gonad} \times 100}{\text{Total weight of fish}}$$

RESULT AND DISCUSSION

Gonado-somatic index (GSI) shows a dose and duration dependent decrease. The maximum GSI value of ovary of *Heteropneustes fossilis* (**Fig.1**) after exposure to 6 mg/l of CdCl₂ is 1.65 on 15th day which gradually decreased to 0.59 after 60 days and at the concentration of 9 mg/l on 15th day the GSI value is 1.48 which decreased to 0.18. Similarly the maximum GSI value of testis (**Fig.2**) on 15th day at the concentration of 6 mg/l of CdCl₂ is 1.27 which decreased to 0.19 after 60 days and 0.98 at 9 mg/l on 15th day which after 60 days decreased up to 0.1. Thus present study revealed that on exposure to cadmium chloride at lethal and sub lethal concentrations, the Gonado-somatic Index of female and male fish showed significant decrease only after long term (45-60 days) exposure. There was a mild effect on short term (15-30 days) exposure to the fish.

In fact, all water bodies are polluted by heavy metals. Cadmium is a heavy metal and poses high toxicity at very low level of exposure and has acute and chronic effects on aquatic animal health and environment. In the present study exposure to lethal concentration of Cadmium chloride for 15, 30, 45 and 60 days showed gradual reduction in GSI values in relation to increasing toxicity. Masud⁹ observed decreased GSI, retardation of oocyte development, denaturation of yolk material in *Cyprinus carpio* exposed to mercurial compounds for 45 and 60 days. Exposure of *Siganus rivulatus* to different waste sources (containing Zn) for 42 days was observed by Olfat and El-Greisy¹⁰ and also resulted decline in GSI.

Kaur and Kaur¹¹ also noted a decline in GSI of fish *Channa punctatus* (Bloch) under stress of nickel chrome electroplating effluent. Similar results also have been observed by Anjali and Kulshrestha¹² in female carp minnow exposed to three pesticides and in both the sexes of a freshwater teleost, *Clarias batrachus* exposed to dimethonate by Begum and Vijayaraghavan¹³. The reduced GSI in the present study

may be due to lowered gonadal activity under Cadmium chloride stress and impairment of the production of steroid hormones which might have arrested the formation of germ cells and cause degeneration or necrosis.

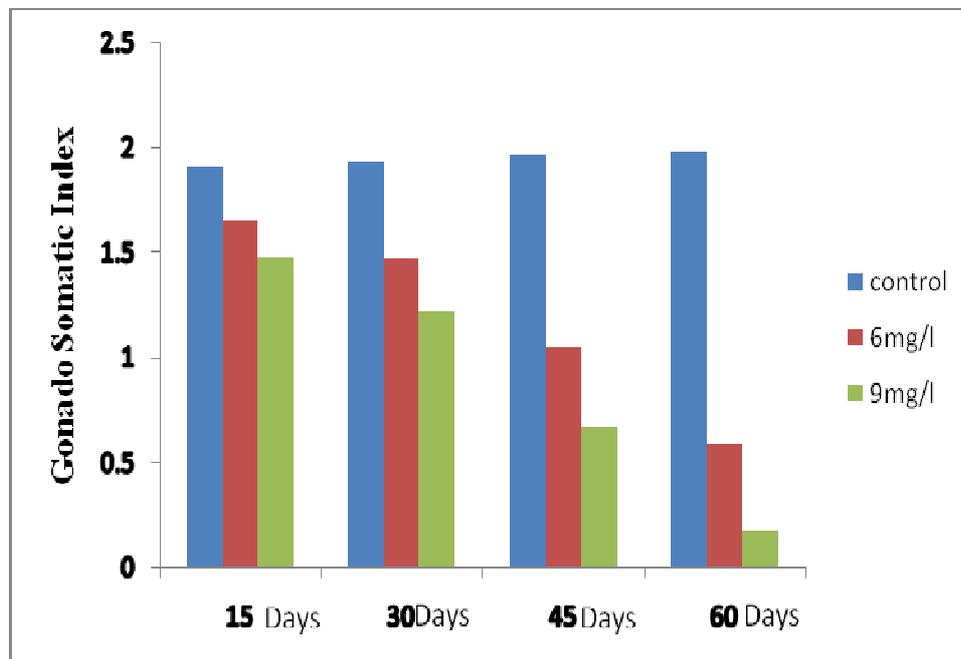


Fig.1: Gonado-somatic Index of ovaries of *Heteropneustes fossilis* exposed to CdCl₂ (6mg/l and 9mg/l)

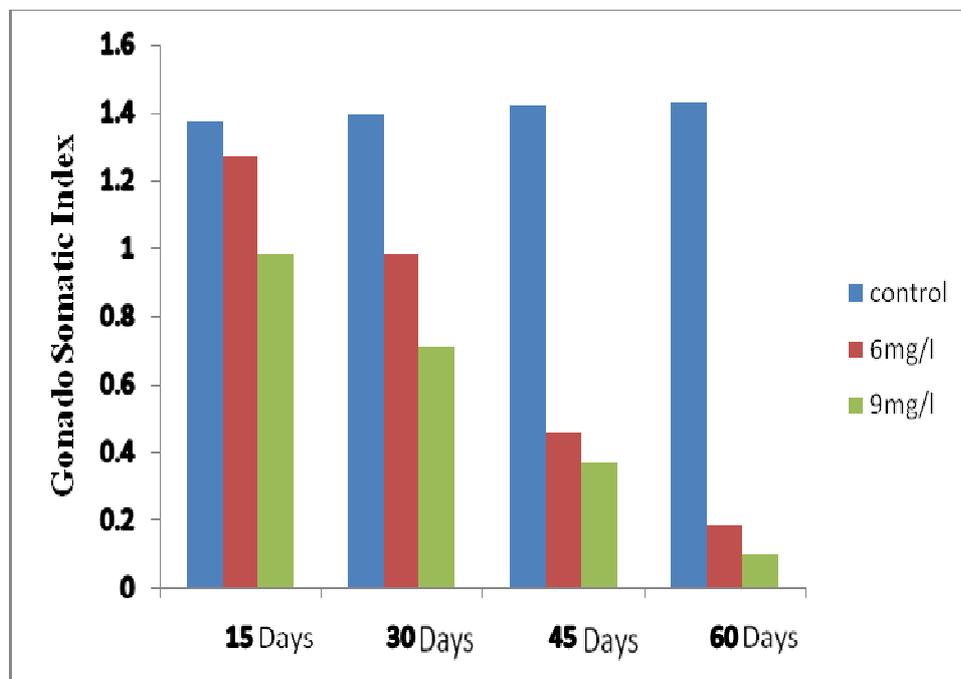


Fig.2: Gonado-somatic Index of Testis of *Heteropneustes fossilis* exposed to CdCl₂ (6mg/l and 9mg/l)

ACKNOWLEDGEMENT

The authors are grateful to Head, Department of Zoology & Applied Aquaculture, Barkatullah University Bhopal India, for his valuable guidance for carrying out this work.

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