

Histopathological Alterations of Hybrid Walking Catfish (*Clarias macrocephalus* x *Clarias gariepinus*) in Acute and Subacute Cadmium Exposure

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Abstract

Histopathological alterations occur in the gills, livers and kidneys of 3-month old hybrid walking catfish (*Clarias macrocephalus* x *Clarias gariepinus*) after acute and subacute cadmium exposure in water, and after intraperitoneal injection. The 96-h LC₅₀ for cadmium in recirculation open systems was 13.6 mg/l, and the 96-h LD₅₀ 1.6 mg/kg of fish. Light microscopic studies were carried out in gills, livers and kidneys. Gill alterations included an increased number of chloride cells, breakdown of the pillar cells and edema of the epithelial cells. In the liver there was blood congestion in sinusoids and swelling of hepatocytes. The kidneys showed vacuolation and necrosis of proximal tubular cells.

Keywords: Histopathological alterations; cadmium exposure; acute; subacute; catfish

1. Introduction

In the recent years, industrial development and agricultural processes have resulted in increased levels of toxic metals in the environment, although relatively high concentrations can also occur naturally (Lopez Alonso *et al.*, 2002). Cadmium is widely used in several industries and is well known as a highly toxic pollutant (Wright and Welbourn, 1994). The major uses of cadmium include electroplating, pigment production, and manufacturing of plastic stabilizers and batteries. In ecotoxicological studies cadmium has been implicated as a cause of numerous human deaths and various deleterious effects in fish and wildlife. Fish have been the focus of many ecotoxicological studies since they are located at the top of the aquatic food chain. Cadmium has been shown to cause pathological changes of varying severity in several organs, such as gill, liver and kidney (Rangsayatorn *et al.*, 2004).

The gill epithelium of the fish is the major site of gas exchange, acid-base balance, ionic regulation, and excretion of nitrogenous waste (Thopon *et al.*, 2003). The liver plays a major role in metabolism excretion, excretion, digestion and storage of various substances, including some that are toxic to fish. Histopathological alterations in fish liver and kidney are key indicators of chemical toxicity, and it is a useful way to study the effects of exposure of aquatic animals to toxins present in the aquatic environment (Thopon *et al.*, 2004; Athikesavan *et al.*, 2006; Loganathan *et al.*, 2006).

Hybrid walking catfish (*Clarias macrocephalus* x *Clarias gariepinus*) is an economically important fish, which is commercially cultivated in Thailand. Because of its relatively high market value, it has become an attractive commodity of both large and small-scale aquaculture enterprises. In the present study, hybrid walking catfish was chosen as the target organism for the cadmium toxicity study. The objectives of the present study were to determine the median lethal concentration of cadmium by exposure in water and by intraperitoneal injection, and to study the histopathological alterations in the target organs in acute and subacute cadmium exposure.

2. Materials and methods

2.1. Experimental fish

Three-month old male hybrid walking catfish (length 20-25 cm) were obtained from a commercial fish farm in Chachoengsao Province, Thailand. The fishes were acclimatized for 14 days in well aerated holding polyethylene tanks (~500L). The water in the tanks was passed through a 1 m filter. The animals were fed once daily with granule food and they were starved for 24 h before and during experiment.

2.2. Chemicals

