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Impact of Curacron Toxicity on Lactate Dehydrogenase in the Serum of the Fish *Cyprinus carpio*

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ABSTRACT

The experiment was conducted on fish, *Cyprinus carpio* to study the effect of curacron on serum biomarker (LDH). Curacron is a organophosphate pesticide and is used by the farmers to protect their crops. This pesticide reaches to the aquatic ecosystem by many ways and affects the aquatic fauna. LC_{50} of Curacron for *Cyprinus carpio* has been calculated by the log-dose/probit regression line method and recorded as 0.38 ppm at 96 h. Three sub-lethal concentrations (0.1, 0.01 mL and 0.001 ml L⁻¹) were selected to expose the fish for 1, 7, 14 and 21 days. Changes in enzyme activity were observed with all concentrations and exposure period. Lactate concentrations were significantly lower in the experimental group, compared with the control group. The above results of blood plasma profile indicate a marked cytotoxic and hepatotoxic effect of curacron in fishes.

Key words: *Cyprinus carpio*, organophosphate, curacron, sub-lethal, haematobiochemical

INTRODUCTION

The widespread environmental pollution caused by the chemical substances such as pesticides is a serious problem for creatures including human (McClure *et al.*, 2001; McKinlay *et al.*, 2008; Boobis *et al.*, 2008). The pollutants that enter the inshore waters and estuaries create serious problems causing extensive damage to the life and activities of the living aquatic organisms and even to mass mortality (Joseph *et al.*, 2010). Various chemical substances entering animal bodies are carried to the organs responsible for detoxification, such as liver and kidney and excreted. Pesticides are major cause of concern for aquatic environment because of their toxicity, persistency and tendency to accumulate in the organisms (Joseph and Raj, 2010). The impact of these pesticides on aquatic organisms is due to the movement of pesticides from various diffuse or point sources. These pesticides are posing a great threat to aquatic fauna especially to fishes, which constitute one of the major sources of protein rich food for mankind (Sharma and Singh, 2007). The pesticides induce its effects first at cellular or even at molecular level, but ultimately it tends to create biochemical disorder that may even cause death. The organophosphate pesticides modify the activity of several metabolic enzymes (Radhaiah and Rao, 1990). Succinic dehydrogenase and Lactate dehydrogenase are the major oxidative enzymes in carbohydrate metabolism. It may be used for demonstrating tissue damage in fish. A significant decrease in LDH activity under sub-lethal toxicity of quinolphos in different tissues of freshwater fish, *C. punctatus* was reported by Sastry and Siddiqui (1984). Ganathy *et al.* (1994) documented decrease in LDH activity in

different tissues of *C. punctatus* exposed to hexachlorocyclohexane. Amali (1995) reported a reduced activity with increasing concentration of quinphos and paddan in *Labeo rohita*. The fish serves as bio-indicator of water quality and the impact of the pesticide can be well understood by analyzing either blood or serum of the fish, because blood is a pathophysiological reflector of whole body (Sharma and Singh, 2004, 2006). Fishes are widely used to evaluate the health of aquatic ecosystems because pollutants build up in the food chain and are responsible for adverse effects and death in the aquatic systems (Farkas *et al.*, 2002; Joseph *et al.*, 2010). Common carp is widely used species in aquaculture for food supply in Iran. It provides a good model to study responses and possible adaptations of local fish populations exposed to various pollutant sources (Afaghi *et al.*, 2007). In the present study, the fish, *Cyprinus carpio* was investigated to evaluate the effect of Organo phosphorus pesticide Curacron on cytotoxic and hepatotoxic enzymes.

MATERIALS AND METHODS

Specimens of *Cyprinus carpio* were obtained from local vicinity in the year 2007 and introduced into large cement tank (6'X4'X3') disinfected with potassium permanganate and washed thoroughly prior to introduction of fish (to prevent fungal infection). Fish were acclimatized for about 20 days before the commencement of the experiment. They were fed on commercial fish food which was given daily at morning hours. LC₅₀ of curacron was calculated by the log-dose/Probit regression line method (Finney, 1971) and was recorded. The test fishes were grouped in three groups (A, B and C) having three different sub-lethal concentrations (A = 0.1 mL, B = 0.01 mL and C = 0.001 ml L⁻¹) for specific time of period (1, 7, 14 and 21 days). Simultaneously a control set was run to compare the toxicated values. Blood samples were collected after severing the caudal peduncle and taken in sterilized centrifuge tubes and allowed to stand for about 1 h, then centrifuged at 2000 rpm for 30 min. The supernatant was separated by a fine rubber bulb pipette in separate test tube and was used for the estimation of LDH by the method of Tietz (1976).

RESULTS AND DISCUSSION

In *Cyprinus carpio*, the serum LDH activity will decrease from the control set. The LDH activity was found to be decrease with increasing exposure period. Further, the LDH activity was maximum 25.5" 0.66 when *Cyprinus carpio* reared in control. As shown in the Table 1 the LDH activity decreased from 22.5" 0.66 to 15.97" 0.13, 16.4" 0.49 to 12.5" 0.65 and 19.34" 0.20 to 11.55" 0.33 in 0.1, 0.01 and 0.001 ml L⁻¹. There is a significant decrease in the percentage variation of LDH with increasing exposure period due to the toxic effect of curacron. The organophosphate pesticides modify the activity of several enzymes. It is well known that tissue damaged by toxicants exhibit a sharp rise in activity of mitochondrial enzymes aspartate transferase and alanine amino

Table 1: Shows the concentration of enzyme Lactate dehydrogenase of control and curacron treated *Cyprinus carpio* in different exposure periods. The results are expressed as F moles of formazon formed mg dL⁻¹ protein

| Concentration of curacron (ml L ⁻¹) | Exposure period (days) | | | |
|---|------------------------|--------------------|--------------------|--------------------|
| | 1 | 7 | 14 | 21 |
| Control | 25.02±0.02 | 20.04±0.05 | 20.24±0.18 | 20.50±0.51 |
| 0.1 | 22.5±0.66 (27.37) | 19.07±0.05 (24.84) | 18.17±0.11 (12.22) | 15.97±0.13 (10.09) |
| 0.01 | 16.4±0.49 (18.08) | 15.06±0.03 (14.87) | 13.5±0.54 (18.47) | 12.5±0.65 (14.63) |
| 0.001 | 19.34±0.20 (13.39) | 16.37±0.42 (11.31) | 13.5±0.32 (10.59) | 11.55±0.33 (9.51) |

Percentage in parentheses. Values are in means±SE

transferase (Abdelsalam *et al.*, 1982; Mikhail *et al.*, 1979). Alanine amino transferase and aspartate amino transferase activities of the blood increase significantly due to curacron poisoning. Alanine amino transferase has been strongly implicated in the production of energy in tissues and is considered as a stress indicator (Gould *et al.*, 1976). Aspartate amino transferase is the main transaminase that interfere with TCA cycle in a major way Lowenstein (1967).

A rise in its activity indicates the occurrence of greater energy demand, which are normally associated with synthetic activities of the cell (Meister, 1955). In this study, the LDH activity in the serum of *Cyprinus carpio* decreased when exposed to different concentrations of curacron. The inhibition of LDH activity indicated may be due to the functioning of intermediates in to the TCA cycle. This might be responsible for the suppression of the oxidative phase of tissue metabolism under curacron impact. The intoxication of these pesticides combine with an enzyme to form an enzyme inhibition complex which react with various functional groups of the enzymes inhibit the normal enzyme activity of major metabolic site. Similar inhibited LDH activity under various pesticide stresses are reported in fishes by Sastry and Siddiqui (1984) and Kabeer *et al.* (1983). However, Natarajan *et al.* (1994) has reported stimulation in LDH activity in response to metasytox and chlordane will be studied in tissues of *Puntias conchoniuis*.

CONCLUSION

The study depicts that the pesticide curacron is highly toxic to the fish *Cyprinus carpio* and the stress responses showed by fish are dependent on concentration and duration of exposure. LDH is as a general indicator of the existence and severity of acute or chronic tissue damage and sometimes, as a monitor of progressive conditions like hemolytic anaemia From the present study, it may be concluded that the analysis of enzyme activity of fishes can effectively be used as an indicator of fish health. Long term exposure of organisms to pesticides means a continuous health hazard for the population. So, human population is at high risk by consuming these toxicated fishes. It is also suggested that these type of toxicological studies are required to monitor the aquatic life and predict the toxic effect of pesticides on aquatic organisms particularly fish.

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