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Effect of Curacron Toxicity on Aminotransferases (ALT and AST) in the Serum of the Fish *Cyprinus carpio*

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ABSTRACT

The present investigation was carried out to understand the impact of curacron on Serum aminotransferases activity (ALT and AST) of fresh water fish *Cyprinus carpio*. Curacron is an organophosphate pesticide and is widely used by the farmers to protect their crops. So every year huge volume of Curacron enters to aquatic ecosystems. The objective of this study was to determine the effect of curcuroc pesticides and its influence of serum biomarker enzyme (ALT and AST). 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. ALT and AST concentrations were significantly higher 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 *Cyprinus carpio*.

Key words: Pesticides, intoxication, supernatant, sub-lethal, biomarker, aspartate

INTRODUCTION

Pesticides are major cause of concern for aquatic environment because of their toxicity, persistency and tendency to accumulate in the organisms (Golovanova, 2005; Joseph and Raj, 2010). Industrialization and technological advancement/development processes have led to the introduction of hazardous chemicals into the environment. These chemicals include the following: agrochemicals, herbicides, pesticides, halogenated polycyclic hydrocarbons and food additives (Ibeto and Okoye, 2010). The curacron is an organophosphate insecticide that used to control insects in agricultural ground, households and urban settings. Due to its chemical properties and widespread use, curacron is a frequently found in point sources and non-point sources in urban and agricultural areas (EPA, 2003). This toxin after application easily enters to current and underground water resources. The indiscriminate use of pesticides, careless handling, accidental spillage, or discharge of untreated effluents into natural water-ways have harmful effects on the fish population, other forms of aquatic life and human health (Lawal and Samuel, 2010). During stress the organism, must maximize its defense mechanisms, Thus the run or fight response is initiated by the activation of the sympathetic nervous system and the organism needs to stay in the activated state until the threat ceases (Yildirim and Yurekli, 2010). Today, many organizations represented curacron as a dangerous poison for almost animal (EPA, 2005). Heavy metals, such as mercury, cadmium and lead, as they represent a group of highly toxic substances accumulating

in the tissues of marine organisms and being conveyed through the food chain to human (Kaplan *et al.*, 2011). Some factors that are also to be considered are the seasonal variations, environment conditions, fish diet and influences on the enzyme systems that activate and detoxify the pollutants (Kamaruzzaman *et al.*, 2010). Various chemical substances entering animal bodies are carried to the organs responsible for detoxification, such as liver and kidney and excreted. The liver is the organ for metabolism and detoxification of various components that enter into the body. It is involved in wide range of functions and hence it is exposed to toxic substances and drugs absorbed from the intestine (Khan and Alzohairy, 2011). 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; Joseph and Raj, 2011a). 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 alanine amino transferase and aspartate amino transferase.

MATERIALS AND METHODS

The experimental fish *Cyprinus carpio* were procured from local vicinity in the year 2007 and introduced into large concrete tank (6'X4'X3') disinfected with KMnO_4 (potassium permanganate) to prevent fungal infection. Acclimatization of fish was done for about 20 days and was fed with commercial fish food which was given at morning hours. LC_{50} was calculated by the log-dose/Probit regression line method (Finney, 1971). The experimental fishes were grouped in three groups (a, b and c) having three different sub-lethal concentrations (a = 0.1, b = 0.01 and c = 0.001^{-1}) for 1, 7, 14 and 21 day exposure). Simultaneously, a control set was run to differentiate the experimental values. Blood samples were collected from 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 Alanine Amino Transferase (ALT) and Aspartate Amino Transferase (AST) by the method of Reitman and Frankel (1957). In statistical analysis the values are expressed in Mean \pm SE.

RESULTS AND DISCUSSION

In *cyprinus carpio*, the serum ALT and AST activity were increase from the control set. The ALT activity was found to be increase with increasing exposure period. The alanine amino transferase and aspartate amino transferase activity in the blood of *Cyprinus carpio* exposed to control and different concentrations of curacron exhibit an increasing trend (Shalaby, 2007). Table 1 shows that the ALT activity increased from the control set in 0.1, 0.01 and 0.001 ml L^{-1} . There is an increase in the percentage variation of ALT with increasing exposure period due to its toxic effect. Changes in the enzyme concentration (Aspartate amino transferase) after exposure to

curacron are shown in Table 2, where the maximum activity was recorded as 6.60 ± 0.41 , 5.59 ± 0.35 and 5.38 ± 0.29 in 21st, 1st and 7th day of exposure when *Cyprinus carpio* reared at 0.1, 0.01 and 0.001 ml L⁻¹ curacron. The percentage increase in aspartate amino transferase over the control values ranged from 7.13 to 13.98, 2.78 to 16.89 and 8.86 to 15.4%, respectively in the 21st and 1st day exposure of 0.1, 0.01 and 0.001 ml L⁻¹ curacron treated *Cyprinus carpio*. The organophosphate pesticides modify the activity of several enzymes (Mohiyuddin *et al.*, 2010). It is well known that tissue damaged by toxicants exhibit a sharp rise in activity of mitochondrial enzymes aspartate transferase and alanine amino transferase (Abdelsalam *et al.*, 1982; Mikhail *et al.*, 1979). Alanine amino transferase activities of the blood increase significantly due to curacron poisoning. Alanine amino transferase and aspartate amino transferase has been strongly implicated in the production of energy in tissues (Srivastava *et al.*, 1999) 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; Rao and Rao, 1984; Al-Attar, 2010). A rise in its activity indicates the occurrence of greater energy demand which is normally associated with synthetic activities of the cell (Meister, 1955). 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 (Joseph and Raj, 2011b).

Table 1: Concentration of enzyme alanine amino transferase (ALT) of control and curacron treated *Cyprinus carpio* in different exposure periods

Concentration of curacron (ml L ⁻¹)	Exposure period (days)			
	1	7	14	21
Control	0.65±0.40	0.64±0.32	0.64±0.25	0.68±0.21
0.1	0.91±0.01 ^a (33.82)	0.95±0.02 ^a (48.43)	0.93±0.05 ^a (45.31)	1.05±0.03 ^b (61.5)
0.01	0.75±0.02 (10.29)	0.78±0.01 (21.87)	0.83±0.02 (29.68)	0.93±0.06 ^b (43.07)
0.001	0.66±0.1 (2.94)	0.69±0.01 (7.81)	0.73±0.01 (14.06)	0.74±0.03 ^b (13.84)

Values are Mean±SE, Value in parentheses are Percentage, ^aIncrease in concentration, ^bIncrease in exposure period. The results are expressed as μ moles of formazon formed/mg dL⁻¹ protein

Table 2: Concentration of enzyme aspartate amino transferase (AST) of control and curacron treated *Cyprinus carpio* in different exposure periods

Concentration of curacron (ml L ⁻¹)	Exposure period (days)			
	1	7	14	21
Control	5.79±0.16	5.50±0.38	5.45±0.48	5.75±0.10
0.1	5.34±0.36 (7.13)	5.38±0.07 ^a (9.28)	5.60±0.02 ^a (9.81)	6.60±0.41 ^{ab} (13.98)
0.01	5.59±0.35 ^{ab} (2.78)	5.35±0.32 (3.83)	5.47±0.37 (6.54)	4.58±0.23 (16.89)
0.001	5.24±0.08 (8.86)	5.38±0.29 ^{ab} (9.28)	5.24±0.06 (14.72)	5.14±0.12 (15.4)

Values are Mean±SE, Value in parentheses are Percentage, ^aIncrease in concentration, ^bIncrease in exposure period. The results are expressed as μ moles of formazon formed/mg dL⁻¹ protein

CONCLUSION

The study illustrates 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. Serum level of ALT and AST become elevated may be due to hepatotoxicity of liver cells. Aminotransferases are the biomarkers to know the intensity of liver damage. 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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