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Chronic effect due to changes in the contents of urea & creatinine in edible cat fish *Channa punctatus* (Bloch), under the stress of sub lethal concentration of methyl parathion – a pesticide

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Abstract

The chronic effect of methyl parathion on cat fish *Channa punctatus* was observed by comparing the amount of urea & creatinine in the bio chemical blood plasma profile of a control group & a group exposed to methyl parathion pesticide, in sub lethal concentration. Lc50 value of fish was found 35µg/l. During the study it was found that the amount of urea in the experimental fish was increased upto alarming level, although the creatinine concentration increased gradually. As such fish food is consumed by the non target organisms & more specifically by the human being, its consumption usually results in the development of such symptoms, which are not mentioned in the routine literature.

Keywords: *Methyl parathion, Channa punctatus, Urea, Creatinine, Human being*

Introduction

For centuries pesticides have been used in agriculture to enhance food production by eradicating unwanted insects and controlling disease vectors (Prakasham, *et al*., 2001). Among these pesticides, organophosphorus compounds (OPs) are commonly used as insecticide. Organo phosphorus (OPs) pesticides have long been of serious environmental concern. They form the largest group of chemicals used in the control of pests, including invertebrates, vertebrates and, to a lesser extent, plants. There are some 200 OPs pesticides available in this class, which have been formulated into literally thousands of different products (Hill, 2003). Methyl parathion is a non synthetic, wide spectrum organophosphorous pesticide. It was one of the earliest organophosphorous pesticides developed (Introduced in 1950). It was used for agricultural and non-agricultural purposes. Once methyl parathion is introduced into the environment, it may cause serious trouble to aquatic organisms and is notorious for causing several metabolic disturbances in non-target species, like fish and fresh-water mussels etc. (Anonymous,2005).

Organophosphorous pesticides have replaced the persistent chlorinated pesticides in the 1970's and in the beginning of 1980's, it is completely replaced. The main advantage of the organophosphorous pesticides was their low cumulative ability and short-term persistence in the environment (Svoboda, *et. al.*, 2001). Methyl parathion is a contact organophosphorous pesticide and extensively used, both in agriculture and households to control insects in soil, plants, fruit and vegetable crops. After its application on crops and plants, methyl parathion is easily washed into surface waters and enters the ground water. Eventually, it enters the aquatic environment in large quantities (Kuivila and Foe, 1995). Methyl parathion degrades rapidly, but under conditions of low temperature, low moisture, high alkalinity, and lack of suitable microbiological degraders, it may remain biologically active in soil for six months or longer. Because of its aquatic distribution, methyl

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parathion affects a wide range of non-target organisms, like inverterbrates, fishes, birds and mammals, especially those inhabiting aquatic environment (Burkepile, *et. al.,* 2000) Due to its chemical properties, widespread use and application, methyl parathion is frequently found in point sources (wastewater treatment plant effluent) and non-point sources (storm water runoff) in urban and agricultural areas. Methyl parathion is known to be extremely toxic to birds and aquatic life (USEPA, 2005). Methyl parathion is transported into rivers largely via storm water runoff and also with rain, events producing pesticide pulses in rivers and streams (Ferrari, *et. al.,* 1997).

Teleost fish may be good indicator of contamination because their biochemical responses are quite similar to those found in mammals. The response of some aquatic organisms to pollutants has been studied through the measurement of hematological and physiological parameters (Begum, 2004). The major reason for carrying out toxicity tests with fish and other aquatic organism is to determine which concentrations of pesticide are harmful to the organisms and which have no apparent effect. A second objective toxicity tests is to monitor the toxicity of effluents or evaluate the quality of surface water. The edible fish was taken into considerate. To asses the quality of water with meaningful procedure, especially if many waste substances are present or if it is not known exactly what is presents.

The purpose of the present investigation is to evaluate the effect of altered amount of urea & creatinine in the body of *Channa punctatus,* exposed to methyl parathion sub lethal concentration and to establish the fish as bio-marker. In food chain it is also used by the several organism including human being.

Materials and Methods

Channa punctatus, (Bloch) is regionally called **SOLI,** belongs to the family ophiocephalidae is collected from the local fish ponds & reservoirs. Specimens of more or less same sized and weight were selected for the present investigation. The average size of fish was 16cm.-19cm. & weight was 60gm.-70gm. During acclamatization commercial fish food was given to them and on alternate day water was changed. Physiochemical nature of water was determined by using the APHA techniques (APHA 1998). With this technique water temperature was recorded $28^{o}c \pm 1^{o}c$ & pH recorded was 7.0±1.5. BOD was normal as standard value.

Effects were made to maintain the temperature & pH of water containing experimental & control fish. Fish were kept in six groups, each one had ten specimens. Fish of four groups were treated experimentally and the remaining two as control. Sampling was done on 3, 7, 15, and 30^{th} day and every time feeding was stopped at least 24hrs. , before taking blood samples.

After anaesthetization with MS222 blood was taken out from caudal vein with the help of heparinized syringe. Blood in sterilized tube was kept in centrifuge for 20 minutes at a speed of 3500 rpm.

After separating, plasma analysis was done with the help of Semi-Autoanalyser using test reagents manufactured by Span Diagnostic Ltd., Sachin, Surat (India).

Results and Discussion

Fish were treated with sub lethal doses of methyl parathion to determine the concentration of urea and creatinine in the blood plasma, causing the level damage in kidney and other body organs. Efforts have also been made to observe similar changes in other organisms including human being in the food chain.

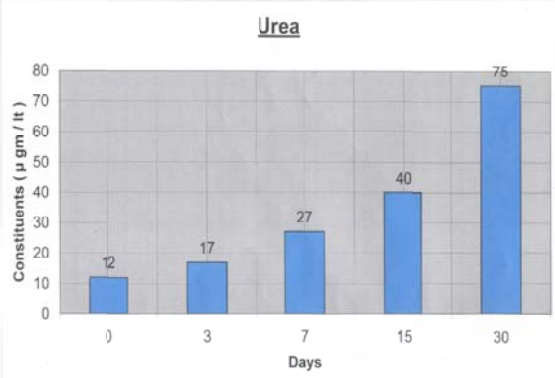
Both the groups of fish (experimental and control) were kept under observation to find out the changes in urea and creatinine. The amount of urea in control fish was observed 12 µg/l ± 5 µg/l and in experimental fish, the amount of urea increased upto 75 µg/l. Similarly the concentration of creatinine in blood plasma was observed about 0.40 µg/l ± 0.35 µg/l in control group, and in experimental group the value increased upto 2.1 µg/l.

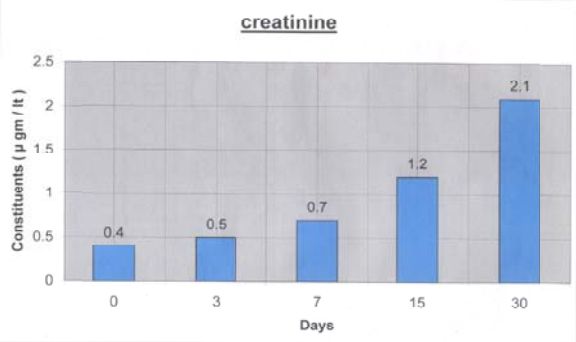
	Control	Experimental			
Urea	12±5	17	27	40	75
Creatinine	0.40±0.35	0.50	0.70	1.2	2.1

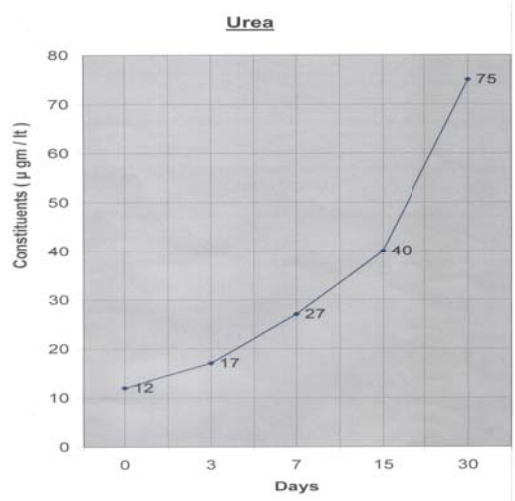
Days

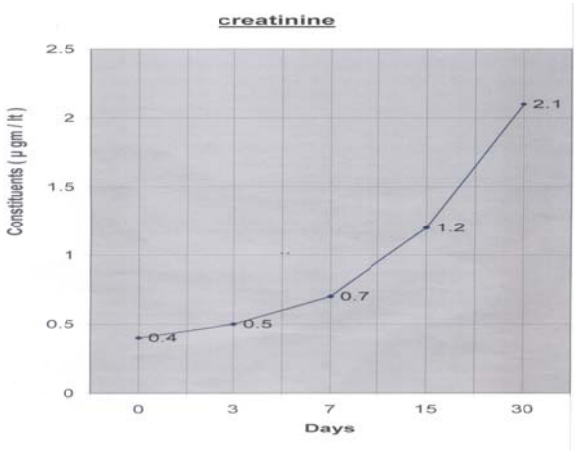
0 3 7 15 30

The extra cellular fluid constitutes the internal environment of the cells of the body. The cells carry out their vital activities in this medium. This fluid should be maintained relatively constant in composition for the normal functioning of the cells. Cytoplasm is the intracellular fluid and is affected functionally by the extracellular fluid. filtration of plasma by glomeruli (2) selective absorption (3) secretion and (4) disorder caused by them. Due to the disturbance in the above mentioned processes and mainly due to decreased glomerular filtration, waste products particularly nitrogenous substances such as urea, creatinine etc. increased in blood.









Any biochemical change in extracellular fluid or tissue fluid affects the biochemistry of cells. Lungs and Kidney are the primary organs maintaining the internal environment.

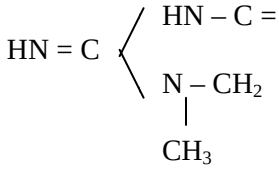
This internal environment is regulated mainly by two pairs of organs. The lungs control the concentration of oxygen and CO_2 and the kidney maintain optimal chemical composition of the body fluids by acidification of urine and also by removing metabolic wastes such as urea, creatinine. The regulation of the internal environment by kidney is a composite of four processes (1)

The term blood non protein nitrogen comprises urea and creatinine etc. Estimation of total blood nonprotein nitrogen (NPN) is commonly undertaken as a measure of protein catabolism of renal function.

Accumulated amount of the methyl parathion in fish may develop disorder and when taken by human being as a final consumer, various abnormalities may be developed. In this manner, the Azotemia like disorder appears showing high concentration of plasma non protein nitrogen causing following abnormal situations:

- Higher tissue protein catabolism.
- Excess break down of blood protein, and is taken up by human being may develop diabetes mellitus, dehydration, cardiac failure and high fever. (Balis, 1976 and Baron *et. al.* 1955)

Creatinine is end product of creatine metabolism. It is an anhydride of creatine. The chemical formula of this creatinine is as follow



Creatinine is mainly found in muscle by the irreversible and non-enzymatic removal of water from creatine phosphate. Formation of creatinine is a preliminary step required for the excretion of most of the creatine. Three amino acids glycine, arginine and methionine are directly involved in the synthesis of creatine. (Meister, 1965)

When the concentration of creatinine becomes alarming in human being, due to consumption of such effected fish, it may cause renal failure, heart failure / shock and obstruction in urinary track. (Bonsnes and Taussing, 1945 and Brod and Sirota 1948).

Conclusion

Exposure of fish *Channa punctatus* to the methyl parathion - a pesticide in sub lethal concentration for about 30 days, with few intervals, directly indicate that the exposure of this pesticide not only affect the health of fish but also the human being and develop the various alarming symptoms which may be proved fatal.

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