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RESEARCH PAPER

Cypermethrin on protein metabolic profiles in rat kidney

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ABSTRACT

Cypermethrin is most widely used because of its high effectiveness against target species and its low mammalian toxicity reported so far. It is a fast-acting neurotoxin and is known to cause free radical-mediated tissue damage. An attempt has been made in estimating its toxicity in rat kidney at molecular levels. Following exposure to oral, sublethal doses (41 mg/kg bw) of cypermethrin as single dose, double dose and multiple dose with 48 h interval the various profiles of protein metabolism, were studied in different groups of rat kidney. Total proteins showed decrement, whereas free amino acids and the activity of protease, aspartate aminotransferase, alanine aminotransferase and glutamate dehydrogenase as well as ammonia and urea significantly increased in cypermethrin-exposed rats. These effects on the protein metabolism of rats exposed to cypermethrin, which caused impairment of protein synthetic machinery and indicated its toxic effects on cellular functioning.

Key words : Cypermethrin, Protein metabolism, Rat kidney.

An increase in global food demand has resulted in a significant increase in the use of pesticides in agriculture. This has caused great concern among health and environmental scientists, since some of these chemicals induce mutations (somatic as well as germ-line) in experimental systems (Meng *et al.*, 2000). In humans, exposure to pesticides has been associated with cancer (Dich *et al.*, 1997).

Synthetic pyrethroid pesticides account for over 30% of the global pesticide use (Eisler, 1992). Two distinct classes of pyrethroids have been identified based on different behavioral, neuropsychological and biochemical profiles. Type I pyrethroids mainly cause hyper-excitation and fine tremors, while Type II pyrethroids possess a cyano-group and produce a more complex syndrome, including clonic seizures (Verschoyle and Aldridge, 1980). These compounds have gained popularity over organochlorine and organophosphate pesticides due to their high efficacy against target species (Elliot *et al.*, 1978), their relatively low mammalian toxicity (Parker *et al.*, 1984), and rapid biodegradability (Leahey, 1985). Cypermethrin [alpha – cyano-3-phenoxybenzyl ester of 2, 2-dimethyl-3-(2, 2-dichlorovinyl) cyclopropane carboxylic acid], is a composite synthetic pyrethroid, a broad spectrum, biodegradable insecticide, and a fast – acting neurotoxin with good contact and stomach action. It is used to control many pests, including moths, and pests of cotton, fruit and vegetable crops. Consistent with its lipophilic nature, cypermethrin has been found to accumulate in body fat, skin, liver, kidneys, adrenal glands, ovaries, and brain (Hall *et al.*, 1980).

Cypermethrin has been classified by the US Environmental Protection Agency (US EPA, 1989) as a possible carcinogen. The pesticide has been shown to induce chromosomal aberrations and micronucleus formation in mouse bone marrow as well as in spleen (Amer and Aboul-ela, 1985; Amer *et al.*, 1993). It also increases the frequency of sister chromatid exchange in bone marrow cells of mice (Giri *et al.*, 2003). DNA damage was observed in lymphocytes of workers occupationally exposed to pesticides such as cypermethrin (Undeger and Basaran, 2002).

The present study critically examines the magnitude and relationships of the metabolites and enzymes involved in the metabolism of proteins in rat kidney treated with sublethal doses of cypermethrin, since the farmers, pesticide applicators, industrial workers and other pesticide users will be exposed to the pesticides repeatedly.

MATERIALS AND METHODS

Test chemical:

Technical grade cypermethrin (92% purity; *cis:trans* ratio 40:60) was obtained from Tagros Chemicals India Limited, Chennai.

Experimental animals:

About 40 adult, healthy, wistar strain albino rats (70±5 days, 175±10 g) were obtained from the Indian Institute of Science (Bangalore, India) breeding colony, and raised on a commercial pellet diet (Sai Durga Feeds and Foods,