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Malathion induced changes on hepatic acid and alkaline phosphatases in developing rats

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ABSTRACT

The effect of malathion, an organophosphorous pesticide, was assessed on the biochemical nature of the hepatic organ. Malathion was administered per os at doses of 5mg, 50mg, 250mg and 500mg/kg body weight at a time interval of 24 hours to developing rats of Charles Foster Strain. Enzyme activities, e.g. acid phosphates and alkaline phosphates estimated would indicate that malathion may induce possible cellularlysis and tissue degeneration at high doses during developing stage.

Keywords: Malathion; acid phosphatases; alkaline phosphatases.

INTRODUCTION

Malathion o, o-dimethyl s-(1,2 – dicarboxy ethyl) phosphorodithiate is an organophosphorous pesticide widely used to preserve the agricultural harvests and products. Within the system it is first converted to its metabolite malaxon which is mainly responsible for its pesticidal properly.[1] Like most of the other organophosphorous pesticides.[2,3] Malathion has also been reported to have a prominent action on the central nervous system and it is found to be potent inhibitor of acetyle cholinesterase activity of the brain.

As brain is closely related to the different organs of the body via the hypothalamo - pituitary - gonadal axis[4,5], therefore, any agent having an action on the brain may interere with the functioning of the different system.

Therefore it is reported in the present research work that, the malathion treatment has induced effect on some of the functionally important biochemical component viz. DNA and protein contents and enzyme activities

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viz. Acid phosphates and alkaline phosphates on the hepatic organ in developing rats.

METHODS AND MATERIALS

I. Animal: Developing albino rats of charles Foster Strain, in both weaning (15 days) and post weaning (25 and 35 days) periods maintained at the laboratory atmosphere for seven days were used for this study.

II. Pestidide (Malathion): The pesticide obtained from Rallis India Limited, Fertilizers and Peticides Division, Research and Development Laboratories and was force fed orally to the rats while the control rats received an equal volume of the vehicle i.e. groundnut oil.

III. Treatments: The rats were orally force-fed with four different doses viz. 5mg, 50mg, 250mg and 500mg per kg body weight of the pesticide and for each dose a 24 hours time interval of treatment was used hence, there was in total four individual groups of rats, each group having at least six rats. After the due time interval of malathion treatment, the animals were killed by instant decapitation and the hepatic organ was immediately dissected out and after dissecting all the adhering tissues, the organ was weighted in an electronic weighing balance and placed in crushed ice.

IV. Estimations: For the enzyme assays, the tissues were homogenized uniformly in ice cold sucrose solution. (A 10% homogenate of each liver was prepared in 0.32 M sucrose solution). The homogenate was then cefrituged in cold at 3,000 g to obtain a cell free extract was used as the enzyme source and the acid and alkaline phosphatase activities were estimated by the method of Urrego and Epstein.[6]

Estimation of protein was carried out by the method of Gornall *et al.*[7] Deoxyribonucleic acid (DNA) was estimated according to the diphenylamine colour reaction of Burton.[8] Statistical significance of differences was calculated using students' test. $P<0.05$ and $P<0.001$ were taken as significant and highly significant respectively when compared to the untreated control rats.

RESULTS AND DISCUSSSION

From the Table I - it is evident that at the lower doses of 5 and 50 mg per kg body weight malathion produces no significant change in the activities of the hepatic acid and alkaline phosphates in both weaning (15 days) as well as the post weaning (25 and 35 days) rats. However, at the higher doses of 250 and 500 mg there is a significant rise in the activities of these enzymes in all the ages studied.

Since DNA Content is an index of the cell number[9], table II shows that the hepatic acid and alkaline phosphates content when expressed as per cell basis also rises significantly at the two higher doses of 250 and 500 mg. Thus elevated activities of hepatic acid and alkaline phosphatases indicate that malathion might cause a

disruption in the liver function[10,11] and may lead to cell death and necrossis[12], when consumed at high doses during the developing stage. Hence, malathion particularly at high doses may interfere with the physiological functioning of the male gonadal system and the toxicity of the pesticide might increase with the time interval of action and this effect may be a direct one on the hepatic organ itself or may also be through the hormonal disbalance resulting from the drug treatment.

Our observations in malathion treated developing rats tend to stress the need for careful consideration of the problem of exposure to such toxic pesticides among the poor socio economic group in a developing country.

Table I

Malathion induced changes on hepatic acid and alkaline phosphatase activities in developing rats

Doses of Malathion (mg/kg body wt)	*Age of Developing Rats*					
	15 Days		*25 Days*		*35 Days*	
	Acid po_4	Alkaline po_4	Acid po_4	Alkaline po_4	Acid po_4	Alkaline po_4
	Mean±SEM	Mean±SEM	Mean±SEM	Mean±SEM	Mean±SEM	Mean±SEM
CONTROL Received vehicle	3.16±.09	1.32±.06	2.36±.14	1.12±.04	2.12±.12	0.96±.07
5 mg	3.14±.08	1.38±.06	2.36±.11	1.21±.15	2.11±.20	1.01±.08
50 mg	3.21±.02	1.49±.05	2.38±.09	1.32±.05	2.21±.02	1.01±.08
250 mg	3.28±.27	1.61±.06*	2.50±.13	1.50±.06*	2.27±.20	1.38±.08*
500 mg	3.73±.24	1.77±.07*	3.41±.14*	1.80±.07**	2.31±.06*	1.69±.06**

Results are expressed as in unit/mg protein.

po_4 = Phophatase

Table II

Malathion induced changes on hepatic acid and alkaline phosphatase activities in developing rats

Doses of Malathion (mg/kg body wt)	*Age of Developing Rats*					
	15 Days		*25 Days*		*35 Days*	
	Acid po_4	Alkaline po_4	Acid po_4	Alkaline po_4	Acid po_4	Alkaline po_4
	Mean±SEM	Mean±SEM	Mean±SEM	Mean±SEM	Mean±SEM	Mean±SEM
CONTROL Received vehicle	53.85±3.09	22.84±2.37	40.8±3.02	15.83±1.64	26.5±2.4	14.48±2.09
5 mg	51.82±3.59	23.59±2.02	41.60±2.77	16.10±1.53	26.43±1.73	15.30±0.79
50 mg	56.92±3.39	24.11±1.72	43.51±3.34	18.37±1.60	28.66±3.02	17.91±1.08
250 mg	56.02±3.80	31.33±2.47*	44.81±3.46	22.65±2.25*	31.72±4.81	21.76±2.62*

500 mg	65.55±5.33*	33.89±2.11*	54.6±5.63*	28.70±3.34*	42.46±2.59*	28.17±1.02

Results are expressed as in unit/mg DNA.

* P<0.05 ** P<0.001

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