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EFFECT OF CONCURRENT EXPOSURE OF LOWER CONCENTRATIONS OF LEAD AND ENDOSULFAN ON GENERAL BIOCHEMICAL PARAMETERS IN WISTAR RATS

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Abstract: The effect of concurrent repeated exposure of lower concentrations of lead and endosulfan were evaluated on general biochemical parameters in male wistar rats. Rats of group I served as untreated control where as Group II received drinking water containing lead as lead acetate @100 ppm (Pb100). Group III was exposed to feed containing technical grade endosulfan @ 10 ppm (E10). Group IV was exposed to Pb (100) +E (10). Blood and target organs were collected for estimation of general biochemical parameters to assess toxicity by combination of these two chemicals at lower doses. The results suggest that the lower doses of endoulfan and lead alone and in combination did not change general biochemical parameters carried out in the study.

Keywords: Lead, Endosulfan, Biochemical parameters.

Introduction

Lead is a major human health hazard due to its wide distribution in the environment and in biological systems (Zhen et al., 2013). Endosulfan is a member of the cyclodiene group of organochlorine pesticides used worldwide in agriculture. It is used around the world for applications on vegetables, fruits, and non-food crops such as cotton and tobacco. This colourless solid has emerged as a highly controversial agrichemical due to its acute toxicity (Wade et al., 2002). A dose of 10 ppm of endosulfan has been tested to be non toxic dose (Banerjee and Hussain, 1987). Since multiple-chemical exposure is believed to represent a realistic picture of the human and animal chemical toxic burden, one chemical may modify the effect of the other by altering its kinetics and/or dynamics in a co-exposure situation. In view of the increased use of endosulfan for agroproduction and high levels of lead in the ground water and environment, coexistence of lead and endosulfan seems to be a reality and

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simultaneous exposure of human and animals to these chemicals could be potentially hazardous.

Human and animals may be exposed to lead and endosulfan concomitantly. The interaction resulting from the concurrent exposure of lead and endosulfan cannot be predicted to be less hazardous. Hence the present study was aimed to evaluate whether repeated co-exposure to lead at lower concentration level through drinking water and to dietary endosulfan at lower concentration could modify the effect produced by each compound on general biochemical parameters in male wistar rats.

Materials and Methods

Colony-bred adult male albino Wistar rats (70-90g; 4-5 weeks age) were procured from Laboratory Animal Resource Section, Indian Veterinary Research Institute, Izatnagar. As per the Institute Animal Ethical Committee guidelines they were maintained under standard managemental conditions. Four groups of six rats were taken for the study. Rats of group I served as untreated control where as Group II received drinking water containing lead as lead acetate @100 ppm (Pb100). Group III was exposed to feed containing technical grade endosulfan @ 10 ppm (E10). Group IV was exposed to Pb (100) +E (10). All the treatments were given daily for 28 days. Rats of all the groups were observed daily for clinical signs and mortality, if any, during the entire period of the experiment and body weights were recorded weekly. After 28 days of treatment with metal and /or pesticide, blood was collected from retro-orbital plexus with the help of capillary tube as described by Sorg and Buckner (1964). Blood was collected and used for estimations of general blood biochemical parameters.

Serum was separated from anticoagulant free blood samples and refrigerated at 4^0C for biochemical estimations. Blood urea nitrogen (BUN), serum creatinine, serum alanine (SALT) and serum aspartate aminotransferases (SAST) were determined by using Span diagnostic kits, India. Estimation of haemoglobin was done by cynomethaemoglobin method using kit (Beacon, India). The organs were examined for any gross abnormality. Liver, kidney, brain, heart, lung and testes were removed, washed free of extraneous material and weighed. Results have been expressed as mean ± SEM. The data were analyzed by ANOVA with Duncan's multiple comparisons (Snedecor and Cochran, 1989).

Results and Discussion

After 28 days, there were no significant changes in the body weights of rats given lower concentrations of lead, endosulfan and lead plus endosulfan in all groups taken for the study. Wade *et al*. (2002) reported that exposure to the mixture containing lead (0.1 ng) and

endosulfan (50 ng) for 70 days did not influence either terminal body weight or weight gain throughout the experiment in rats. The rats exposed to treatment did not show any apparent toxic signs in rats. Banerjee and Hussain (1987) reported no overt toxicity signs and symptoms in rats treated with 50 ppm of endosulfan for six weeks. Institoris *et al*. (1999b) also reported no clinical signs of toxicity during cage-side observations and on dissection of rats after 28 days of exposure to lead acetate @ 80 mg/kg orally. Increase in serum ALT may be the indication of injury to the liver. Increase in the levels of BUN and creatinine may be the indication of nephrotoxicity.

In the present study, there were no significant changes in absolute and relative weights of liver, heart, kidney, brain, lungs and testes in all the treated groups as compared to control. The changes in haemoglobin content of rats exposed to treatment were not noticed as compared to control. SAST, SALT, Creatinine and BUN levels were also not changed significantly as compared to control. Teijon *et al*. (2006) reported the changes in blood urea nitrogen, alanine aminotransferase, and alkaline phosphatase in the first month of post weaning of rats given with 400 ppm of lead in drinking water. Ashour *et al.* (2007) reported elevated serum urea, uric acid and creatinine in rats receiving 1000 and 2000 ppm of lead acetate. Our study was conducted with 100 ppm of lead which has showed no changes in the biochemical entities.

In conclusion, the effects on general biochemical parameters by combination of lower doses of endosulfan and lead were not modified significantly as compared to their individual effects in the present study.

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TABLES

Table 1: Effect of 28- day treatment with lead, endosulfan and their combination on general biochemical parameters in rats

Groups	SGPT (units/ml)	SGOT (units/ml)	Creatinine (mg/dl)	BUN (mg/dl)
Control	63.62±0.36	77.21±0.57	1.25±0.00	17.59±0.22
Pb-100	64.07±0.35	76.88±0.39	1.26±0.02	18.57±0.67
E-10	64.63±0.39	77.43±0.72	1.28±0.01	18.11±0.12
Pb-100+E-10	63.85±0.39	78.44±0.75	1.25±0.01	18.02±0.22

Table 2: Effect of 28- day treatment with lead, endosulfan and their combination on organ weights in rats

Groups	Liver	Heart	Brain	Kidney	Lungs	Testis
Control	6.66±0.05	0.75±0.01	1.46±0.01	1.25±0.01	1.36±0.01	1.95±0.48
Pb-100	6.55±0.08	0.77±0.01	1.47±0.01	1.22±0.03	1.37±0.01	2.05±0.41
E-10	6.68±0.15	0.75±0.01	1.45±0.01	1.24±0.01	1.31±0.04	2.07±0.09
Pb-100+E-10	6.42±0.36	0.75±0.01	1.45±0.02	1.30±0.01	1.29±0.04	1.96±0.07

Table 3: Effect of 28- day treatment with lead, endosulfan and their combination on haemoglobin (g/dl) in rats

Groups	Haemoglobin (g/dl)
Control	15.81±0.32
Pb-100	16.00±0.26
E-10	15.67±0.33
Pb-100+E-10	16.21±0.41

Pb-100 indicates lead 100 ppm and E-10 indicates endosulfan 10 ppm. Values (mean ± S.E.M., n=6) in the same column does not vary significantly ($P \leq 0.05$) in Duncan multiple comparison post hoc test.