

INCIDENCE OF ENDRIN RESIDUES IN CUCUMBER AND ITS EFFECTS ON THE BIOLOGICAL SYSTEM OF RATS

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Abstract

The residue levels of Endrin were estimated in cucumber (*Cucumis sativus*) samples showed that 35.5% contained endrin residues ranging from 304.3 to 669.4 ug per 100 g vegetable. The calculated daily consumption of endrin by human population, thus falls between 13.1 and 28.7 ug per kg body weight. The disappearance of endrin in cucumber was also noted after spraying the insecticide in an experimental field. The residues persisted upto 14 days. Female albino rats receiving 28.7 ug endrin per kg body weight, accumulated endrin in their livers (5.47 ug/g) and its amount in the blood increased progressively (15.21 ug/ml) upto 28 days. The enzymes AST and ALT increased progressively, but no endrin was excreted in the faeces. The growth rate of rats as well as principal body organs, were adversely affected by the oral administration of the insecticide (JPMA 36, 209, 1986).

INTRODUCTION

The beneficial effects of insecticides in protecting food materials are evident; yet the indiscriminate and injudicious use of these toxic substances, are creating many problems in the public health sector. In continuation of the work reported earlier¹ the present project was, undertaken to detect the presence of endrin residues in cucumber, and its effects on the biological system of albino rats.

MATERIALS AND METHODS

Samples of Cucumber (*Cucumis sativus*) were collected randomly from different fields and markets. Cucumber crop was also sown in an experimental plot measuring 1350 square feet. At the time of maturity of the vegetable, the crop was sprayed with 0.05 per cent endrin solution at rate of 100 gallons per acre. Cucumber samples were collected from that plot daily. Random and sprayed samples were qualitatively screened for endrin residues in their edible portion, using thin layer chromatography².

Samples found positive for endrin residues, were subjected to quantitative estimation.³

Twelve adult female albino rats of approximately same weight (188 ± 3 g) were randomly divided into two groups A and B. The control group A was fed normal stock diet throughout the experimental period of 28 days. In addition to the normal diet, rats in the treated group B, were daily administered endrin orally at the rate of 28.7 ug/kg body weight. The initial and subsequent weekly body weights of rats were recorded. Initial and weekly blood samples were collected by cardiac puncture under anaesthesia from one randomly selected rat from each group for the estimation of endrin⁴, AST and ALT enzymes⁵. Samples of feces were collected at weekly intervals and analysed for endrin³. At the end of 28 days, the rats were killed and weights of their principal organs like adrenals, heart, kidneys, liver, lungs and spleen, were recorded for comparison. The livers were analysed for any accumulation of endrin.⁶

RESULTS AND DISCUSSION

Forty five samples of cucumber collected randomly from various fields and markets, were analysed for the presence of endrin residues. Sixteen samples (35.5 per cent) contained endrin ranging from 304.3 to 669.4 ug per 100 g of the vegetable.

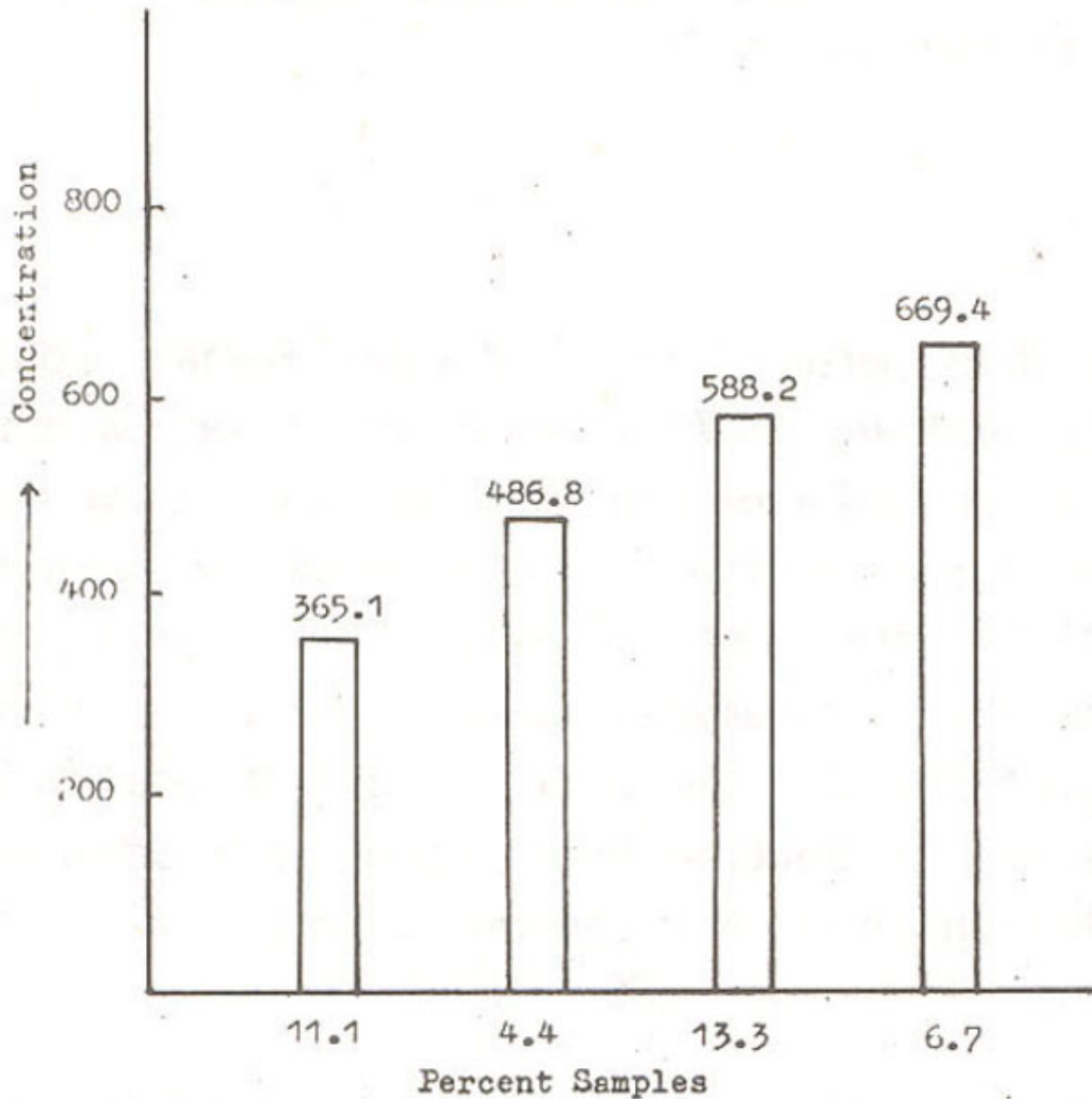


Figure 1. Various percentages of samples containing different amounts of Endrin.

Figure 1 shows that 11.1 per cent samples contained endrin upto a maximum amount of 365.1 ug per 100 g of vegetable and 6.7 per cent of samples were having the highest amount of 669.4 ug/100 g. These results indicate that the daily consumption of endrin by human population ranges between 13.1 and 28.7 ug per kg body weight, provided it is assumed that an adult healthy man of 70 kg body weight with normal dietary habits, consumes 300 g of the vegetable. This amount is very high and much alarming as compared to 0.2 ug per kg body weight which has been accepted by FAO.⁷ Residues of endrin persisted in the edible portion of cucumber, upto 14 days and diminished thereafter (Figure 2).

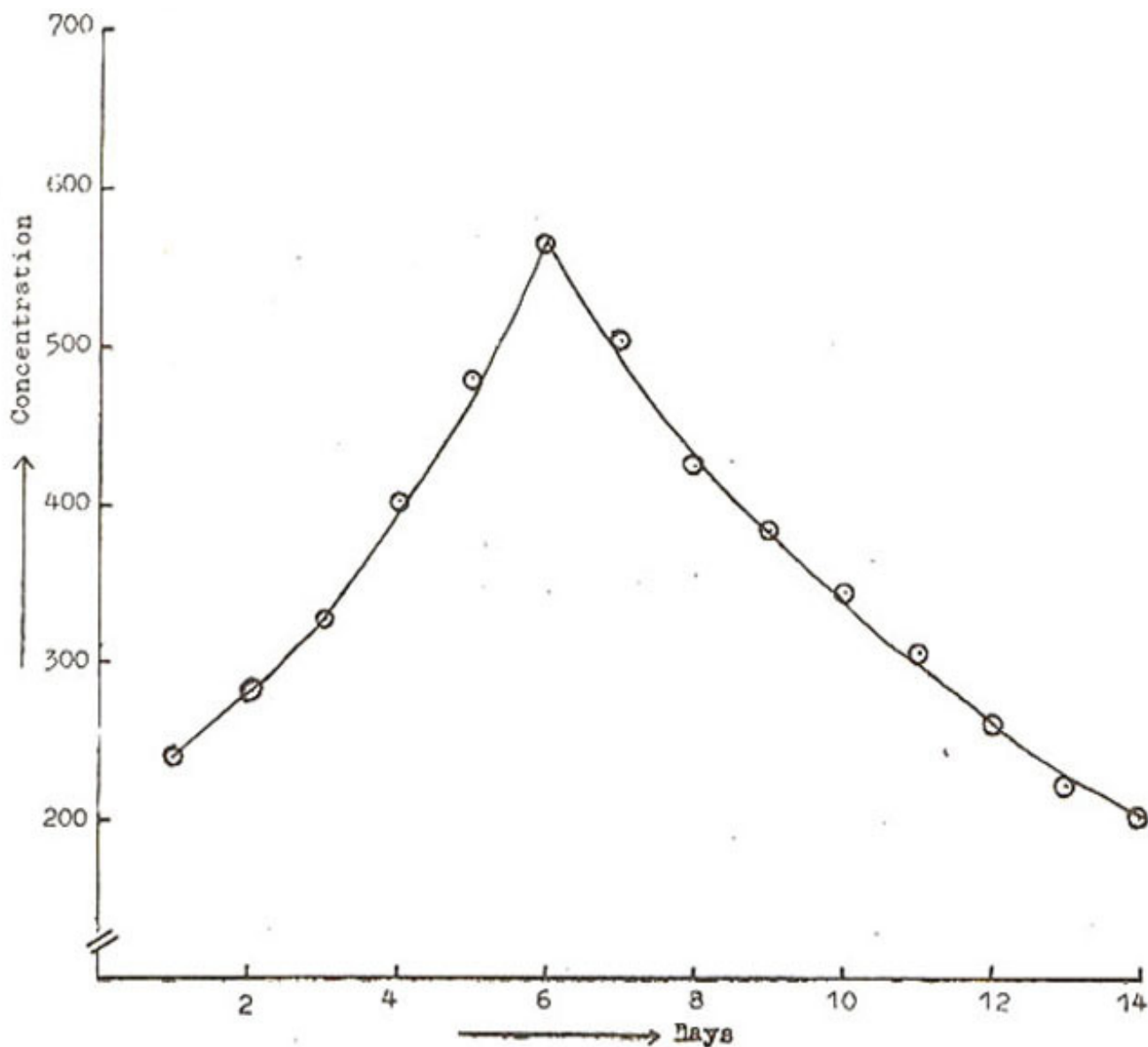


Figure 2. Concentration of endrin residues on various days in cucumber crop sprayed with the insecticide.

The amount of endrin progressively increased and reached a maximum of 567.9 ug/100 g on the sixth day after the application of the insecticide. Other studies show that endrin residues on cucumber disappeared within 12 days,⁸ and in radish crop the residues persisted from 7 to 12 days.⁹ The regression lines (Figure 3)

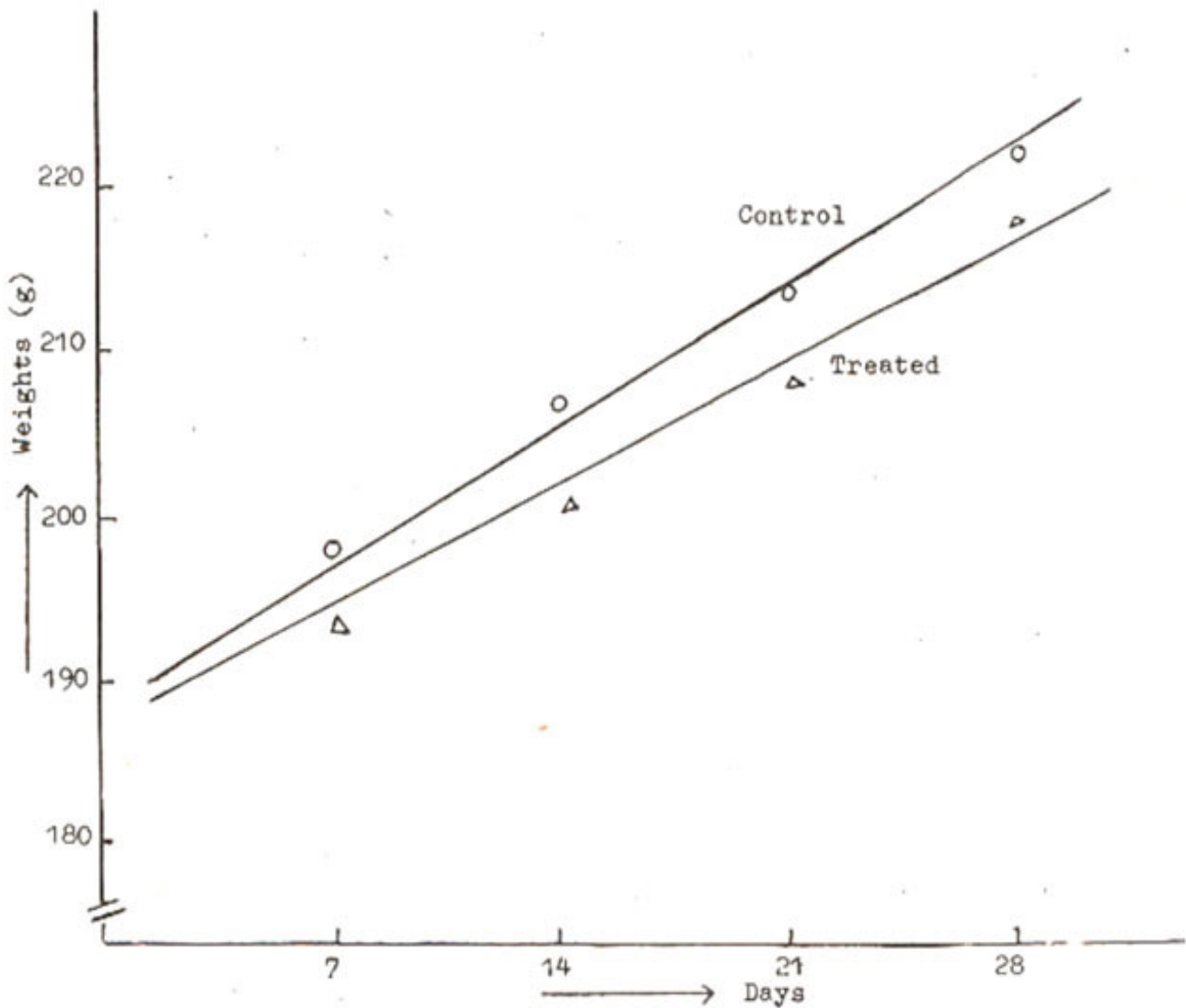


Figure 3. Effect of endrin on the growth rates of rats.

drawn on the basis of average weekly body weights of rats in both control and treated groups, indicated that endrin affected the growth rate of rats adversely, though non-significantly when compared with that of the control group. The weekly blood analysis indicated that the amount of endrin was below the detectable limits for the first two weeks. It was 10.42 and 15.21 ug per ml of blood in the third and fourth weeks respectively. Other studies' also show that the concentration of endrin in blood increased with the passage of time. The analysis of blood for the levels of two enzymes Aspartate amino transferase (AST) and Alanine amino transferase (ALT), revealed that the level of both the enzymes increased with the passage of time (Table 1).

TABLE - II
Effect of Endrin on various Body Organs of Rats.

Group	Control	Treated
Average body weight (g)	222.166	216.666
Organ	Ratio (organ wt./body wt.)	
Adrenals	9.63×10^{-5}	8.54×10^{-5}
Heart	2.70×10^{-3}	2.79×10^{-3}
Kidneys	4.93×10^{-3}	5.00×10^{-3}
Liver	23.0×10^{-3}	25.8×10^{-3}
Lungs	4.89×10^{-3}	5.02×10^{-3}
Spleen	8.55×10^{-4}	8.81×10^{-4}

These results are in agreement with those reported in the literature¹⁰
 The analysis of feces collected at weekly intervals, indicated that endrin was not excreted by the rats. This absence might be attributed to complete absorption of the small orally administered dose (28.7 ug/kg) of endrin across the intestinal walls during digestion. The analysis of livers of rats in the treated group indicated that average amount of endrin accumulated in 28 days, was 5.47 ug per g of the tissue. The weights of various body organs of individual rats in both the groups, were recorded and the average weight for each group was calculated. The ratio of organ weight to the body weight (Table II),

TABLE -I
Levels of AST and ALT in the Blood of Rats
as affected by Endrin.

Days	AST		ALT	
	(I)*		(I)*	
	Control Group A	Treated Group B	Control Group A	Treated Group B
7	62	66	20	20
14	62	68	20	23
21	62	73	19	24
28	61	80	20	25

* I is the amount of enzyme which catalyzes the transformation of one micro mole of substrate per minute under standard conditions.

indicated that the weight of all organs increased in the treated group, except that for the adrenals which regressed in response to the treatment with endrin.

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