

# THE EFFECT OF LINDAN ON IMMUNE RESPONSE IN CHICKENS

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The effect of lindan (gamma isomer of hexachlorocyclohexan) on some immune responses in chickens was investigated. The chickens were given a single sublethal dose (50 mg/kg) or repeated subtoxic doses (20 mg/kg) of the compound and immunized with sheep erythrocytes. It was found that neither of the treatments consistently influenced haemolysin and haemagglutinin titres and did not altered the number of splenic germinal centres.

The paper presents the further investigations on the effect of insecticides on some immune responses in chickens. The subject of the previous experiments were chemicals representing organophosphate and carbamate pesticides (8, 9). The present studies concern organochlorine compounds.

So far, from among the later pesticides a special attention was paid to DDT. It was reported that DDT proved to be immunosuppressive in some laboratory animals decreasing, particularly after chronic poisoning, the production of antibodies and serum immunoglobulin level (7, 10, 11).

The restrictions in DDT application in agriculture created the necessity to introduce substitutes. One of them is lindan. Since this compound is widely used in agriculture, market gardening, and fruit-farming, there is a great hazard for animal health. Contrary to DDT, lindan was not the subject of extensive immunological studies.

## Materials and Methods

Animals. — Seven-week-old White Leghorn chickens were used in the experiments.

Immunization. — All the chickens were immunized intravenously with 1 ml of 1 per cent sheep red blood cells (SRBC).

Insecticide. — The birds were given 50 mg/kg body weight of lindan (gamma isomer of hexachlorocyclohexan) supplied by Chemical Products Laboratory, Jaworzno, Poland. The compound was dissolved in soya-bean oil and administered orally 1 day before immunization (−1), at day of immunization (0), and 1, 2 and 3 days after immunization. Additionally some chickens were receiving lindan for 48 days in a daily dose of 20 mg/kg and then immunized with SRBC.

Serological examinations. — Haemolysins and haemagglutinins were determined according to methods described previously (8).

Histological examination. — To count splenic germinal centres, the spleens were fixed in formalin and paraffin sections stained with haematoxylin and eosin were prepared. The number of germinal centres was calculated per 1 mm<sup>2</sup> of the section area.

Statistical analysis. — The significance of differences was verified by use of Student's *t* test.

## Results

All the chickens poisoned with a single sublethal dose of lindan showed clinical symptoms of intoxication. The symptoms were observed for 24—48 hours. Approximately 10—20 per cent of the chickens died.

The results of the serological and histological examinations of the chickens treated with a single dose are presented in Table 1. As can be

Table 1

The effect of a single sublethal dose of lindan on immune responses in chickens immunized with sheep erythrocytes

Treatment day	No. of splenic germinal centres	Haemagglutinin titre (log)	Haemolysin titre (log)
not treated	0.95	11.94	5.16
−1	0.71	12.08	5.05
0*	1.11	11.40	5.11
1	0.86	11.65	5.38
2	1.00	12.08	4.00**
3	0.91	11.62	5.33

\* Immunization

\*\*  $P < 0.05$

seen from the Table the prevailing majority of the poisoned birds displayed no significant differences in immunological indices as compared to controls. Only in chickens which were given lindan on the second day after immunization a significant statistically decrease in haemolysin titre was noticed.

In chickens receiving lindan for 48 days, all mean values of immunologic indices and absolute spleen weights were lower than those in control group (Table 2). However, only the difference between the spleen weights was confirmed statistically. This resulted from the fact that birds poisoned were by 37 per cent lighter than controls. Therefore, no differences were found between relative spleen weights calculated per kg body weight.

Table 2

The effect of repeated administration of lindan on immune responses and spleen weights in chickens immunized with sheep erythrocytes

	No. of splenic germinal centres	Haema-glutinin titre (log)	Haemo-lysin titre (log)	Spleen weight	
				absolute g	relative g/kg
Control	0.83	14.77	6.22	3.52	1.86
Treated with lindan	0.68	14.27	5.77	2.21*	1.88

\*  $P < 0.05$

### Discussion

The results obtained in this study indicated that despite the obvious symptoms of a serious intoxication, lindan showed no essential influence, except one case, on haemolysin and haemagglutinin production. The lack of this influence was observed both in acute and chronic poisoning.

Similar results were reported by other authors who poisoned chickens with another organochlorine compound — DDT. Latimer and Siegel (6) after the application of highly toxic doses of DDT found no significant alterations in antibody production against *Salmonella pullorum* and bovine serum albumin antigens. Also, Glick (2) demonstrated that ingestion of DDT did not influence haemagglutinin levels in chickens although quantities of IgG and IgM were considerably reduced. On the other hand, however, chickens fed high doses of DDT and then subjected to various unfavourable factors (e.g. starvation) showed depressed ability to produce antibodies as compared with controls (3).

These findings differ in some measure from results obtained by Košutzky et al. (5) who observed two-phase immune response in chickens poisoned with DDT. During the first phase, an increase in haemolysin titres was noticed, later the titres decreased below the normal level. Similarly Colmano and Gross (1) found that chickens receiving DDT metabolite — DDD were more resistant to Marek's disease and mycoplasmosis, and more sensitive to *E. coli* infection.

Taking into account all these experimental data, it is impossible to draw any conclusive suggestion regarding the immunosuppressive properties of the examined compounds. At present one thing seems to be unquestionable that the discussed organochlorine chemicals, particularly DDT, are more immunodepressive in mammals than in birds. Although Ferenčík et al. (4) demonstrated that lindan and DDT may alter the activity of lisosomal enzymes of immunocompetent cells in poisoned chickens, but these results were not confirmed by serological studies.

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