

Immunopathological effects of lindane on humoral immune response in sheep

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ABSTRACT

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Organochlorine group of pesticides have property of persistence in environment resulting in their residues in most food stuffs. The continuous intake of these pesticides even in low doses may have deleterious effect on body's immune system. To study the effect of lindane on humoral immune response in sheep, 8 lambs, six months old were used in two groups of 4 lambs each. These lambs were vaccinated with *Brucella melitensis* rev.1 at day zero and day 90. One group was given lindane daily orally at dose rate of 1.25 mg/kg b.wt. for 6 months. Serum globulin and gamma globulins were estimated in blood at 10 days interval. Specific humoral immune response was measured by standard tube agglutination test and ELISA at 10 days interval. There was significant suppression in serum globulins, gamma globulins and specific brucella antibodies in lambs fed lindane in comparison to controls indicating immunosuppressive effect of the pesticide.

Key words: Lindane, Sheep, Humoral immune response, immunosuppression.

INTRODUCTION

Lindane or γ -BHC is an insecticide of organochlorine group which is extensively used in agriculture. The indiscriminate use of pesticides lead to their residues in air, water and food chain. Exposure of man and animals to these residues for long period may have deleterious effects on the physiological functions of various body systems and interfere with immune responses. The information on this vital subject is very scanty However, there are reports of immunotoxic effect of chronic feeding of pesticides in domestic animals (Kataley *et al.*, 1982; Koller, 1979; Girdhar and Singhal, 1989). Therefore, present investigation was planned to study the effects of chronic feeding of lindane on humoral immune response in sheep.

MATERIALS AND METHODS

To assess the effect of lindane on humoral immune response in sheep, six months old 8 lambs, were taken and randomly divided into two groups of 4 lambs each. The lambs were vaccinated with *Brucella melitensis* rev. 1 vaccine at day zero and day 90. Group I was kept as control and group

It was given lindane daily orally 1.25 mg/kg b.wt. for 6 months (FAO/WHO, 1974). At 10 days interval, blood samples were collected and subjected for estimation of serum globulins and serum gamma globulins (Chauhan, 1995). To measure specific humoral immune response induced by *Brucella* vaccine, ELISA and standard tube agglutination test (SAT) were performed.

The ELISA values were obtained by dividing the absorbance value of various test serum samples by absorbance value of negative control (Kurstak, 1985). For statistical analysis of the results, student 't' test was applied (Snedecor and Cochran, 1967).

Table 1 : Effect of lindane on humoral immunity - standard tube agglutination test (mean reciprocal titre \pm S.E., n=4)

Months	Groups	
	Control	Lindane
0	0.00 \pm 0.00(0)	0.00 \pm 0.00(0)
1	200.00 \pm 40.00(160-320)	120.00 \pm 23.09(80-160)*
2	240.00 \pm 46.19(160-320)	110.00 \pm 30.00(40-160)*
3	70.00 \pm 10.00(40-80)	30.00 \pm 77(20-40)
4	100.00 \pm 50.33(80-320)	80.00 \pm 28.28(40-160)*
5	90.00 \pm 25.17(40-160)	40.00 \pm 14.14(20-80)
6	55.00 \pm 15.00(20-80)	25.00 \pm 9.57(0-40)

*Significant difference from the control ($p \leq 0.05$).

Figures in parentheses indicate range of titre.

Table 2 : Effect of lindane on humoral immunity - ELISA (Mean ELISA values \pm S.E., n=4)

Months	Groups	
	Control	Lindane
1	2.77 \pm 0.07	2.51 \pm 0.05*
2	3.11 \pm 0.07	2.48 \pm 0.05*
3	2.60 \pm 0.07	1.82 \pm 0.05*
4	4.06 \pm 0.08	3.48 \pm 0.06*
5	2.91 \pm 0.06	2.41 \pm 0.05*
6	2.06 \pm 0.07	1.58 \pm 0.06*

*Significant difference from the control ($p \leq 0.05$).

Table 3 : Effect of lindane on serum globulins and γ -globulins (grams/100 ml) of sheep (Mean \pm S.E., n=4)

Months	Groups			
	Control		Lindane	
	Globulins	γ -globulins	Globulins	γ -globulins
0	1.93 \pm 0.03	1.49 \pm 0.08	1.87 \pm 0.03	1.48 \pm 0.05
1	2.07 \pm 0.05	1.65 \pm 0.07	1.97 \pm 0.04*	1.56 \pm 0.04*
2	2.17 \pm 0.04	1.75 \pm 0.08	2.00 \pm 0.03*	1.57 \pm 0.04*
3	2.05 \pm 0.05	1.62 \pm 0.08	1.88 \pm 0.03*	1.49 \pm 0.05*
4	2.51 \pm 0.06	1.98 \pm 0.08	2.17 \pm 0.02*	1.75 \pm 0.05*
5	2.30 \pm 0.05	1.77 \pm 0.08	2.05 \pm 0.02*	1.60 \pm 0.04*
6	2.20 \pm 0.06	1.68 \pm 0.08	2.00 \pm 0.03*	1.55 \pm 0.05*

* Significant difference from the controls ($p \leq 0.01$).

RESULTS AND DISCUSSION

A significant depression in *Brucella melitensis* rev. 1 vaccine induced humoral immune response as measured by ELISA and SAT has been observed in present investigation in sheep exposed to lindane in comparison to controls. After 2 months, the mean SAT titres were 1:240 and 1:110 in group I and group II, respectively (Table 1). The corresponding mean ELISA values at the same time were 3.11 and 2.48 in group I and II, respectively (Table 2). Suppression of humoral immune response has earlier been reported with lindane in cats, rabbits (Burkatzkaya, 1963) and rats (Dewan *et al.*, 1980; Saha and Banerjee, 1974). Krots *et al.* (1978) observed reduction in *Brucella* induced complement fixing antibody titre in rabbits fed DDT which is similar to the results of this study. The immunosuppressive action of lindane is due to its detrimental effect on lymphoid organs. The decreased number of lymphocytes along with decreased functional capacity has been reported in patients following pesticide intoxication (Katsenovich *et al.*, 1981). The decreased number and activity of T-lymphocytes might affect T-cell dependent humoral immune response.

The mean serum globulin and γ -globulin values were also decreased in lindane fed group as compared to control group from one month onwards. After 2 months, the mean serum globulin values were 2.17 and 2.00 g/100 ml in group I and II, respectively; while levels of serum gammaglobulins at the same period were 1.75 and 1.57 g/100 ml, respectively (Table 3). The reduction in serum gamma globulin levels further confirms the decreased antibody titre as measured by SAT and ELISA. The decreased serum gammaglobulins is an indication of the lowered immunity, while SAT and ELISA detected the reduction in specific antibody titre to *Brucella melitensis*. A decrease in serum globulin and immunoglobulin levels has been reported in rabbits due to DDT, carbaryl and carbofuran (Street and Sharma, 1975), in rats due to lindane (Saha and Banerjee, 1994) and in birds due to endosulfan (Sanjay Kumar, 1994). The decrease in serum γ -globulin contents may be due to the effect of lindane on peripheral lymphocytes which synthesize γ -globulins. This reduction might also be due to the immunosuppressive effect of lindane on antibody production or due to functional impairment of lymphocytes. The immunosuppressive action of insecticides can be explained on the basis of functional defect in immunocompetent cells, depletion of responding cell types and alteration in normal hormone levels (Faith *et al.*, 1990).

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