

DEPRESSION OF IMMUNOBIOLOGICAL REACTIVITY OF ANIMALS BY SOME ORGANOPHOSPHORUS PESTICIDES

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Formation of typhoid agglutinins during immunization with NIISI polyvaccine is severely depressed and the total serum protein concentration lowered in albino rats exposed to the action of pesticides chlorophos, metaphos, and their mixtures.

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Besides their specific action, some industrial poisons may have a nonspecific toxic action on the body, and in particular, they may lower its resistance to infectious agents. They do so by inhibiting to some degree the immunobiological reactivity of the organism [3-7].

Information on the effect of pesticides on immunobiological reactivity of animals may be found in the literature [1, 2]. This worker studied the effect of the organochlorine compounds hexachlorane and its γ -isomer on the immunobiological reactivity of rabbits and cats immunized with typhoid vaccine. She found that after exposure of cats for 1-2 weeks to γ -hexachlorane the agglutinin titer was lower than in control animals. The changes occurred in phases: an increase of immunobiological reactivity occurred at the beginning of poisoning, followed by its depression at a later stage.

Because of absence of data concerning the effect of organophosphorus pesticides on immunobiological reactivity in the literature, in the present investigation we studied the effect of chlorophos, metaphos, and their mixtures on immunity in rats vaccinated with NIISI polyvaccine.

EXPERIMENTAL METHOD

Experiments were carried out on 60 albino rats weighing 150-160 g. Altogether there were 3 experimental and 1 control series. In each experimental series 3 groups of experimental animals were used (6 rats in a group). The experimental rats of group 1 received 0.05 LD₅₀ chlorophos daily, equivalent to 30 mg/kg body weight, the animals of group 2 received 0.05 LD₅₀ metaphos, or 1.25 mg/kg, and the animals of group 3 received 0.05 LD₅₀ of a mixture containing the equivalent of 10 mg chlorophos and 0.5 mg metaphos/kg body weight.

In the experiments of series I (18 rats) the experimental animals received the pesticides 2 weeks before the beginning of immunization, and again throughout the period of immunization, for 50 days altogether. In the experiments of series II (18 rats) pesticides were given to the experimental rats starting from the beginning of immunization, for 35 days altogether, and in those of series III (18 rats) the animals began to take the poisonous chemical after vaccination for 2 weeks, again for 35 days. In the experiments of series IV (6 control rats), the animals were merely immunized.

The pesticides studied were injected directly into the stomach of the experimental animals from a syringe each morning before feeding. The experiment with immunization thus lasted for 35-50 days. The animals were vaccinated intraperitoneally with NIISI polyvaccine (one billion bacterial cells/ml), in 2 cycles.

On the 1st day of the first cycle 0.2 ml polyvaccine was injected, followed after 4 days by 0.4 ml, and after another 4 days by 1 ml, followed by an interval of 6 days. The second cycle then began. On the 1st day of the second cycle 1 ml vaccine was injected, with 1.5 ml after 4 days, 2 ml after another 4 days, and then an interval of 6 days. The total dose of vaccine in the two cycles of immunization was 6100 million

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bacterial cells. At the end of the experiment (after the interval of 6 days) blood was taken from the rats and serum obtained. The total serum protein concentration was determined refractometrically, and the titer of agglutinins and the protein fractions were determined by electrophoresis on paper. Antigen for titration of the agglutinins was a typhoid diagnostic antigen (3 billion bacterial cells/ml). The animals were investigated once after the end of immunization.

EXPERIMENTAL RESULTS

The total serum protein concentration of rats immunized at different times with NIISI polyvaccine and receiving pesticides was as follows: in the rats of series I receiving chlorophos, 8.35%; in rats receiving metaphos, 8.27%; and in animals receiving a mixture of these pesticides by mouth, 7.65%. The protein concentration in the animals of the control series was 8.78%. The difference between the total protein concentration in rats receiving the mixture of pesticides and the control animals was statistically significant ($P < 0.05$).

A statistically significant decrease in the total protein concentration by comparison with the control was also obtained in the rats of series II (by 13.2%; $P < 0.05$).

In the experimental animals of series III a marked decrease was also observed in this index (compared with the control) in all groups (by 9.3% for rats receiving chlorophos, by 9.4% for rats receiving metaphos, and by 10.7% for rats receiving a mixture of pesticides; $P < 0.05$).

The results of the agglutination reaction with typhoid diagnostic antigen gave clear evidence of a marked inhibition of immunobiological reactivity of the experimental animals. After immunization the titer of agglutinins in the control rats receiving vaccination only was 1 : 1200, compared with 1 : 83.3 in the experimental animals of series I receiving chlorophos, 1 : 46 in those receiving metaphos, and 1 : 50 in those receiving a mixture of these pesticides. In the experiments of series II, the corresponding values of this index were 1 : 75, 1 : 75, and 1 : 29, and in the experiments of series III, 1 : 41.6, 1 : 33.3, and 1 : 46.

The study of the blood protein fractions revealed no significant changes. The slight increase in content of γ -globulins in the experimental rats of series II receiving metaphos and a mixture of pesticides, and also in the experimental animals of series III receiving chlorophos and metaphos, was not statistically significant by comparison with the control group.

The change in concentration of albumins in the experimental animals of all 3 series was irregular and was not significant. Appreciable changes in the blood protein fractions evidently take place in more severe cases of poisoning, when a regular shift toward an increase in the globulin fraction is observed.

No correlation could be found between the globulin concentration and agglutinin titer of the healthy control animals after immunization.

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