

PAPER

PARAMETERS OF ACUTE TOXICITY AND TOXIC EFFECTS OF THE SYNTHETIC PYRETHROID ASHIMETHRIN ALPHA ON THE ANIMAL BODY

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Abstract

The article presents the results of studying the acute toxicity of the synthetic pyrethroid ashimethrin alpha (Achich Life Science Put.Ltd., India) on the body of rabbits and Karakul sheep. To determine the main toxicometric parameters, experimental rabbits were given ashimethrin alpha orally once in the form of a 10% suspension at doses of 1300, 1375, 1450, 1525 and 1600 mg / kg, and Karakul sheep received doses of 200, 275, and 350 mg/kg (based on the active ingredient). Studies have established that LD₅₀ for rabbits is 1450.00 mg/kg, and for sheep 347.79 mg/kg. Our observations showed that oral administration of the studied pyrethroid to rabbits at doses of 1375–1600 mg / kg and Karakul sheep 275–350 mg / kg 3 hours after administration caused poisoning with neurotoxicity, death usually occurred within the first 48 hours. During the experiment, violations of the morphological, biochemical and immunological parameters of animal blood were observed. Ashimethrin alpha was quickly absorbed in the gastrointestinal tract, followed by distribution and accumulation in the spleen, liver, and myocardium. The maximum levels of pyrethroid were found in the contents of the stomach (rumen) of dead and involuntarily killed rabbits and Karakul sheep. Complete elimination of the drug was completed after 28 days, according to the results of the veterinary and sanitary examination, the slaughter products fully met the requirements of GOST.

Key words: ashimethrin alpha, pyrethroid, biochemical, LD₅₀, mg/kg.

Introduction

Currently, pesticides from the group of synthetic pyrethroids are widely used in Uzbekistan to protect productive livestock and birds from arthropods that carry many dangerous infectious and invasive diseases [10].

Synthetic pyrethroids are analogues of natural pyrethrins contained in Dalmatian chamomile flowers, they are characterized by high insecticidal activity, rapid biodegradation in the external environment, and the doses and concentrations recommended for practical use, in particular in veterinary medicine, are relatively safe not only for animals and birds, but also for other beneficial inhabitants of biocenoses [1, 9, 10].

However, in order to prevent possible negative effects, which are undoubtedly inherent in these xenobiotics, a comprehensive

detailed study of their toxic properties is necessary. In this regard, we conducted experimental studies to study the toxicity and specific effects of the synthetic pyrethroid ashimethrin alpha on the body of rabbits and sheep.

Material and methods

The experiments were carried out on twenty 5–6-month-old rabbits of the Hikol breed and twelve Karakul sheep, 1.5–2 years old. The synthetic pyrethroid ashimethrin alpha (Achich Life Science Put.Ltd., India) was administered orally to animals once as a 10% suspension for rabbits at doses of 1300, 1375, 1450, 1525 and 1600 mg/ kg, and for Karakul sheep – 200, 275 and 350 mg/kg (according to the active substance).

The static method of B.M. Shtabsky et al. (1980) was used to calculate the main parameters of acute toxicity of the drug [11]. The degree of danger of pyrethroid was evaluated according to the classification by L.I. Medved et al. (1977) [8]. For two weeks after the application of ashimethrin alpha, the experimental animals were constantly monitored clinically, taking into account the number of dead and surviving animals. Dead rabbits and Karakul sheep were subjected to autopsy followed by a pathoanatomic examination of their internal organs and tissues.

In order to identify possible negative effects of the drug in the surviving animals, hematological and immunological status indicators were evaluated using generally accepted methods. [4, 5, 6, 7]. For this purpose, blood was taken from the animals before and 14 days after pyrethroid administration.

To determine the pharmacokinetic parameters of ashimethrin alpha and conduct a veterinary and sanitary examination of slaughtered products from rabbits and sheep [2, 3], they were removed from the experiment in a humane manner 28 days after the start of the experiment. The dynamics of accumulation, distribution and excretion of the drug and its residues from the animal body were evaluated according to MU 5001-89: Guidelines for the determination of residual amounts of pesticides in food products.

Discussion

As a result of the conducted studies, it was found that the synthetic pyrethroid ashimethrin alpha with a single oral administration to rabbits is characterized by the following toxicometric parameters: $LD_{10}=1319.16$, $LD_{16}=1347.92$, $LD_{50}=1450.00$ (1265-1635), $LD_{84}=1552.08$, $LD_{90}=1580.84$, $LD_{100}=1603.12$ mg/kg.

When studying the acute toxicity of ashimethrin alpha, the toxicity parameters for experimental Karakul sheep were determined: $LD_{16}=247.74$, $LD_{50}=347.79$, $LD_{84}=447.83$, $LD_{100}=497.86$ mg/kg.

Assessing the degree of danger of the drug in accordance with the classification of L.I. Medved et al. [8], ashimethrin alpha turned out to be low-toxic for rabbits and medium-toxic for Karakul sheep.

Our observations showed that oral single administration of the studied pyrethroid to rabbits at doses of 1375 and 1450 mg / kg and Karakul sheep at doses of 275 and 350 mg / kg 3 hours after administration caused them to develop a similar set of acute neurotoxicity symptoms, which was manifested by general depression, abundant salivation, bronchospasm, ataxia, seizures, paresis, and paralysis of the limbs, the onset of a comatose state. Death often occurred within the first 48 hours and relatively rarely later. The severity and rate of manifestation of clinical signs of intoxication, as well as the severity of the pathological process, its outcome, and the subsequent rate of rehabilitation were closely correlated with the dose of the administered drug.

Pathoanatomic changes in the internal organs and tissues of animals that died as a result of acute poisoning with ashimethrin alpha were characterized by pronounced hemodynamic disorders in the brain, liver, kidneys, lungs, spleen, acute catarrhal inflammation of the gastric mucosa (rennet) and small intestine.

In subsequent experiments to study the negative effect of the drug ashimethrin alpha on the animal body, it was found that acute poisoning of rabbits and sheep with this pyrethroid was accompanied by abnormalities in the morphological, biochemical and immunological parameters of their blood.

In rabbits, they were characterized by a decrease in the number of shaped blood elements - erythrocytes and leukocytes, hemoglobin content, and inhibition of acetylcholinesterase activity by 17-26%. In sheep, an increase in the level of methemoglobin was observed by 3 times, the activity of aspartate and alanine aminotransferase enzymes by 1.6-3.0 times, while reducing the number of white blood cells and inhibiting acetylcholinesterase activity by 19% (Figs. 1 and 2).

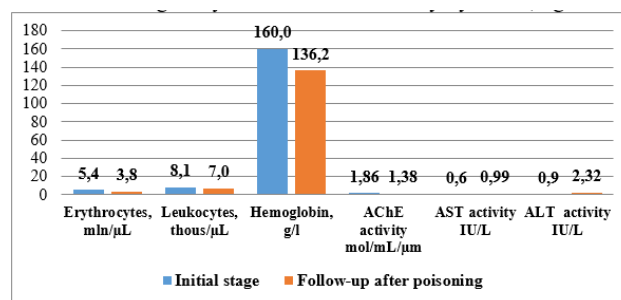


Figure 1. Morpho-biochemical parameters of blood of rabbits receiving ashimethrin alpha at a dose of 1375 mg/kg orally

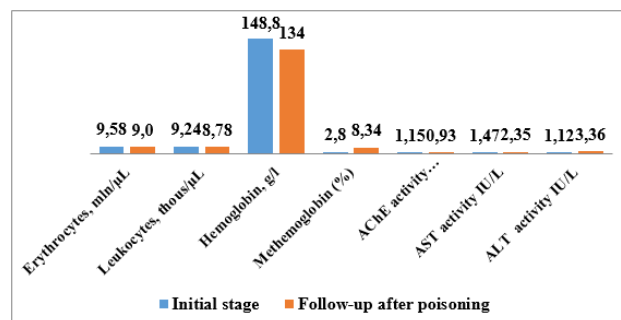


Figure 2. Morpho-biochemical parameters of blood of Karakul sheep treated with ashimethrin alpha at a dose of 275 mg/kg orally

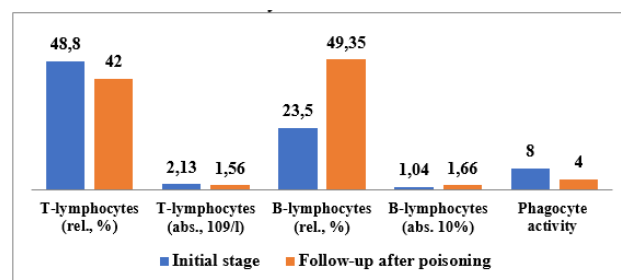


Figure 3. Immunological parameters of blood of rabbits receiving ashimethrin alpha at a dose of 1375 mg/kg orally

Immunological parameters were characterized by a decrease in the relative and absolute number of T-lymphocytes by 24% and 38%, phagocytic activity of neutrophils by 2 times, and a significant increase in the relative and absolute content of B-lymphocytes in the peripheral blood of poisoned rabbits by 2.1 and 1.6 times, respectively (Fig. 3 and 4).

The results obtained indicate a polytropic mechanism of the toxic effect of the synthetic pyrethroid ashimethrin alpha on the body of warm-blooded animals, as there are violations of the functional state of the liver, membrane-damaging effects and suppression of cellular immunity.

Acute intoxication of animals with pyrethroid ashimethrin alpha was characterized by rapid absorption from the stomach and intestines into the blood, followed by distribution and accumulation in all vital organs and tissues. Moreover, regardless of the species differences of the experimental animals, the spleen, liver and myocardium served as storage organs of the drug. To a lesser extent, pyrethroid residues were found in the brain, lungs, and muscle tissue. The maximum levels of ashimethrin alpha were found in the stomach contents of dead and involuntarily killed rabbits and the rumen of Karakul sheep, which were 9.0 and 4.0 mg/kg, respectively. Complete elimination of ashimethrin alpha

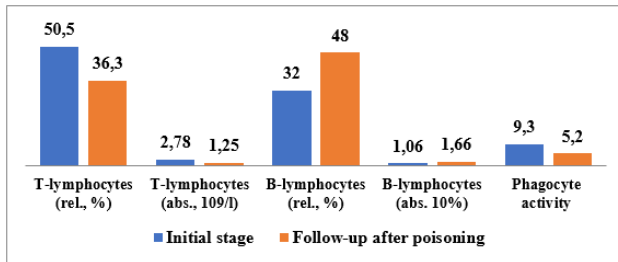


Figure 4. Immunological parameters of blood of Karakul sheep treated with ashimethrin alpha at a dose of 275 mg/kg orally

from the body of poisoned animals was completed 28 days after a single oral administration to rabbits at a dose of 1375 mg / kg, and to Karakul sheep – 275 mg/ kg.

Veterinary and sanitary examination of slaughtered products obtained from rabbits and sheep 28 days after the introduction and manifestation of clinical signs of pyrethroid poisoning was carried out using organoleptic, biochemical and microbiological studies. The results showed that the meat products fully met the requirements of GOST [2, 3].

Conclusion

Thus, the analysis of our results allows us to conclude that the synthetic pyrethroid ashimethrin alpha, according to its main toxicometric parameters, poses a high potential danger to farm animals and therefore requires skillful and rational use in animal husbandry. In concentrations and doses recommended for therapeutic treatments of productive animals, the drug does not pose a health hazard. However, in cases of pyrethroid poisoning, along with the general toxic effect, neurotoxic and suppressive effects on cellular immunity are manifested. The polytropic mechanism of the toxic effect of the pesticide creates certain difficulties for the development of an effective antidote. In this regard, the most reliable way to prevent poisoning with synthetic pyrethroids for animals is to strictly control the content of their residues in feed and other environmental objects.

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