

Pathomorphological changes of induced acute alphamethrin toxicity in broiler chicks

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ABSTRACT

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The present investigation was undertaken to study the acute toxicity of alphamethrin in broiler chicks and establish the approximate lethal dose (ALD) of alphamethrin by oral route in broiler chicks. Acute toxicity study of alphamethrin in broiler chicks was determined by approximate lethal dose method. Initially different arbitrary doses (200, 300, 450, 675, 1013 mg/kg body weight) of alphamethrin were given to a single broiler chick until the lowest lethal dose was obtained. The approximate lethal dose (ALD) of alphamethrin by oral route in broiler chicks was determined as 1013 mg/kg body weight. During acute toxicity the treated chicks manifested extreme dullness, depression, anorexia, open mouth breathing, incoordination in movement, resting the head on support, lacrimation followed by tremors, convulsion, coma and death within 25 minutes of administration. Grossly, there were congestion in most of the organs like liver, lungs, kidneys, heart, thigh muscle and spleen. Histopathologically, treated birds showed severe depletion of lymphocyte population from lymphoid organs, severe congestion in brain, degenerative and necrotic changes along with mononuclear cell infiltration in liver, congestion and haemorrhage in lungs and congestion, degeneration and necrosis in kidneys.

Keywords: Acute toxicity, alphamethrin, broiler chicks, pathology

INTRODUCTION

Poultry is one of the fastest growing segments of the agricultural sectors in India. Agriculture continues to be the main stay of the Indian economy and possess the challenge to produce enough food for the burgeoning population. The use of insecticides is believed to be one of the major factors behind the increase in agricultural productivity in the 20th century²⁰. Chickens are especially vulnerable to pesticide toxicity because poultry houses and birds are dusted with pesticides. Exposure of poultry to chemical pesticide causes health consequences to poultry culminating in great economic loss, while also posing a potential threat to public health due to the presence of pesticide residues in poultry meat⁶.

Alpha-cypermethrin is a highly active pyrethroid insecticide, effective against a wide range of pests encountered in agriculture and animal husbandry. In veterinary medicine it is applied topically, as a spray or pour on to cattle and sheep (150 mg alphamethrin/animal) and as a spray to poultry (8 to 10 mg per bird), for the control of ectoparasites such as ticks, fleas, lice and blow flies⁴. Instances of poisoning due to alphamethrin are on increase in recent years due to their indiscriminate use. Birds often become the victim due to ingestion of grains of insecticide treated crops. So the

present investigation was undertaken to study the acute effects of alphamethrin in poultry.

MATERIALS AND METHODS

Acute toxicity study was determined by approximate lethal dose method as described by Hayes⁷. For this purpose 5 day old broiler chicks (Vencobb) having weight between 50 -70g were taken. Initially different arbitrary doses (200, 300, 450, 675, 1013mg/kg body weight) of alphamethrin were given to a single broiler chick orally by gastric probe until the lowest lethal dose was obtained. The broiler chicks were kept under constant observation for acute manifestation of toxicity.

The broiler chicks died during the acute toxicity study were examined for appearance of any gross lesions. The lesions present in different organs of the dead chicks were recorded. The representative tissue samples were collected in 10% formal saline solution for histopathological study. The routine procedure adopted at Department of Veterinary Pathology, College of Veterinary Science and Animal Husbandry, Anjora, Durg, was employed for histopathological examination. Tissue sections were cut between 3-5 μ m and stained with haematoxylin and eosin (H&E) as per the method described by Culling³.

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RESULTS

The Approximate Lethal Dose of alphamethrin in broiler chicks was determined as 1013 mg/kg body weight. The broiler chicks, which received 200 mg/kg of

body weight alphamethrin orally, exhibited mild depression and incoordination in movement. The chicks given alphamethrin @ 300 mg/kg body weight revealed the clinical signs of dullness, depression and

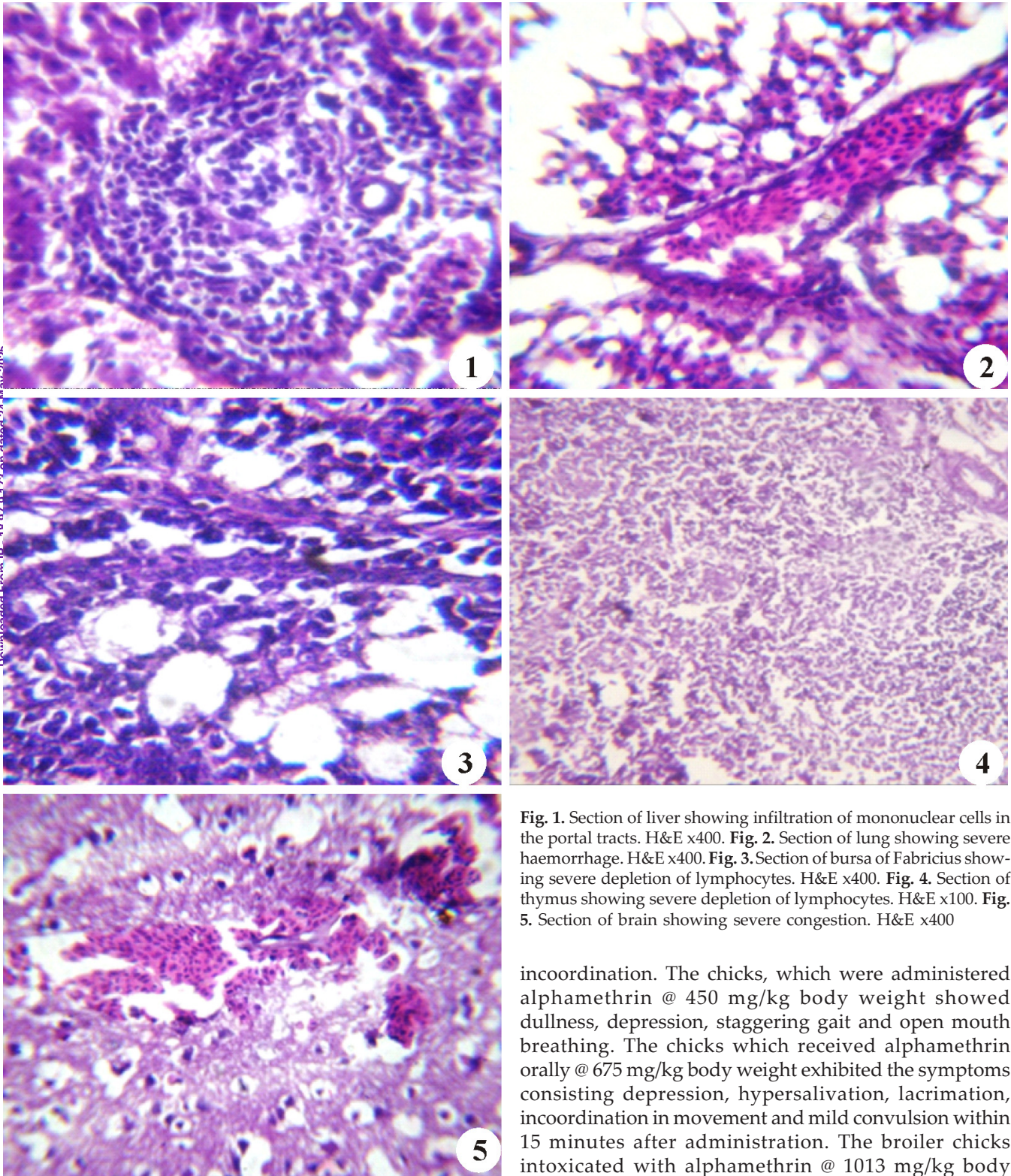


Fig. 1. Section of liver showing infiltration of mononuclear cells in the portal tracts. H&E x400. **Fig. 2.** Section of lung showing severe haemorrhage. H&E x400. **Fig. 3.** Section of bursa of Fabricius showing severe depletion of lymphocytes. H&E x400. **Fig. 4.** Section of thymus showing severe depletion of lymphocytes. H&E x100. **Fig. 5.** Section of brain showing severe congestion. H&E x400

incoordination. The chicks, which were administered alphamethrin @ 450 mg/kg body weight showed dullness, depression, staggering gait and open mouth breathing. The chicks which received alphamethrin orally @ 675 mg/kg body weight exhibited the symptoms consisting depression, hypersalivation, lacrimation, incoordination in movement and mild convulsion within 15 minutes after administration. The broiler chicks intoxicated with alphamethrin @ 1013 mg/kg body

weight showed depression within 25 minutes after dosing. Induced chicks manifested dullness, depression, anorexia and reluctant to move, followed by open mouth breathing, sitting in a position keeping beak on the ground with closed eyes, resting by keeping the head on support, twisting of neck and vomition followed by tonic convulsion, dyspnoea, coma and death.

Gross pathological study of intoxicated broiler chicks revealed varying degree of congestion in liver, kidneys, lungs, brain and intestine. Severe haemorrhages were recorded in thymus. Kidneys were swollen grossly. Microscopically the liver of induced chicks revealed severe degeneration with cytoplasmic vacuolation and necrotic changes along with infiltration of mononuclear cells in the portal tracts (Fig. 1). In the present study, spleen had congestion and severe lymphocytolysis in the malpighian corpuscles of the chicks intoxicated with alphamethrin @ 1013 mg/kg body weight. Histopathology of lungs of induced chicks revealed severe congestion and hemorrhages (Fig. 2). Kidneys of intoxicated chicks had severe congestion, degenerative and necrotic changes of lining epithelium of proximal and distal convoluted tubules. The alphamethrin treated broiler chicks showed severe depletion of lymphocyte population from the bursal follicles (Fig.3). Microscopic observation of thymus of treated chicks exhibited congestion, degeneration and mild depletion of lymphocytes in the thymic follicles (Fig.4). Microscopically cardiac muscles of induced chicks had mild congestion and degenerative changes. Brain of treated chicks revealed mild neuronal degenerative changes and severe congestion (Fig.5).

DISCUSSION

Most of the clinical signs observed in alphamethrin induced chicks were in close conformity with earlier reports in rats⁵. Gross pathology of intoxicated broiler chicks of the present study were in agreement with the earlier reports in fenvalerate induced broiler chicks¹⁵. In the present study microscopically the liver of induced chicks had severe degenerative and necrotic changes along with mononuclear cellular infiltration. Similar findings were reported by Shriwas¹⁵ who observed necrosis of hepatocytes, cytoplasmic vacuolation, bile duct hyperplasia and mononuclear cellular infiltration. The oral administration of toxicants like pyrethroids severely affect the liver, the primary organ involved in their activation and/or detoxification¹³. Depletion of lymphocytes was also reported in earlier study of acute fenprothrin toxicity in rats². Pesticide has been reported to cause immune dysfunction followed by depletion of lymphocytes in spleen of broiler chicks⁸.

Histopathological changes in the lungs were in accordance with the findings of Malpe *et al*¹¹ in deltamethrin induced rats and Tamang *et al*¹⁷ in cypermethrin induced black Bengal goats. The present findings of congestion, degenerative and necrotic changes of kidneys are in the consonance with the observations made in cypermethrin toxicity in chicks¹. However, Tapase *et al*¹⁸ observed hypertrophy and hyperplasia of the capillary endothelial cells of glomeruli in kidneys leading to obliteration of capsular space in fenvalerate treated mice. Tamang¹⁶ opined that the toxic irritant substance brought to the kidneys via blood circulation can exert direct toxic effect on tubular epithelium or may cause anoxia due to congestion and reduction in blood circulation. Thus, the pathological alteration in the kidneys could be the direct effect of alphamethrin intoxication and or result of anoxia due to congestion.

Depletion of lymphocytes at few places in bursa of Fabricius along with degeneration and necrosis of lymphoid follicles was also recorded by Misri¹² in cypermethrin treated birds. Exposures to pesticides even in low doses lead to toxic effect on immune system⁸. The histopathological lesions of thymus were in close conformity with the earlier reports in fenvalerate treated broiler birds¹². Nagarjuna and Doss¹⁴ also noticed congestion and slight infiltration in heart tissue in rats exposed to sublethal doses of cypermethrin. But Malpe *et al*¹¹ noticed severe congestion and haemorrhages in heart of deltamethrin treated rats. The changes in brain like neuronal degenerative changes and severe congestion were also reported in the rats¹⁰ exposed to higher dose (250 mg/kg body weight) of alphas-cypermethrin.

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