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Histopathological changes in heart induced by lead and thiram alone and combined exposure in broilers

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Abstract

A study was conducted to examination of histopathological changes in the heart of lead acetate, tetramethylthiuram disulfide and its combination induced toxic effects in broilers. Hundred day old broiler chicks divided into four groups, in each group has 25chicks. The control group fed with normal diet, lead acetate @300 ppm per day, tetramethylthiuram disulfide @60 ppm per day and its combination of lead acetate and tetramethylthiuram disulfide with same dose. Histopathologically, heart showed severe dilatation and degeneration of cardiac muscles with infiltration of inflammatory cells. Thickened wall of capillaries with congestion, haemorrhages, fibrous tissue proliferation and pyknotic nuclei of cardiac muscle were also observed.

Keywords: Leadacetate, heart, tetramethylthiuram disulfide

Introduction

The entry of Pb into the food chain is a major concern, since it can cause chronic health problems both in animals and humans. Plants can absorb Pb from soils. Animals and people living in the vicinity of hazardous waste sites and contaminated areas may have choice to expose to lead and lead containing chemicals through inhalation, ingestion and contact (skin).

The TMTD is a proven seed protectant as it effectively control the possible fungal attack and thereby sustains germination potential of the seeds in agricultural practices. Thiram has been used in the treatment of human scabies, as a sun screen and as a bactericide applied directly to the skin or incorporated into soaps (Sharma *et al.*, 2003) [1].

The present study was reveals toxic effects of lead, thiram and combination of compounds in chicks.

Materials and Methods

Chemicals

Lead acetate (PbAc) obtained from Thermo Fisher Scientific India Pvt. Ltd., Mumbai, and thiram obtained from Seed Research and Technology Centre (SRTC) Professor Jayashankar Agriculture University.

Experimental animals: the day old broiler chicks from Venkateshwara Hatcheries, each group contain twenty five chicks. Then lead and thiram give to chicks according to scheduled. The experiment was carried out according to the guidelines of Ethical Committee.

Methods

The Histopathology of heart revealed and recorded at end of the first, third and fifth week of experiment. Detailed necropsy was conducted, heart was collected in 10% Formalin. Samples were processed, sectioned (5 μ m) and stained with Hematoxylin and Eosin (H&E) as per the standard protocol given [4].

Results

The heart of control group of birds showed normal architecture (Fig 01). The PbAc intoxicated group birds heart sections showed distortion of cellular architecture, infiltration inflammatory cells into inter fibrillar areas, swollen to pyknotic nuclei in cardiac muscle fibres on 1st week of experiment. Distorted cardiac muscle cells, loss of striations, inflammatory cells infiltration

mild fibrous tissue proliferation, and dilation of inter fibrillar area along with disruption of myofibrils were observed on 3rd week of experiment. Congestion of cardiac vessels with mild hyperplasia of endothelial cells and infiltration of mononuclear cells in dilated cardiac muscles were also observed. Heart section of group 2 birds on 5th week of experiment showed disrupted myofibrils, haemorrhages and severe infiltration of inflammatory cells, moderate to severe congestion, and perivascular fibrosis along with condensed nuclei were observed (Fig 02 and 03).

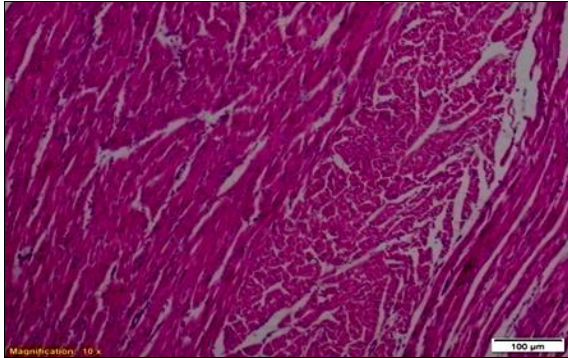


Fig 1: Normal architecture of control group of heart

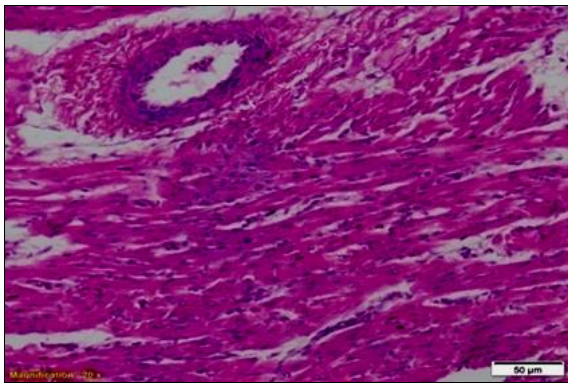


Fig 2: Heart showing mild perivascular fibrosis (Group 2, 5th week): H&E 50 µm

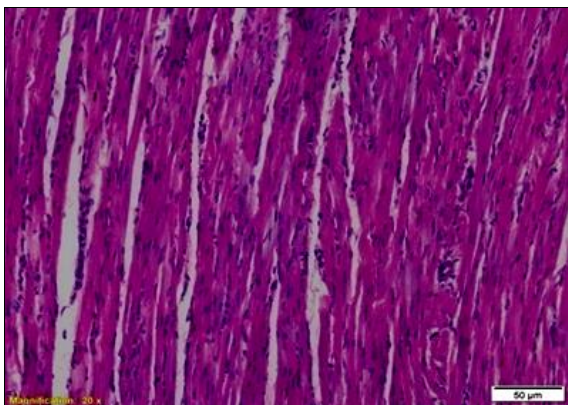


Fig 3: Heart showing moderate to severe infiltration of MNC in inter fibrillar area and pyknotic nuclei (Group 2, 5th week): H&E 50 µm

TMTD fed (group 3) birds of heart showed mild disrupted and shrunken myofibrils with loss of striations and mild fibrous tissue proliferation on 1st week of experiment. Sections of heart on 3rd week of experimental study showed similar lesions but the lesions were moderate to severe with pyknotic nuclei. On 5th week of experiment the heart sections showed similar lesions but the blood vessels were thickened. (Fig 04 and 05).

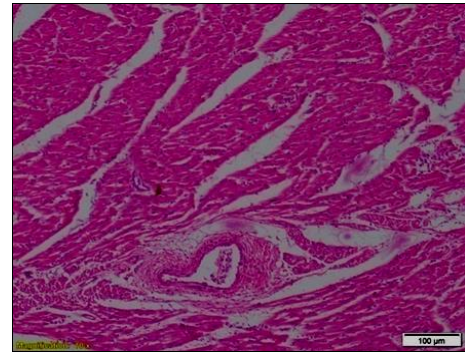


Fig 4: Heart showing thickening of blood vessel, congestion, infiltration of MNC and disrupted myofibrils (Group 3, 5th week)

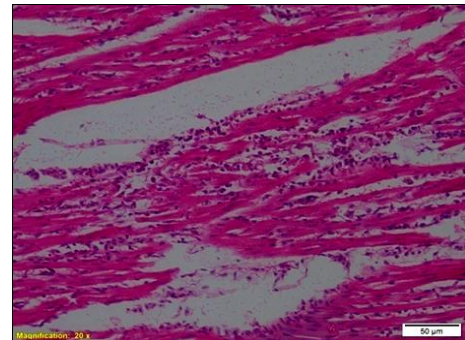


Fig 5: Heart showing disrupted myofibrils with infiltration of MNC, loss of striations and degenerated myofibrils (Group 3, 5th week)

In combined toxicity cardiac vessels showed mild perivascular fibrosis, endothelial hyperplasia, mononuclear cells infiltration, muscle fibres are disrupted and pyknotic nuclei. (Fig 06 and 07).

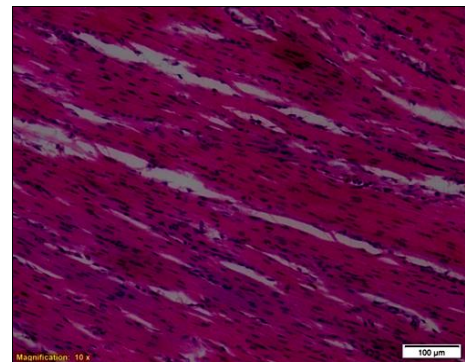


Fig 6: Heart showing mild infiltration of MNC, loss of striations, pyknotic nuclei and disrupted muscle fibers (Group 4, 5th week)

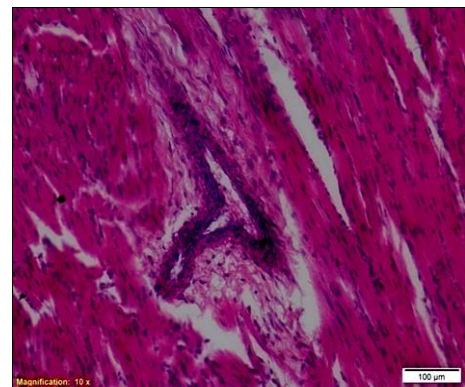


Fig 7: Heart showing perivascular fibrosis and hyperplasia of endothelium with loss of striations (Group 4, 5th week)

Discussion

Heart of PbAc intoxicated group 2 showed distortion of cellular architecture, infiltration inflammatory cells into interfibrillar areas and swollen to pyknotic nuclei in cardiac muscle fibers. Mild proliferation of fibrous tissue, dilation and disruption of myofibrils were observed in few other sections of group 2 birds. Blood vessels were congested with mild hyperplasia of endothelial cells. In addition moderate to severe haemorrhages, perivascular fibrosis and pyknotic nuclei of cardiac myocytes were observed. Similar findings were documented by Liu *et al.* (2017) [5]. And opined that excess PbAc induces inflammatory injury through inhibition NF-KB signalling pathway in the chicken hearts.

The heart sections of TMTD group birds showed mild disruption, shrunken myofibrils, loss of striations, pyknotic nuclei of cardiac myocytes and mild fibrous tissue proliferation. Subapriya *et al.* (2007) [6]. Presented degeneration, loss of striations and granular cytoplasm in the cardiac myocytes during second and fourth week of experiment in broilers. Similar degenerative changes were also observed in layer birds earlier by Nageswara *et al.* (1996) [7].

Severe oxidative stress induced by of PbAc and TMTD might be the causative factors for severe changes in heart, there by influenced the heart function and led to reduced oxygen (hypoxia/anoxia) and nutrients related cell injury of vital organs has been suggested by various authors in individual toxicity of these compounds. However, the publications on mixed toxicity are sparse.

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