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The Effects of Cypermethrin on Bone and Bone Marrow in Short and Long Treatment in Wild Pigeons *(Culumba livia gaddi*)

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Abstract: Cypermethrin used to control many insect pests in domestic, industrial and agricultural situations. Under this study a total of (80) adult domestic pigeons were purchased from local market in Basrah city. Then to study the short term exposure of cypermethrin for two months with four groups; group one low dose 0.25 mg/day, group two intermediate dose 0.5 mg/day, group three high dose 0.75 mg/day and fourth control group. While, to study the long term exposure of cypermethrin for four months divided into four groups; group one low dose 0.25 mg/day, group two intermediate dose 0.75 mg/day, group three high dose 1 mg/day and fourth control group. At the end of the experiment all pigeons were killed, selected bone and bone marrow and fixed in 10% neutral buffered formalin for histopathological study. The short term exposure showed in low dose bone with an osteosis and prominent blood vessels, with metaphases and diphyses, metaphases going down into diphyses forming new bone. The bone marrow with a reduced number ofnormoblst or non active haemopoesis. In intermediate dose the bone with a chondroses and going down to diphyses with new bone formation. While, the bone marrow non active haemopoesis and the majority normoblst. In high dose the bone with osteosis and vacuolation but, the bone marrow looks like yellow with poor haemopoesis with prominent fat cells. In pigeon with long term exposure the pathological changes as chondroses in metaphysic with giving rise to osteosis in diphyses and normoblst, heterophiles and mature red blood cells nucleated but reduced activity in both bone and bone marrow of low dose respectively. While, in intermediate dose the bone with metaphyses extending into diphyses with proliferation of chondrocytes into metaphyses but the bone marrow with a congestion and mature red blood cells. In high dose the bone osteosis and prominent blood vessels and metaphyses with mark proliferation of chondroide tissue and presence of chondroide tissue into bone trabeculae indicating active newbone formation but bone marrow with a poor haemopoesis and yellow in character prominent adipose tissue. In conclusion it can said that cypermethrin effect not only in different organs but also on bone and bone marrow in birds when enter the cycle of this component by may be eaten fishes or any water species or seeds treated with cypermethrin.

Key words: Cypermethrin, bone marrow, haemopoesis, pesticides

INTRODUCTION

Pesticides have become omnipresent contaminants of our environment and have been found in water, soil, air and both human and animal tissues all over the world and one of them was cypermethrin (Anwar, 1997). Synthetic pyrethroids have been considered among the safest pesticides available and are used worldwide (Dorman and Beasley, 1991). It was contains a cyano group substituent on the alpha-carbonof the phenoxy-benzyl moiety and it is classified as a Type II pyrethroid (Gray, 1985; WHO, 1989). Casida *et al*. (1983) reported that administration of Type II pyrethroids induces ataxia, convulsions, hyperactivity and profuse salivation in rats and mice. Also, Cypermethrin used to control many insect pests in domestic, industrial and agricultural situations. It is used in surface sprays for controlling insect pests in domestic, public and commercial buildings (Chemical Management Unit, 2002).

The cypermethrin distribution is studied in several mammalian species and widely in many tissues like: liver, kidney, central and peripheral nervous tissue, lipid (Robert, 1987; Khan, 2005).

The aim of this study was to investigate the pathological effects of cypermethrin on bone and bone marrow of pigeons.

MATERIALS AND METHODS

Experimental model: A total of (80) adult domestic pigeons were purchased from different owners in local market in Basrah city and reared in a clean cages

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(200x100x80 cm.) in poultry unite/college of veterinary medicine/Basrah university, all pigeons were acclimatized for 10 days before start the experiment.

Chemicals: Cypermethrin from manufacting chemicals Ltd. England were used under this study, then, it was further diluted in distilled water to obtain the desired concentration. The solution was prepared and used immediately, by oral gavage using disposable syringe after removing the needle, the doses of cypermethrin weredetermine by testing the compound on few pigeons and the maximum toxic dose which was used according to the active ingredients of the substance.

Treatments: To study the short term exposure of cypermethrin on pigeons for two months a total of fourty birds were randomly divided into four groups (10 pigeons each group); group one as low dose of 0.25 mg/day, group two as intermediate dose of 0.5 mg/day, group three as high dose 0.75 mg/day, fourth group was given 1 ml distilled water as control group. While, to study the long term exposure of cypermethrin for four months a total of fourty birds were randomly divided into four groups (10 pigeons each group); group one as low dose of 0.25 mg/day, group two as intermediate dose of 0.75 mg/day, group three as high dose 1 mg/day, fourth group was given 1 ml distilled water as control group. At the end of the experiment all pigeons were killed by cervical dislocation, selected visceral organs were fixed in 10% neutral buffered formalin for further histopathological study.

Histopathological examinations: Four Fm thick paraffin sections were prepared after the bone were decalcified after fixation in 20% Hcl over night to remove calcium from the bone section and were cut and prepared and according to the method of (Luna, 1968 and Bancroft *et al*., 1990).

RESULTS

Short term exposure: The short term exposure to cypermethrin were showed treated- related changes as below:

In low dose of cypermethrin the bone found with an osteosis and prominent blood vessels, with metaphases and diphyses; metaphases going down into diphyses forming new bone (Fig.1). The bone marrow showed a reduced number of normoblst or non active haemopoesis (Fig. 2).

In intermediate dose of cypermethrin the bone showed a chondroses and going down to diphyses with new bone formation (Fig. 3). While, the bone marrow showed non active haemopoesis and the majority normoblst (Fig. 4).

In high dose the bone showed osteosis with vacuolation (Fig. 5), while, the bone marrow looks like yellow with

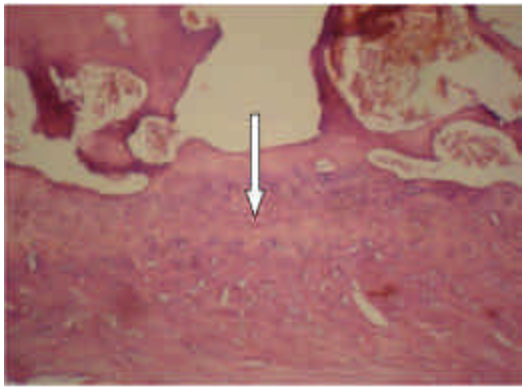

Fig. 1: Bone of pigeon with short term exposure (low dose) of cypermethrin with new bone formation. E and H. 250 X

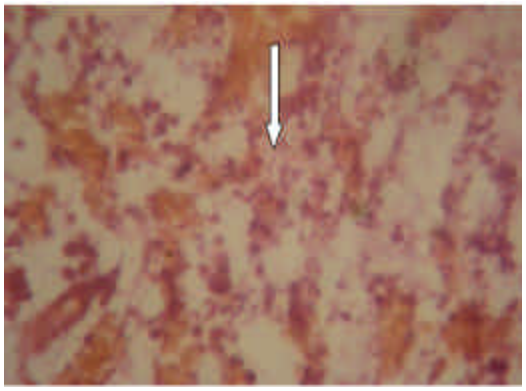

Fig. 2: Bone marrow of pigeon with short term exposure (low dose) of cypermethrin showing reduced haemopoesis. E and H. 250 X

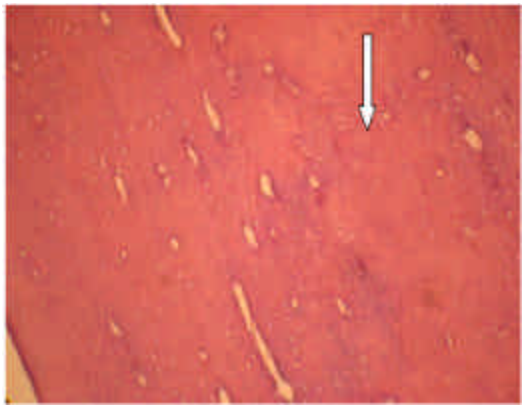

Fig. 3: Bone of pigeon with short term exposure (Intermediate dose) of cypermethrin with osteosis. E and H. 250 X

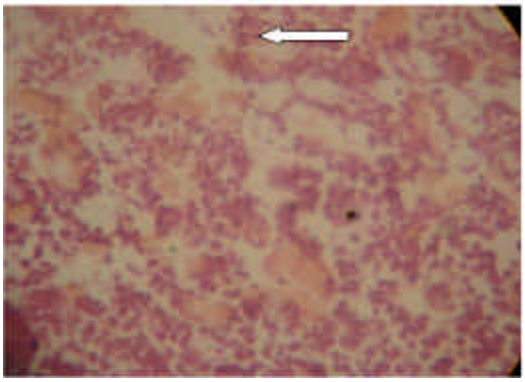

Fig. 4: Bone marrow of pigeon with short term exposure (Intermediate dose) of cypermethrin with reducing haemopoesis. E and H. 250 X

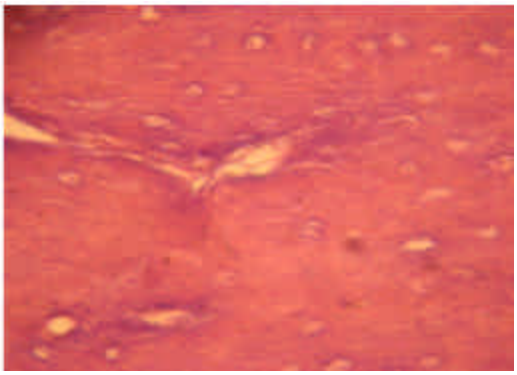

Fig. 5: Bone of pigeon with short term exposure (High dose) of cypermethrin with osteosis. E and H. 250 X

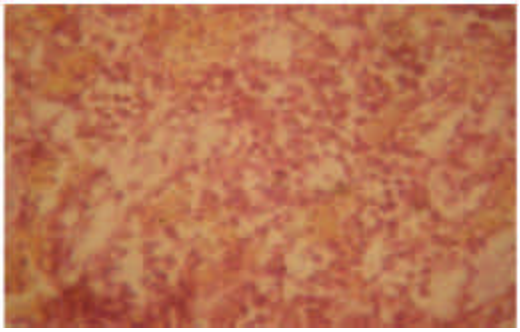

Fig. 6: Bone marrow of pigeon with short term exposure (high dose) of cypermethrin showed poor haemopoesis. E and H. 250 X

poor haemopoesis with prominent fat cells (Fig. 6). As compared with control groups of bone and bone marrow (Fig. 7, 8) respectively.

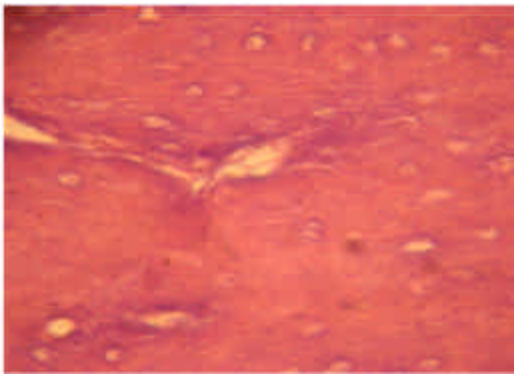

Fig. 7: Bone of control group within normal limits

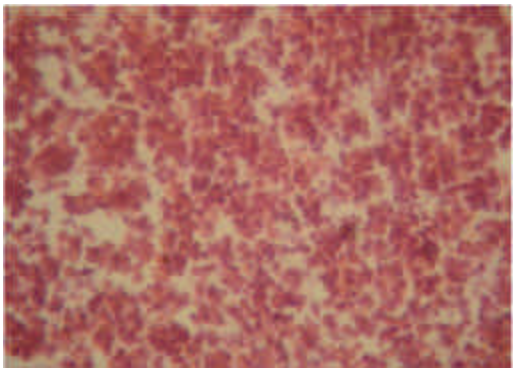

Fig. 8: Bone marrow of control group showed active haemopoesis

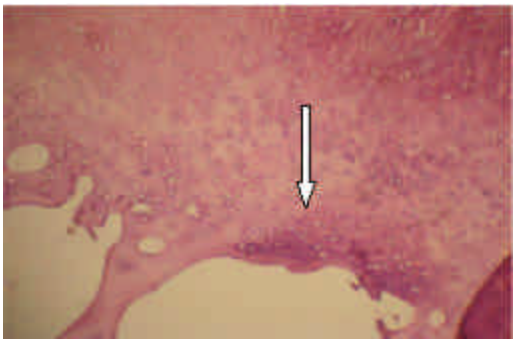

Fig. 9: Bone of pigeon with long term exposure (low dose) of cypermethrin. E and H. 250 X

Long term exposure: In pigeon with long term exposure to cypermethrin the pathological changes as below:
In low dose the bone showed a chondroses in metaphysic with giving rise to osteosis in diphyses (Fig. 9). While, in bone marrow with normoblst, heterophiles and mature red blood cells nucleated but reduced activity (Fig. 10).

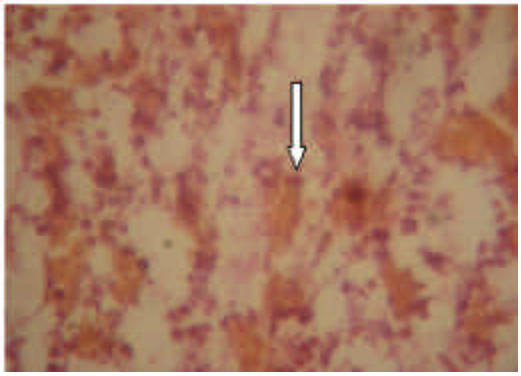

Fig. 10: Bone marrow of pigeon with long term exposure (low dose) of cypermethrin showing poor haemopoesis. E and H. 250 X

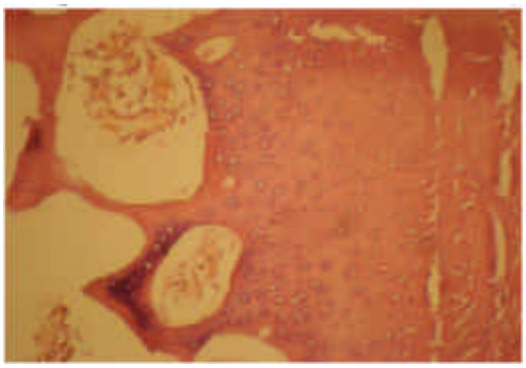

Fig. 11: Bone of pigeon with long term exposure (Intermediate dose) of cypermethrin with osteosis. E and H. 250 X

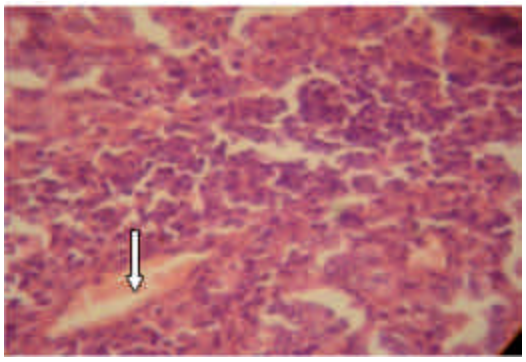

Fig. 12: Bone marrow of pigeon with long term exposure (Intermediate dose) of cypermethrin note congestion and poor haemopoesis. E and H. 250 X

In intermediate dose the bone showed a metaphyses extending into diphyses with proliferation of chondrocytes into metaphyses (Fig. 11) but the bone marrow with a congestion and mature red blood cells (Fig. 12).

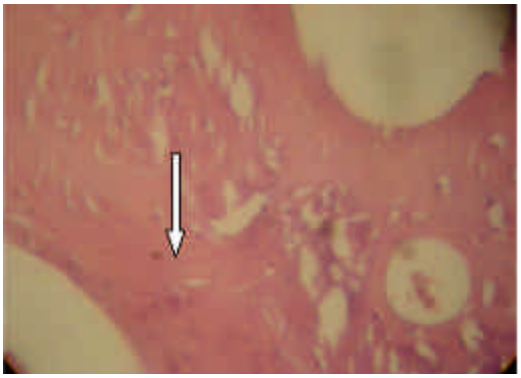

Fig. 13: Bone of pigeon with long term exposure (High dose) of cypermethrin active bone formation. E and H. 250 X

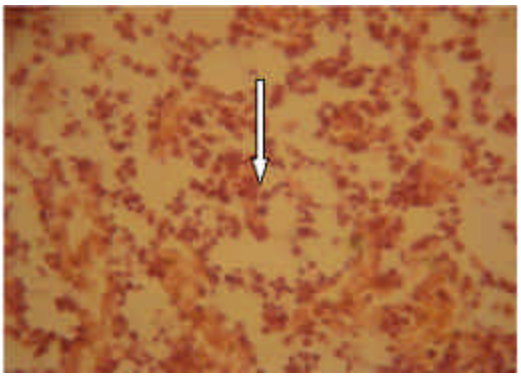

Fig. 14: Bone marrow of pigeon with long term exposure (High dose) of cypermethrin poor non active haemopoesis. E and H. 250 X

In high dose the bone osteosis and prominent blood vessels and metaphyses with mark proliferation of chondroide tissue, also, presence of chondroide tissue into bone trabeculae indicating active new bone formation (Fig. 13) but bone marrow showed a poor haemopoesis and yellow in character prominent adipose tissue (Fig. 14). As compared with control group (Fig. 15, 16).

DISCUSION

Pesticides are used extensively in agriculture but their residues often reach aquatic ecosystems. They can be transferred through phytoplankton to fish and ultimately to humans and birds, one of them was cypermethrin (Basanta and Subhas, 2003). The histopathological study showed that exposure to the cypermethrin cause similar and many pathological changes as treated in short and long term in both bone and bone marrow. This may be related to that cypermethrin reduce the activity

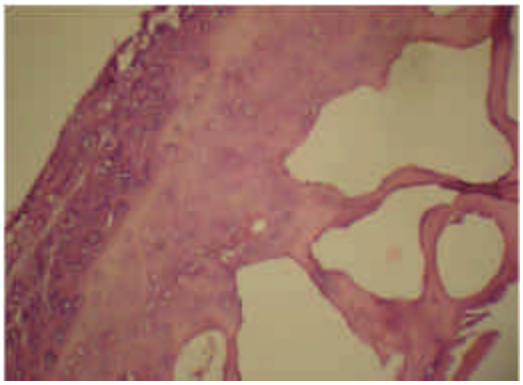

Fig. 15: Bone of control group within normal limits

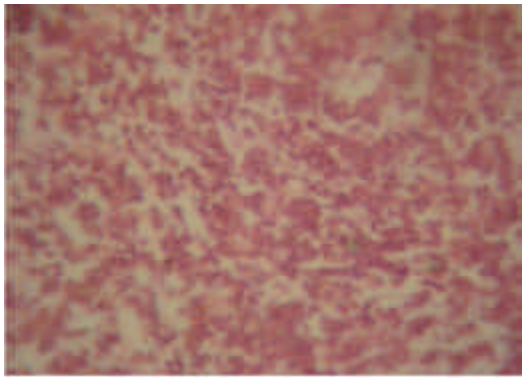

Fig. 16: Bone marrow of control group showing active haemopoesis

and formation of bone cells as a toxic component and make the marrow non active and reduce their function, also, may be to the hyperactivity to correct the reduction of blood cells.

Many studies at the world on different animals recorded that treated with cypermethrin cause decrease on hemoglobin concentration, total R.B.C., P.C.V. and M.C.H.C. (Mansee, 1998; Samita *et al*., 1999; Yousef *et al*., 2003; Ahmed *et al*., 2009; Khan *et al*., 2009). Kadhim (2012) found that hydrocortisone caused proliferation of adipose tissue in bone marrow and suppression of haemopoesis and osteoblasts differentiation in male rats.

Robert (1987); Tamang *et al*. (1991); Khanna *et al*. (2002) reported that cypermethrin can distribute in many different tissues like; lipid, central and peripheral nervous tissue, liver and kidney in several mammalian species but it is concentrated in the lipid and central nervous system.

Cypermethrin was moderate toxic in both of dermal absorption and ingestion (Wefco, 1989; WHO, 1996), furthermore, the signs of toxicity appear within few hours following oral administration and survivors recover within three days (Yılmaz *et al*., 2004). Alpha-cypermethrin, is a non-systemic insecticide with contact and stomach action. It consists of the active isomer of synthetic pyrethroid insecticide cypermethrin and is highly effective against wide range of chewing and sucking insects. It is also active against mosquitoes, flies and other insect pests in public and animal houses (URL1: http://www.chemicalland21.com/arokorhi/lifescience/agro/ALPHA-CYPERMETHRIN. htm; Stephenson *et al*., 1984). In fish aquaculture cypermethrin is used against lice infestations (Das and Mukherjee, 2003). Alpha-cypermethrin is practically non-toxic to birds but is highly toxic to fish and aquatic invertebrates. This is mainly because it is metabolized and eliminated significantly more slowly by fish than mammals or birds (WHO, 1996). In general, the hypersensitivity of fish to pyrethroid intoxication is partly due to species = specific differences in pyrethroid metabolism but principally to the increased sensitivity of the piscine nervous system to these pesticides. It is also highly toxic to bees but cause no mutagenic effects (URL2: http://www.dpiwe.tas.gov.au/inter.nsf/Attachments/EIL-57A2J4/$ FILE/CYPERMETHRIN.pdf).

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