Toxic effects of deltamethrin on blood parameters of common myna (Acridotheres tristis)

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***Abstract*: Feeding deltamethrin-contaminated grains to common myna may end in toxic effects during this bird. This study was done to research the consequences of recommended doses of deltamethrin, sometimes utilized in grain storage mynas were fed grains contaminated with 0.25 and 0.50 mg deltamethrin per kg diet for 21 days and therefore the effects on survival and blood parameters were studied. Plasma acid, creatinine levels, and creatinine in the blood were increased. The glucose levels significantly increased in birds treated with the high dose of deltamethrin. The albumin or cholesterol levels weren't changed, and total protein and globulin in plasma were decreased. Administration of 0.25 mg/kg deltamethrin caused increased blood triglyceride levels, 0.50 mg/kg deltamethrin decreased triglyceride levels.**

***Keywords*: Deltamethrin; Blood parameters; Common Myna**

Introduction

Deltamethrin is an insecticide belonging to the pyrethroid family. Pyrethroids are the man-made versions of pyrethrins, natural insecticides from chrysanthemum flowers. Deltamethrin is employed outdoors on lawns, ornamental gardens, golf courses, and indoors as a spot or crack and crevice treatment. In its purest form, deltamethrin is colorless or white to light beige crystals that haven't any odor. The common trade of deltamethrin include Butoflin, Butoss, Butox, Cislin, Crackdown, Cresus, Decis, Decis-Prime, K-Othrin, and K-Otek. poisoning is liable for approximately 50% of deaths in wild birds and mammals (Guitart et al. 2010). Biologists and environmentalists are concerned regarding these toxic effects. In many countries, various pesticides are utilized in wheat silos to regulate insects and rodents. In fact, cereal grains for animal feedstuffs are often contaminated with pesticides (Tsiplakou et al. 2010). The common myna while feeding from the seeds from agricultural fields fed with contaminated cereal grains. In many developing countries, deltamethrin is one among the authorized ingredients for post-harvest storage (Savi, Piacentini, and Scussel 2015).

Deltamethrin is rapidly absorbed through the intestinal epithelium and distributed into all fat-rich tissues. quite 70% of it's going to be excreted through urine and feces within the first 24 hours after exposure (Godin et al. 2007). In previous studies, it's been shown that the metabolites produced during detoxification and biotransformation can induce oxi- dative stress also as physiological and biochemical changes (Nieradko-Iwanicka and Borze˛cki 2015) within the cytoplasm and extracellular fluids, like blood (Banaee et al. 2011). Monitoring the alterations of the blood biochemical parameters might be a useful tool to diagnose toxic effects in target organs and to work out the physiological status in birds exposed to pesticides (Dahamna, Sekfali, and Walker 2004). Alterations in bio- chemical parameters (Garg et al. 2004), and hematologic factors (Khan, Ahmad, and Khan 2012), reproductive disorders (Bishop et al. 2000), neurological disorders, histopathological changes (Garg et al. 2004), and reduced survival rate of chicken and embryos are reported in birds exposed to varied pyrethroid pesticides.

Materials and methods

Common myna birds were purchased from local market. All birds were tagged kept in indoor aviaries, and provided with feedstuff and water ad libitum at the PG Department of Zoology, BN Mandal University. Birds were allowed to adjust to caging conditions for two weeks before the initial experiment. Tweve myna with the average weight of 132.55 12.75 g) were used in this study. The birds were grouped in three, two groups were fed a diet containing 0.25 and 0.50 mg deltamethrin per kg diet for 21 days, while the third group was fed a control diet. The ingredients of the feed used for the experiment were corn, soybean meal, wheat bran, rice flour, oyster shell, and vegetable oil, premix vitamins and minerals.

In the adaptation period, myns were fed commercial pellet diet and pure water. Treated feed was prepared by thoroughly blending the standard diet with commercial deltamethrin. Body weight of birds and feed consumption of the group were measured every 7 days throughout the adaptation and experimental periods. The animals were killed by decapitation. The blood was collected and stored in heparinized sterile glass vials (5 ml heparin equivalent to 25 units) at 4 °C and centrifuged for 15 min at 4 °C. Plasma samples were immediately stored at 21 °C.

Results and discussion

In this study, the sub-lethal concentrations (0.25 and 0.5 mg deltamethrin per kg diet) were selected according to concentrations of deltamethrin residues commonly found in crops(Pal and Shah, 2008). No mortality was observed during the experiment. The behavioral changes in mynas treated by deltamethrin were significant in the third week rather than the first or second week. The birds treated with 0.25 and 0.5 mg/kg deltamethrin exhibited aggressive and nervous behavior, anorexia, sluggishness, lethargy, and loss of equilibrium, in agreement with a recent study by Alias et al. (2011).

Table 1. Growth performance of Common myna fed grains contaminated with 0.25 and 0.50 mg deltamethrin per kg diet for 21 days.

Growth index	Control	0.25 mg deltamethrin	0.50 mg deltamethrin
Initial weight (g)	128.08 ±14.65	134.75 ±13.97	135.17 ±14.48[a]
Final weight (g)	226.08 ±22.20	217.92 ±29.29	201.75 ±19.47
Weight gain (%)	78.99 ±29.41	62.93 ±24.06	53.60 ±31.57
Feed conversion ratio (FCR)	7.21 ±2.82	9.50 ±4.89	12.00 ±6.35

The feed conversion ratio shown in Table 1 indicates that the common myna fed diets containing 0.5 mg/kg deltamethrin on day 21. The FCR was significantly increased in birds fed diets containing 0.5 mg/kg deltamethrin. The weight gain in common myna fed diets contaminated with 0.5 mg deltamethrin was significantly lower than that of control group at the end of the experiment. The decrease in growth induced by deltamethrin treatment is a result of decreased efficiency of nutrient utilization or reduced absorption of nutrients. Similar results have been reported by Chandra et al. (2013). Changes in the blood parameters of common myna after feeding 0.25 and 0.50 mg deltamethrin per kg diet for 21 days are presented in Table 2.

Table 2. Changes in the blood parameters of myna due to deltamethrin feeding for 21 days.

Blood biochemical parameters	Concentrations of deltamethrin per kg body weight		
	Control	0.25 mg	0.50 mg
Glucose (mg/dL)	188.51 ±16.92	203.03 ±16.41	214.16 ±8.28
Total Protein (g/dL)	5.81±0.23	4.24 ±0.67	3.60 ±0.36
Albumin (g/dL)	3.26 ±0.33	3.10 ±0.48	2.78±0.55
Globulin (g/dL)	2.55±0.44	1.14 ±0.59	0.82 ± 0.62
Cholesterol (mg/dL)	144.50 ±24.68	174.41 ±14.38	155.14 ±33.80
Triglyceride (mg/dL)	186.92±29.72	274.53 ±18.66	126.29 ± 2.73
Creatinine (mg/dL)	0.27±0.10	0.52 ±0.07	0.46 ± 0.07
Uric acid (mg/dL)	4.96 ±0.06	5.60 ±0.05	5.55 ±0.04

Birds fed diets with 0.25 mg/kg deltamethrin also exhibited raised glucose levels, but this group was not significantly different from the control group. The plasma glucose level was significantly higher in birds treated with 0.5 mg/kg deltamethrin than that in the control group. Hyperglycemia, observed in mynas fed with deltamethrin contaminated diets, indicates impaired glucose metabolism and glycogen degradation in liver (Banaee, Nematdoust Haghi, and Ibrahim 2013). Increased glycaemia following long term exposure to deltamethrin is probably associated with the increased biosynthesis of cortisol. Due to this increase, hepatic glycogen is rapidly broken down into glucose to yield energy for dealing with the toxic effects of deltamethrin. Moreover, decreased insulin synthesis is reported in the pancreas of birds exposed to deltamethrin (Eraslan et al. 2007), which in turn may play a role in the impairment of glucose regulation. Increased glucose in the blood of mice exposed to deltamethrin was reported by Eraslan et al. (2007).

Deltamethrin had a significant effect in reducing total protein and globulin in the plasma of mynas. The reduction of total protein in the plasma was up to 27% and 38% after 0.25 and 0.50 mg/kg deltamethrin treatment, respectively. Decreased total protein in mynas treated with deltamethrin along with changes in protein patterns might be due to malnutrition, reduced protein synthesis in liver, or decreased utilization of dietary protein. Reduced rate of protein synthesis in liver might account for decreased globulin levels. Moreover, a significant loss of total blood protein and globulin may be due to renal failure and nephro toxicity caused by deltamethrin.

Previous studies show that exposure to pesticides and their bioaccumulation in the liver can affect the metabolism and biosynthesis of lipid and blood cholesterol levels (Mu et al.2015). However, the present results indicate that deltamethrin has no significant effects on the blood cholesterol levels in mynas.

Although triglyceride levels increased significantly in the plasma of birds fed diets with 0.25 mg deltamethrin, the decrease in triglyceride levels was observed in the plasma of mynas fed diet with 0.5 mg/kg deltamethrin. Significantly increased triglycerides in the blood of mynas in response to treatment with 0.25 mg deltamethrin per kg diet might be an energy producing mechanism in detoxification process. Also, liver dysfunction may increase blood triglycerides. Disorder in triglyceride uptake by adipose tissue may temporarily increase triglycerides. But in the long-term, increase of stress hormones such as cortisol in the blood of animals exposed to various insecticides stimulates lipid breakdown in adipose tissue (Banaee 2012). Therefore, decreased triglycerides may also be the result of reduced lipid stores in mynas treated with 0.50 mg deltamethrin. Creatinine and uric acid increased in all concentrations of deltamethrin on day 21. Uric acid is produced by the liver during deamination and transamination of amino acid process and is excreted through the kidneys. Increased uric acid and creatinine levels in the blood of mynas fed diets contaminated with deltamethrin may be caused by histopathological lesions in the kidney and renal glomerular dysfunction.

Conclusion

Pesticides used in the maintenance of grains have adverse effects on the health of both wild and domestic birds. It can be concluded that deltamethrin causes biochemical changes in the blood. Furthermore, measuring the plasma biochemical parameters may be useful for assessing exposure and sub-lethal effects of deltamethrin on both wild and domestic birds. Deltamethrin residues transferred to edible animal products represent another reason for concern. Therefore, the measuring levels of pesticide residues before using cereals in the diet of birds.

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