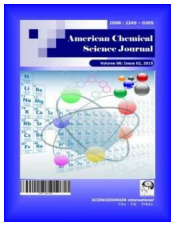

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Effect of Pre-planting Seed Dressers on Serum Enzymes of Laying Chickens

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Authors' contributions

This work was carried out in collaboration between all authors. Authors IOA and ADO designed the study. Authors IOA and TOB carried out the field work and laboratory analyses. Author IOA performed the statistical analysis, managed the literatures and wrote the first draft. All authors read and approved the final manuscript.

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ABSTRACT

The study was conducted to assess toxicity of synthetic insecticides in chickens. Twenty-five week old Nera black pullets (n=48) were fed with pre-planting insecticide-treated diets at recommended doses (T1=control, T2=2 g dressforce /Kg grains, T3=2.5 g apronstar /Kg grains, T4=2.5 g seedrex /Kg grains) for 14 days. Serum enzymes were assessed using standard procedures. Each treatment had 3 replicates. Data were analysed using analysis of variance at $\alpha_{0.05}$. Serum enzymes were significantly (*P*=0.05) elevated for aspartate aminotransferase (AST), alanine aminotransferase (ALT) alkaline phosphatase (ALP) for treatment diets. No mortality was recorded throughout the period of the experiment. Synthetic insecticides used resulted in liver dysfunction of chickens. Hence, alternative cheap bio-insecticides should be sourced.

Keywords: Chickens; insecticides; liver; toxicity.

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1. INTRODUCTION

Food is a major sustenance for man but it could also contribute to human disease or health hazard if proper care is taken into consideration. The multiple roles livestock production plays in the livelihood of people in the developing countries cannot be over-emphasised. It is a source of food and nutrition, employment to the populace. It ensures environmental sustainability and confers economic and social status [1]. Livestock production accounts for one-third of agricultural gross domestic product in Nigeria [2] with poultry contributing the highest percentage to the gross domestic product in the livestock sub-sector. It has been observed that poultry production is an important activity for supplying the teeming human population with quality protein, as well as providing additional income to the farmers [3]. Pests are major agents which affect agricultural crops, which consequently raise the cost of livestock production, as well as threaten food security. In order to control or reduce the effect agricultural pests, pesticides are used to combat the effects of pests at pre-planting and post-harvest stages. Grains to be planted are treated with different classes of insecticides in order to ensure adequate germination and emergence.

Globally, pesticides contribute significantly in agricultural production, safer storage of food commodities and public health security. However, the increase use of synthetic pesticides in crop protection results in increase possibility of feed/ food contamination [4]. Previous researchers have noted that the contamination of human foods of animal origin with pesticide residues occurs primarily due to the consumption of polluted feeds and fodders by the farm animals [5,6]. In Nigeria, some farmers consume excess pesticide treated grains and birds and other livestock are usually accidentally or deliberately exposed to the pesticide-treated grains in order to reduce the cost of production. Liver plays a major function in metabolism. It is a principal organ of detoxification in the body and a damaged liver is evident in raised levels of serum enzymes. Nigeria agriculture is dependent on extensive use of synthetic insecticides [7,8,9]. The most commonly used pre-planting seed dressers in Nigeria include the mixture of the following imidacloprid, metalaxyl-M, tebuconazole, difenoconazole, permethrin, carbendazim and chlorothalonil. Hence, it becomes necessary to examine the toxic effects of pre-planting seed treatment on liver function test of chickens.

2. MATERIALS AND METHODS

2.1 Preparation Experimental Diets

Five batches of diet were formulated. The first group was contained no pesticide and it served as the control diet (T1). The 2rd group (T2) contained maize grains treated with 20% imidacloprid, 20% metalaxyl-M and 2% tebuconazole at 2g/Kg of maize grains. The 3rd group (T3) contained maize grains treated with 20% thiamethoxam, 20% metalaxyl-M and 2% difenoconazole at 2.5 g/Kg of maize grains. The last group (T4) contained maize grains treated with 33% permethrin, 15% carbendazim and 12% chlorothalonil treated maize grains at 2.5 g/Kg of maize grains as recommended by the manufacturer. The experimental diet is shown in Table 1. Each of the diets was fed for 14 days.

Table 1. Gross composition of experimental diet

Ingredients	Proportion (%)
Maize (%)	45.50
Soya bean (%)	19.00
Fish meal 72% CP (%)	2.00
Wheat offal (%)	23.80
Bone meal (%)	6.00
Oyster shell (%)	3.00
Salt (%)	0.20
Methionine (%)	0.25
Premix (%)	0.25
Determined nutrients	
Dry matter (%)	88.02
ME (Kcal/kg)	2705.72
Crude protein (%)	16.69
Crude fibre (%)	4.82
Ether extract (%)	5.64
Calcium (%)	3.47
Phosphorus (%)	1.14
Lysine (%)	0.82
Methionine (%)	0.53

T1= Control diet, T2= contained 20% imidacloprid, 20% metalaxyl-M, 2% tebuconazole treated maize grains; T3= contained 20% thiamethoxam, 20% metalaxyl-M, 2% difenoconazole treated maize grains; T4= contained 33% permethrin, 15% carbendazim, 12% chlorothalonil treated maize grains

2.2 Management of Experimental Birds

Forty-eight (48) twenty five weeks old Nera Black strain laying chickens were used for this study. The birds were procured from a farm in Nigeria. There are four dietary treatments, and each treatment had 3 replicates. Each treatment had 12 birds. The study lasted for 14 days. The hens

were reared on a deep litter system. Fresh feed and cool, drinking water were supplied *ad-libitum* throughout the period of the study.

2.3 Collection of Data

On the 14th day of the study blood samples were collected from the birds through wing veins into a set of sample bottles without anti-coagulant and it was used for serum chemistry. Separation of serum was done by centrifugation at 3500 xg for 5 minutes, and kept frozen for analysis of alanine aminotransferase (ALT), aspartate amino-transferase (AST) and alkaline phosphatase (ALP). Serum parameters were analysed using Randox commercial assay kits.

2.4 Chemical Analysis

Proximate analysis of experimental diets was analyzed according to the procedure of A.O.A.C. [10].

2.5 Experimental Design

The design of the experiment was a completely randomized design.

2.6 Statistical Analysis

Data obtained were subjected to analysis of variance (ANOVA) and analysed using general lineal model of 9.1 version of SAS statistical package [11]. Significant treatment means were separated using Duncan's multiple range test of the same software.

3. RESULTS AND DISCUSSION

Table 2 shows serum enzymes of laying chickens fed with pre-planting insecticide-treated maize-based diets. Aspartate aminotransferase (AST) was higher for all the birds fed with insecticide-treated maize-based diets. The values obtained for T2 (20.40 IU/L) and T4 (20.07 IU/L) were however statistically similar to the control (18.83 IU/L). Alanine aminotransferase (ALT) was significantly (*P=.05*) higher for all the birds fed with treatment diets. The highest mean value was recorded for those fed with T2 (6.77 IU/L), closely followed by those fed T4 (6.13 IU/L). Birds fed treatments diets recorded higher mean values of alkaline phosphatase (ALP) which were significantly (*P=.05*) higher than the control diets (288.60 IU/L). Highest mean value was obtained for birds fed T3 (351.08IU/L). The elevation of serum enzymes is an indication of liver damage. These enzymes may be leaked into the blood as a result of liver impairment.

Serum enzymes are commonly used as sensitive biochemical markers for the assessment of hepatocellullar injury, as well as liver disease. Increased values obtained in this study may be an indication of early indicators of liver disease. Liver of birds fed insecticide-treated maize-based diets might be experiencing gradual damage. Abnormal increase in serum enzymes such as AST, ALT and ALP has been shown to be an indication of liver damage [12]. Although AST and ALT have been reported to be found in high concentration in the cytoplasm and mitochondria of liver cells than in the blood [13], increased activities of the enzymes have been attributed to increased membrane permeability and leakage into the blood circulation when hepatocytes are injured [14]. It has earlier been reported that administration of sub-lethal dose of chlorpyrifos resulted in altered enzyme activities of liver, renal damage and reproductive disorders to experimental animals [15]. Chlorpyrifos has also been shown to decrease red blood cell counts, white blood cell counts, packed cell volumes and serum protein levels, while it increased MCV, MCHC, blood cholesterol the activities of AST, ALT and ALP [16,17]. It has also been reported to increase liver weight, blood creatinine and urea levels, while it decreased body weight, kidney and testis weight [18,19]. It has also been observed a decrease in body weight, kidney and testis weight of albino rats exposed to chlorpyrifos orally at a dose of 0.955 mg/100 g b.w. for 3 months [20]. Loss of cell architecture

Table 2. Serum enzymes of laying chickens fed with insecticides-treated maize-based diets

Parameters	T1	T2	T3	T4	SEM
AST (IU/L)	18.83^{c}	20.40^{bc}	21.63^{ab}	20.07^{bc}	0.06
ALT (IU/L)	4.10^{d}	6.77^{a}	4.70^{c}	6.13^{b}	0.05
ALP (IU/L)	288.60^{a}	343.77^{b}	351.08^{b}	322.75^{c}	0.53

SEM= Standard error of mean; T1= control diet; T2= contained 20% imidacloprid, 20% metalaxyl-M, 2% tebuconazole treated maize grains; T3 = contained 20% thiamethoxam, 20% metalaxyl-M, 2% difenoconazole treated maize grains; T4= contained 33% permethrin, 15% carbanderzim, 12% chlorothalonil treated maize grains; AST = aspartate aminotransferase, ALT = alanine aminotransferase, ALP = alkaline phosphatase,

[a.b.c]Means with different superscripts within the same rows are significantly (P=.05) different

and increased degeneration of hepatic cells were observed in liver of chlorpyrifos administrated rats. Most of the hepatic cells were necrotic and enlarged and cytoplasm was granular and vacuolar, with widening blood sinusoids, which was an indication of hepatic degeneration as noted in the result of this study. The increased levels of AST, ALT and ALP activities of the experimental birds suggest hepatic damage and dysfunction. Aluminium phosphide-treated maize-based diets have also been observed to result in liver degeneration of laying chickens [21].

4. CONCLUSION

It is thus concluded that exposure of the tested insecticides, which are mixtures of several active ingredients are harmful to people, livestock and other non-target species. Exposure of laying chickens to the used insecticides resulted in damage of the liver of the experimental birds. Hence, such should be handled with extra care and proper awareness should be given to the farmers to consult with extension agents before using these harmful chemicals. Cheap bio-insecticides may be considered as potential substitute for the used insecticides, if their safety to humans and livestock is ascertained.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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