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THE EFFECT OF AFLATOXIN APPEARANCE IN THE FEEDSTUFFS UPON THE POULTRY PRODUCTION

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Abstract

The present paper is focused on the study regarding the contamination of feedstuffs with aflatoxin and presents the percentages of contaminated samples. It has also been study the effect of the aflatoxin contamination upon the poultry production on different types of poultry.

INTRODUCTION

The ubiquitous fungus *A. flavus* often invades feedstuffs consumed by chickens causing malperformance, pathological alterations and metabolic disorders. Moreover, the danger from dietary aflatoxin is high in hot and humid climates.

This investigation reports the occurrence of aflatoxin in poultry feed ingredients and compounded feeds. The field reports on the incidence of aflatoxicosis in poultry are not unknown. Sensitiveness or resistance to dietary aflatoxin is inherited as distinctive characteristics of species, breed and strain. Hence, it was desirable to investigate in detail the performance of various avian species and breeds of commercial importance as influenced by commonly occurring dietary levels of aflatoxin and to examine the safety limits in the levels of toxin in practical feed formulations. Investigations were also aimed at the evaluation of the interaction between aflatoxin and protein levels in the diet and the effect of dietary modifications of aflatoxic diets in chickens.

Aspects of Aflatoxicoses in Poultry

Aflatoxin Contamination of Feedstuffs

The results of analytical survey on occurrence of aflatoxin in feedstuffs indicated that seventy-five percent of groundnut cake samples were found to be positive for aflatoxin B_1. The values ranged from 0 to 2 ppm with an average of 0.52 ppm. As regards maize, 53% samples were found to be contaminated with aflatoxin and its average content was 0.26 ppm. The toxin levels in maize samples ranged from 0.0 to 2.3 ppm. The average aflatoxin content (ppm) and the percentages of contaminated samples of unspecified poultry feed, starter, grower and layer feeds were

0.14 and 60: 0.14 and 46; 0.19 and 37, 0.35 and 50; respectively. However, the toxin levels in these feeds ranged from 0.0 to 2.0 ppm. Occurrence of the toxin in rice polish and wheat bran samples was in order of 18 and 3 percent. The aflatoxin content in the rice polish samples ranged from 0.0 to 0.36 ppm with an average value of 0.016 ppm. In case of bran, it varied from 0.0 to 0.27 ppm with an average of 0.09 ppm. All the samples of meat meal were found negative when analyzed for the toxin contamination. Similarly, fish meal samples analyzed did not have the toxin. However, the samples of fish meal showed aflatoxin contamination (25 % samples). The aflatoxin B_1 content ranged from 0.0 to 0.5 ppm.

Dose Related Response

Studies which were undertaken to examine the effect of commonly occurring levels of dietary aflatoxin on performance of White Leghorn (WL), Rhode Island Red (RIR) x White Leghorn (RIR x WL cross) and quail chicks revealed that there was a significant depression in body weight and feed consumption in WL 3 and RIR x WL4 cross chick at 58 days of age due to as low a dietary toxin leave; of 0.2 ppm. The feed conversion remained unaffected up to 0.5 and 0.2 ppm in RIR x WL cross and WL chicks, respectively. The performance of quail chicks fed diets containing 0.2 and 0.3 ppm aflatoxin was comparable with the chicks given aflatoxin-free diet. Feed consumption of quail chicks remained uninfluenced up to a dietary level of 0.5 ppm aflatoxin, but there was a reduction in the efficiency of feed utilization at 0.5 and 0.75 ppm. Earlier workers (10, 11, 12) observed reduced feed consumption in quail chicks due to toxin levels ranging from 0.4 to 0.75. dry matter, protein, calcium and phosphorous retentions were adversely affected at 0.3 ppm and higher levels of toxin in different types of chicks. A significant reduction in serum protein concentration and an increase in blood uric acid content was observed in RIR x WL cross and WL chicks at 0.75 ppm aflatoxin. Mortality attributable to dietary aflatoxin occurred in RIR x WL cross and quail chicks at only 0.75 ppm level and it was 9.0% and 11%, respectively. In WL chicks, mortality of 9% was recorded at both 0.5 and 0.75 ppm. The responses of purebred chicks to low dietary levels of aflatoxin indicated that the body weight gain at 0.3 ppm and feed consumption at 0.5 ppm reduced significantly. There was significant increase in feed/gain ratio and reduction in retention of dry matter, protein, calcium and phosphorous at 0.3 ppm and higher levels.

Hematological levels remained unchanged in chicks given different levels of toxin. Blood glucose concentration decreased numerically. A significant decrease in total serum alkaline phosphatase, serum glutamic

oxalocetic transaminase (SGOT) and serumglutamic pyruvic transaminase (SGPT) was observed at 0.5 and 0.75 ppm.

Effects of Micronutrients

The effect of dietary aflatoxin revealed that doses of 0.5 and 0.75 ppm reduced growth, feed consumption, feed efficiency, retention of dry matter, protein and calcium and increased faecal lipid content in WL as well as purebred broiler chicks. Different dietary changes made in aflatoxic diets modified the toxic effect of dietary aflatoxin. The levels of 0.5 and 0.75 ppm aflatoxin were found innocuous to WL and purebred broiler chicks when fed on modified diets. The dietary modification included the raising of protein level by 5% and an increase of 100 Kcal ME/kg or supplementation of 0.3% L=Lysine HCl and 0.2% DL-methionine along with an increase in calories in thr diet.

Effects of High Levels of Dietary Protein

The effect of aflatoxin and its relationship with dietary protein in commercial broilers revealed that dietary aflatoxin at levels of 0.8 and 1.6 ppm significantly reduced growth and feed consumption of broilers. Efficiency of feed utilization remained unaffected due to various levels of aflatoxin except that at 1.6 ppm, which caused a significant increase in feed/ gain ratio at 7 weeks of age. There was a significant reduction in the retention of dry matter (1.6 ppm0, protein 0.8 and 1.6 ppm) and calcium (o.8 and 1.6ppm). A mortality of 10 and 19 percent, reduction in liveability of 1.5 and 2.9 percent at 0.8 and 1.6 ppm, respectively, was recorded in broilers fed diets containing 22 percent protein during the entire experimental period. There was a significant increase in relative weight of liver, kidney and spleen at 1.6ppm level.

Total lipid content increased significantly at 0.4 ppm and higher levels. Steatorrhea characterized by a significant increase in faetal fat content was noticed in broilers at 0.2 ppm and higher levels of dietary aflatoxin. A linear correlation between dietary toxin levels and liver lipid or faecal lipid content was recorded. Inclusion of 0.2 or 0.4 ppm levels of aflatoxin resulted in reduction in total serum proteins, uric acid and cholesterol concentrations. Lowered hemoglobin content (0.8 ppm),erythrocyte count (0.8 ppm) and packed cell volume (o.2 ppm) together splenomegaly suggested that aflatoxicosis induced anemia in broiler chickens.

The investigation also revealed significant interaction effect between different levels of proteins, uric acid, serum cholesterol and packed cell volume. Increasing dietary protein level from 22 to 25 or 27 percent in aflatoxic diets of broilers showed a protective effect against the toxicity of 0.8 and 1.6 ppm aflatoxin. The levels of toxin, which caused adverse effect on physical and biochemical responses in broilers, were found to be

innocuous at higher (25 or 27) dietary protein levels. However, 27 percent was found to be more effective in protecting against 1.6 ppm level of aflatoxin. The protective effect of higher levels of protein may be attributed to the improvement in the quality of protein the protein mixture in aflatoxic diets. Some of the observations of the present study are in agreement with the findings of earlier workers (1-6).

Effect of Low Levels of Dietary Protein

The effects of low levels of dietary aflatoxin (0.0 to 0.75 ppm) and the influence of the dietary modifications of aflatoxin diets were studied in laying coturnix during the summer for a period of 100 days. Feeding of dietary aflatoxin at 0.5 and 0.75 ppm significantly reduced the egg production of coturnix. The egg production on modified (CP, 25.5% and additional riboflavin, folic acid, pyridoxine and choline) aflatoxin diets (0.3 and 0.75 ppm) was comparable to the quails fed control diet. A significant reduction in feed consumption occurred due to dietary levels of 0.3, 0/5 and 0.75 ppm aflatoxin. The feed consumption of coturnix kept as modified aflatoxin diets was significantly higher than on other dietary treatments including control. Various aflatoxin levels and dietary modifications did not cause any significant change in egg weight.

Dietary aflatoxin levels ranging from 0.0 to 0.5 ppm did not cause any adverse effect on fertility of eggs. A significant reduction in hatchability of fertile eggs was observed at 0.3, 0.5 and 0.75 ppm levels of toxin. Dietary modifications of diet containing 0.75 ppm toxin resulted in a significant improvement in fertility of eggs, which was comparable with that of coturnix on toxin-free diet.

A level of 0.75 ppm aflatoxin caused a reduction in retention of dry matter where as retention of protein was adversely affected at 0.5 ppm as well as 0.75 ppm. Dietary modifications of aflatoxic diets improved the retention of dry matter and protein. No significant difference was observed in hemoglobin content and packed cell volume between the coturnix fed different levels of aflatoxin and modified aflatoxic diets. The blood constituents such as total serum protein, uric acid, SGOT, SGPT and blood glucose were unaffected by various dietary treatments except that a significant decrease on serum protein (1.87 g/100 ml) and an increase in SGOT (61.41 and 48.5 µ /moles/min/lit) and SGPT (12.56 and 10.09 µ moles/min/lit) was observed at 0.75 ppm level of toxin in aflatoxic and modified aflatoxic diets fed coturnix. A study reported by earlier workers (7) on the adverse effect of dietary aflatoxin on laying Japanese quails indicated that aflatoxin fed at levels of 2.4 or 6 µg per g to 72 day quails for a period of six weeks caused malperformance, pathological alterations

mainly liver and bile duct and there was no drastic change in metabolic performance.

Some of the workers (8) observed that low levels of mold metabolites might not cause any apparent physiological or pathological damage but low levels might reduce the performance of the animals which would result in tremendous economic losses. Further, the experimental evidence of the reduced performance of various metabolic functions by low levels of aflatoxin could be significant. More or less the adverse effect on performance laying coturnix observed in the present experiment might be attributed to the interactions between dietary aflatoxin, higher environmental temperature during summer and consumption of aflatoxin diets by the coturnix for longer periods (i.e.100 days). There were also reports in the literature that dietary alterations have an influence on severity of aflatoxicosis. Increasing the unsaturated fatty acids or protein of an aflatoxic diet were found to give protection to broilers against aflatoxicosis (9) or inclusion of good quality protein were reported to protect rats from aflatoxicosis (10, 11).

Aflatoxicosis in Guinea Fowls

Statistical analysis of data on body weight of guinea fowls at 50 to 86 days of age revealed no significant differences between different dietary levels of aflatoxin, and between the reference and aflatoxin test diets containing varying levels of aflatoxin. Dietary aflatoxin up to 1.0 ppm did not adversely influence the body weight. Similarly the feed consumption and efficiency of feed utilization also remained uninfluenced by 0.2 to 1.0 ppm of dietary aflatoxin. The number of guinea fowls that died during the experiment in different dietaty treatments was within the normal limits and mortality was not attributable to dietary aflatoxin content. No gross pathological changes were observed in vital organs of the birds sacrificed at the end of 62 days experimental feeding. A single report available in the literature indicated that guinea fowls could resist to a level of 800 ppb aflatoxin B_1 in the diet (12). This supporta the present observations.

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