EC VETERINARY SCIENCE
Mini Review

# Incorporation of Adsorbents in Feed Contaminated with Aflatoxins Boosts Immunity and Alleviates Aflatoxin Carry-Over in Tissues of Broiler and Layer Birds

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## Abstract

The study investigated the effect of Ugandan adsorbents in suppressing aflatoxicosis-induced decline in immunity against Newcastle and infectious bronchitis as well as its role in alleviating carry-over of aflatoxin metabolites into animal tissues. The experiment involved use of two binders including UGAB-1 and UGAB-2. The binders were applied at 5 levels of concentration at 0.0, 0.25, 0.5, 1.0 and 2.0% in the poultry diets. Adsorbent type and level of inclusion in the diet significantly ($P < 0.05$) affected Newcastle and infectious bronchitis geometric mean anti body titers and total tissue aflatoxin carry over. Regardless of binder type, the highest levels of geometric mean anti body titers and least levels of total tissue aflatoxin carry over of aflatoxins were obtained at 2.0% inclusion levels. These results revealed that the lowered immunity against Newcastle and Infectious Bronchitis resulting form ingestion of aflatoxin contaminated feeds can be reversed by incorporation of cheap and readily available natural adsorbents to make animal products safe for human consumption.

***Keywords:*** *Aflatoxins; Broiler; Layer Birds*

## Introduction

Aflatoxicosis, is a syndrome resulting from ingestion of feeds contaminated with aflatoxins (Bryden 2012). Results from a comprehensive animal feed quality survey in Uganda revealed that the mean aflatoxin concentration in broiler starter, broiler finisher, layer mash and dairy meal was 40.5 ppb, 42.8 ppb, 67.5 ppb, 6.4 ppb (Kaaya 2006, 2011). These aflatoxin concentrations were significantly higher than 20 ppb, the critical aflatoxin concentration beyond which feeds are considered unsafe for animal consumption. Ingestion of feeds containing such alarming levels of aflatoxins is associated with growth depression owing to reduced feed intake, impaired nutrient utilization and decline in feed quality. It is estimated that with each mg/kg increase of AFs in the diet, the growth rate for broiler birds would be depressed by at least 5% (Dersjant-Li., *et al*. 2003). In laying birds, aflatoxicosis reduces egg production and egg size by 10 and 5% respectively (Hamilton, 1971), in addition to impairing semen quality. Additionally, aflatoxins are immune-suppressants and aflatoxicosis has been noted to escalate the susceptibility of birds to infectious diseases such as Newcastle disease (CAST, 2003).

Many Mycotoxins especially aflatoxins produced by *Aspergillus flavus* and *Aspergillus parasiticus* (Richard., *et al*. 2009) can cause serious health problems in livestock like petechial hemorrhages in the liver and kidneys of broiler chicken and increased the weight of liver (Denli., *et al*. 2009), hence the serious economic losses. Acute aflatoxicosis outbreaks do occur, but most mycotoxin-associated animal health problems are obscure chronic conditions related to reduce efficiency of production and increased susceptibility to infectious disease. Such detrimental effects of aflatoxicosis on animal growth and immune system translate into low productivity and market value and hence low profitability of products of intensive poultry production systems. The aflatoxin in feed maybe assimilated into animal tissues (including meat and eggs), hence exposing consumers to ingestion of carcinogenic compounds through consumption of livestock products.

The use of microbial inactivation, mold inhibitors, fermentation, physical separation, thermal inactivation and sequestering agents has been reported for the decontamination and remediation of highly contaminated feedstuffs. However, most of these measures are costly and only partially effective. At the present time, the most promising and practical approach has been the addition of adsorbents to contaminated feed to selectively bind the aflatoxins during the digestive process, allowing the aflatoxins to pass harmlessly through the animal. A number of adsorbents are capable of binding aflatoxin and reducing or preventing its toxic effects. Natural sorbents are generally recognized as safe for animal feeds at levels of 2 % or less by FDA. The major advantages of adsorbents include low cost, safety and the ease with which they can be added to animal feeds. At present though, the most commercial aflatoxin binders are composed of hydrated sodium calcium aluminosilicate (Akkaya and Bal, 2012), zeolite (Kaki., *et al*. 2012), bentonite (Nuryono., *et al*. 2012), kaolin (Hesham 2004), and activated carbon (Gallo and Masoer 2010). However, not all these adsorbents are equally effective in protecting livestock against the toxic effects of aflatoxin and several adsorbents have been shown to impair nutrient utilization (Chung., *et al*. 1990). For the case of the Bentonites and other hydrated sodium calcium aluminosilicates (HSCAS) the efficacy of the sequestration varies from one location to another, which necessities testing before they are utilized in feeding trials. We therefore sought to determine the effect of Ugandan bentonite in suppressing aflatoxicosis-induced decline in immunity against key diseases of poultry and its role in alleviating carry-over of aflatoxin metabolites into animal tissues [1-5].

## Summary of Methods

Studies were conducted to assess the efficacy of bentonite from the Albertine Graben region of Uganda on immunity against Newcastle and infectious bronchitis diseases, and accumulation of aflatoxin metabolites in tissues and organs. Experimental feeds were deliberately contaminated with 250 ppb of aflatoxin. The feed was then fortified with three aflatoxin binders including a commercial binder (CB), and two Ugandan bentonite types (UGAB-1 and UGAB-2). The aflatoxin binders were incorporated at varying levels of 0.0, 0.25, 0.5, 1.0 and 2.0% of the diet. Experimental birds (broilers and layers) were then subjected to diets with different binder types incorporated at varying levels.

## Summary of the Results

Generally, bentonite type and inclusion level significantly ($P < 0.05$) affected Newcastle and infectious bronchitis geometric mean anti body titers and total tissue aflatoxin carry over. The Newcastle antibody titre increased by 64% and 62% at 2.0% inclusion levels of UGAB-1 and UGAB-2respectively. The infectious bronchitis antibody titre increased by 55.3% and 58.4% at 2.0% inclusion levels of UGAB-1 and UGAB-2 respectively. On the other hand, least aflatoxin carry-over was obtained at 2.0% inclusion level of UGAB-2 in the liver and kidney tissues, respectively while no aflatoxins were detected at 1.0% and 2.0% inclusion levels of UGAB-1 and UGAB-2, respectively. In addition, whereas the Bursa of Fabricius decreased by 22.26% and 22.2% for UGAB-1 and UGAB-2, liver relative weights increased by 27.5%, 28.4% for UGAB-1 and UGAB-2. For the case of kidneys relative weights optimum increase of 21.8% and 21.7% was obtained with UGAB-1 and UGAB-2 inclusion, respectively.

## Conclusion

Results from these studies revealed that feeding aflatoxin-contaminated diets significantly lowered immunity against Newcastle and Infectious Bronchitis and facilitated carryover of aflatoxin into animal tissues. Addition of aflatoxin binders obtained from Uganda to the contaminated diets resulted into improved immunity and alleviated aflatoxin carry-over into tissues, making animal product safe for human consumption.

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