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REVIEW ARTICLE

AFLATOXICOSIS IN BROILER CHICKENS, AMELIORATION WITH MYCOSORB: A REVIEW

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ABSTRACT

Aflatoxins (AF), the toxic secondary metabolites produced by Aspergillus flavus and Aspergillus parasiticus, are a major concern in the poultry production. The dietary aflatoxins reduce weight gain, feed intake, and increase feed conversion ratio. Aflatoxicosis significantly reduced the carcass traits. Affected birds show poor vaccine response and low antibody titre, as both cellular and humoral immunities are affected .Although numerous detoxification methods have been tested, none seems able to fulfill the efficacy, safety, safeguarding of nutritional elements and costs requisites of a detoxification process. This paper reviews the detoxification methods by using esterified glucomannan (Mycosorb) in aflatoxicated birds

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INTRODUCTION

Mycotoxins of importance in poultry are mainly produced by the fungi genera Aspergillus, Fusarium and Penicillia, at the pre-harvest, harvest and in storage or during feed processing whenever conditions are favorable. No region of the world escapes these silent killers and their negative impact on poultry productivity and human health is enormous (Devegowda, 2001; Devegowda and Aravind, 2002). Aflatoxins (AF) are a group of closely related biologically active mycotoxins produced by Aspergillus flavus and Aspergillus parasiticus. They commonly occur as natural contaminants of poultry feeds (Sapcota *et al*., 2006). Among aflatoxins, AFB1 is an extremely hepato-toxic and carcinogenic compound (Girish and Devegowda, 2006). Aflatoxin B1 is more predominantly found than others and is the most toxic type to poultry and frequently contaminates animal's feeds at low levels. The stability of B1 to thermal and chemical treatment increases its potential. Aflatoxins cause a variety of effects in poultry including decreased feed utilization, poor growth, egg production and break in immunity. Even small amounts of AFB1 in feeds may cause poor growth, hatchability and increase susceptibility to disease.

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Aflatoxins are highly hepatotoxic, neurotoxic, teratogenic, carcinogenic imparting various deleterious effects on vital organs such as liver and kidney resulting in reduction of body growth, poor feed utilization and lowering immunogenesis leading to mortality (Girish and Devegowda 2006 , Kubena *et al,* 1990). Affected birds show poor vaccine response and low antibody titre, as both cellular and humoral immunities are affected (Corrier, 1991).

Extensive research has been conducted as regards to prevention and control of aflatoxicosis by the use of various chemicals or dietary supplementation of certain agents like nutritional, physical, chemical and biological approaches have been proposed to detoxify mycotoxin contaminated feed and feedstuffshydrated sodium calcium aluminosilicate (HACAS) (Jindal *et al*., 1993). Bentonite (Rosa *et al*., 2001), Zeolite (Miazzo *et al*., 2000), activated charcoal (AC) (Edrington *et al*., 1997), inorganic sorbents (Baily *et al*., 1998) and a blend of organic acids and aluminosilicates (Mahesh and Devegowda, 1996) have shown considerable promise in detoxifying aflatoxins in contaminated feeds. Mycosorb (Esterified glucomannan) extracted from the yeast cell wall was shown to bind with aflatoxin, ochratoxin and T-2 toxin, individually and combined (Raju and Devegowda, 2000). Additions of esterified glucomannan at 0.5 or 1.0 g/kg to diets supplying.

A glucan polymer product has protected swine (Swamy *et al*., 2002) and broilers (Swamy *et al*., 2004)) against some of the detrimental effects of multiple mycotoxins, but without restoring growth rate. Yeast cell walls Cell walls derived from the Saccharomyces cerevisiae yeast are also used as a dietary mycotoxin adsorbing agent. Yeast cell walls consist almost entirely of proteins and carbohydrates. The carbohydrate fraction is composed primarily of glucose, mannose, and N-acetyglucosamine. Glucans and mannans, the two main sugars, are found in about equal concentrations in Saccharomyces cerevisiae. Yeast mannan chains of various sizes are exposed on the external surface and are linked to cell wall proteins.

Body weight and Weight Gain

The growth depression was found to be improved when Mycosorb (1 g per kg) was incorporated in the aflatoxin (300 ppb) treated groups from 3rd week onwards and the amelioration was found to be 63.57 per cent, @ 1 g /kg of Mycosorb in the diet (Wade, 2008). Mogadam and Azizpour, (2011) found in his study, that the addition of yeast glucomannan was effective on body weight gain and the highest result was significantly obtained compared with the negative control group during day 7 to 42 ($P < 0.05$) when yeast glucomannan was added at of 0.1% of feed to the AF containing diets. Arvind *et al*. (2003) reported that the contaminated diet (aflatoxin 168 ppb, ochratoxin 8.4 ppb, zearalenone 54 ppb, and T-2 toxin 32 ppb) supplemented with E-GM significantly countered (8.84%) the growth-depressing effects of the contaminated diet.

Raju and Devegowda (2000) studied the influence of modified glucomannan (Mycosorb) on performance in broilers exposed to aflatoxin (0.3 mg kg-1) and reported that addition of Mycosorb (1 g kg-1 diet) increased body weight by 2.26%. Kamalzadeh *et al.* (2009) observed that the live weight of birds in groups given diets with 0.5, 1 and 1.5 g Mycosorb kg-1 increased by 2.72, 6.46 and 7.44%, respectively when the feed contaminated with aflatoxin. Supplementation of glucomannan-containing yeast product (1kg/ton) to the aflatoxin (2mg/kg) contaminated diets significantly alleviated the growth depression effects, Girish and Devegowda (2006). Yildirim *et al.* (2011) observed improved weight gain in broilers on EGM incorporated in aflatoxin contaminated diet. The beneficial effects of yeast glucomannan on performance of broilers have been reported earlier by Raju and Devegowda (2000), Swamy *et al.* (2002), Aravind *et al.* (2003), Karaman *et al.* (2005) Girish and Devegowda (2004) and Basmacoglu *et al.* (2005). Although the precise mode of action of E-GM is not known, it is hypothesized that E-GM might trap the mycotoxin molecule in its glucomannan matrix and prevent toxin absorption from the gastrointestinal tract (Raju and Devegowda, 2000). These beneficial effects of Mycosorb might be attributed to its ability to trap the mycotoxins in the gastrointestinal tract (Girish and Devegowda, 2006).

Feed consumption and feed efficiency

The dietary addition of Mycosorb as a counteracting agent in aflatoxin (300 ppb) fed group improve the anorexic condition reflecting in higher feed consumption.

Though ameliorative effect of dietary Mycosorb was varying, the best effect was observed in the groups fed @ dose 1.0 g/kg (Wade, 2008). Raju and Devegowda (2000) reported that supplementation of 1 g kg-1 Mycosorb to the diet containing 0.3 mg aflatoxin kg-1 caused 1.6% increase in feed intake of broiler chicks. Similar result has been recorded by Girish and Devegowda (2006). Improvement of feed conversion ratio was observed when aflatoxin added diet was fortified with Mycosorb as counteracting agent (Wade.,2008). This finding is in agreement with Girish and Devegowda (2004). The beneficial effect might be due to the ability of Mycosorb to trap the aflatoxin irreversibly (Devegowda *et al.,* 1998). Karaman *et al.* (2005) was observed higher feed intake (7.4%), body weight gain (24%) and better feed conversion ratio (13.7%) were obtained with 0.1% yeast glucomannan (1 g Mycosorb kg-1)in aflatoxin containing diet at 0.5 and 1 g kg-1. Arvind *et al*.(2003) feeding the contaminated di*et al*so resulted in significant reduction in feed intake(7.11%)and poorer feed efficiency (2.3%). Further, supplementation of E-GM to the contaminated diet effectively improved feed intake (5.06%) and feed efficiency (3.25%). Chickens fed control diet with E-GM performed significantly better (3.48%) than those on the basal di*et al*one. Ghahri *et al*. (2010) observed improved feed efficiency in aflatoxin containing diet, when supplemented with the estrified glulucomannan.Feeding broilers with diets containing aflatoxin (2 mg/kg) and T-2 toxin (1 mg/kg), significantly reduced feed intake, weight gain and feed efficiency. Modified glucomannan (1 kg/ton of feed) significantly improved body weight, feed intake, suggesting action against both aflatoxin and T-2 toxin.

Nutrient Retention

Dry mater (DM) retention is significantly ($P<0.05$) affected due to aflatoxicosis (Ahmed, 2005). The improvement in the DM retention was noticed after the dietary inclusion of Mycosorb(1g/kg) in aflatoxin (300ppb) fed birds (Wade,2008). Gogoi (2003) reported the protein retention was reduced due to aflatoxicosis (300 ppb) to the extent of 7 per cent. Wade,(2008) fortified Mycosorb(1g/kg) in the diet of aflatoxin fed birds and noted that the significantly ($P<0.05$) improve the protein retention. High rate of protein retention is related well with that of body weight gain Aflatoxicosis (300ppb) lowered the ether extract retention to the extent of 6.25 per cent in toxin alone fed group as compared to normal birds of control group. However, incorporation of Mycosorb (1g/kg) in the diets of aflatoxin fed broilers, significantly improved the ether extract retention. Wade, (2008) reported no significant difference was observed in crude fibre **(**CF) retention in both aflatoxin and mycosorb treated group. This might be due to the fact that the CF digestion takes place in the caeca, which might not have been affected due to aflatoxicosis. However, available literature is limited to elucidate the matter. The dietary inclusion of aflatoxin in broilers significantly reduced ($P<0.05$) the calcium and phosphorus retention Bhaskar *et al.* (2002), Gogoi (2003) and Ahmed (2005). This might be due to the action of aflatoxin hampering the process of calcium digestion and absorption resulting in lower calcium and phosphorus retention. Reduced feed intake by the birds consuming dietary aflatoxin might have contributed for lower calcium and phosphorus retention.

However, when toxin fed broilers were treated with Mycosorb the calcium and phosphorus retention was improved and the value was found to be comparable with that of control group Wade, (2008).

Carcass Trait

Studies on carcass characteristics of broiler revealed that the dressing yield was reduced significantly (P<0.05) Ramakrishna *et al.* (2005), Churchil *et al.* (2001), Mani *et al.* (2001), Bhaskar *et al.* (2002), Gogoi (2003), Ahmed (2005) .Since the dietary aflatoxicosis significantly reduced the body weight of broilers the depression in dressed yield must have been as a sequence to this. However, inclusion of Mycosorb in the aflatoxin contaminated diet improved the dressed yield. Though the dressing yield among the Mycosorb fed groups were comparable, however, incorporation of higher dose (lg/kg) of this binder gave dressing yield matching to that of control group (Wade, 2008). Aflatoxicosis in broilers reduced eviscerated yield were reported by, Bhaskar *et al.* (2002), Gogoi (2003) and Ahmed (2005). Since dietary aflatoxicosis significantly reduced the body weight of broilers, the depression in eviscerated yield must have been as a consequent to this.Addition of Mycosorb in toxin mixed diet of boilers improved the condition significantly (P<0.05) and the results followed the same trend to that of dressed yield. The giblet yield increased significantly in aflatoxin (300 ppb) alone fed birds as compared to control group. This might be due to the enlargement of liver, proventriculus and gizzard which are the component of giblet. Similar findings were reported by Mani *et al.* (2000), Gogoi (2003), Ahmed (2005) and Sapcota *et al* (2006c,d). However, the giblet weight was corrected when the toxicated birds were offered Mycosorb in the diet. Among the Mycosorb treated groups both medium and higher doses (0.5g and l g/kg) showed the best amelioration reflecting in total counteraction (Wade, 2008)

Conclusions

It could be concluded that aflatoxin B_1 in the broiler diet can influence the performance and feed efficiency, nutrient retention and carcass trait. The addition of a Mycosorb (estrified glucomanan) could significantly reestablish harmful effects on broilers.

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