EVALUATION OF MODIFIED GLUCOMANNAN (MYCOSORB®) AND HYDRATED SODIUM CALCIUM ALUMINOSILICATE TO AMELIORATE THE INDIVIDUAL AND COMBINED TOXICITY OF AFLATOXIN AND T-2 TOXIN IN BROILER CHICKENS.

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Summary

The effects of modified glucomannan and hydrated sodium calcium aluminosilicate on individual and combined toxicity of aflatoxin and T-2 toxin were evaluated using twelve dietary treatments (four x three factorial) on broiler chickens from 0-5 weeks of age. Aflatoxin (2 mg/kg) and T-2 toxin (1mg/kg) significantly reduced feed intake, weight gain and feed efficiency. Further aflatoxin increased the relative weights of liver, kidney, gizzard and spleen whereas T-2 toxin increased the relative weights of liver and gizzard. Aflatoxin also reduced the relative weights of thymus and bursa of Fabricius while T-2 toxin reduced relative weight of the thymus. Aflatoxin and T-2 toxin also reduced antibody titres against Newcastle disease and infectious bursal disease. Significant interaction between aflatoxin and T-2 toxin were observed for their additive effects on body weight, feed intake, feed efficiency, relative organ weights and antibody titres. Modified glucomannan (1 kg/ton of feed) significantly (P≤0.05) improved body weight, feed intake, decreased relative organ weights and improved antibody titres, bursa of Fabricius and thymus weights. Hydrated sodium calcium aluminosilicate (10 kg/ton of feed) showed improvement against AF, however no beneficial effect was shown against T-2 toxin.

I. INTRODUCTION

Among the known mycotoxins, aflatoxin, ochratoxin and T-2 toxin are most important to poultry. Aflatoxin B1 (AF) is the most potent hepatotoxic and immunosuppressive where as T-2 toxin has been reported to cause oral lesions and decreased feed intake in broiler chickens. These mycotoxin-contaminated feedstuffs when consumed produce a range of devastating effects on the general well-being and productivity of poultry (Devegowda et al., 1998a).

Practical methods to detoxify mycotoxin contaminated grain on a large scale and in a cost effective manner are currently not available. At present, one of the most promising and practical approaches is the use of adsorbents. Research indicates that a number of adsorbents are capable of adsorbing aflatoxin B1 and reducing its toxic effects.

A natural product called glucomannan, a cell wall derivative of Saccharomyces cerevisiae, has received much attention in minimising mycotoxins present in the contaminated diets of livestock and poultry (Devegowda et al., 1998b; Whitlow et al., 2000; Smith et al., 2000)

The objectives of the trial were to evaluate the individual and combined effects of aflatoxin (AF) and T-2 toxin (T-2) on performance, organs morphology and antibody titers against Newcastle disease and infectious bursal disease with and without supplementation of modified glucomannan (MGM) and hydrated sodium calcium aluminosilicate (HSCAS).
II. METHODS

A total of 720 day-old sexed commercial broiler chicks were divided at random into 36 replicates of 20 chicks each having an equal number of males and females. Two dietary levels each of AF (0 & 2mg/kg), T-2 toxin (0 & 1mg/kg), MGM (0 & 1kg/ton) (Mycosorb®, a proprietary product of Alltech Inc., Nicholasville, KY, USA) and HSCAS (0 & 10 kg/ton) were tested in a four x three factorial from 0-5 weeks of age. Organ morphology, antibody titres for Newcastle disease (ND) and infectious bursal disease (IBD) at 35 days, and performance parameters weekly from 0-5 weeks were measured. The data obtained were analysed with SAS, GLM procedure and means were compared with Duncan multiple range test.

III. RESULTS

AF and T-2 toxin individually depressed body weight and feed efficiency (Table 1). AF increased relative weights of liver (21.7%), kidney (26.4%), and gizzard (16.8%), whereas T-2 toxin showed increase in relative weights of liver (20.0%) and gizzard (10.8%). Reductions in relative size of thymus [by AF (23.3%) and T-2 toxin (18.6%)], bursa [by AF (30.1%)] and ND and IBD titles [by individually AF and T-2 toxin] were noted. The mycotoxins interacted in an additive manner and caused significant reductions in body weight and feed intake. Significant interaction between AF and T-2 toxin were observed for their additive effects on relative organ weights (Table 1) and antibody titres.

IV. DISCUSSION

Body weight was depressed in both individual and combined mycotoxins fed group, where AF & T-2 acted in an additive manner and showed the greatest effect. The increased growth depression observed with the simultaneous feeding of more than one mycotoxin may be due to additive toxic effects of individual toxins (Raju and Devegowda, 2000). A significant additive interaction was seen between two mycotoxins for their effects on feed intake and feed conversion ratio (FCR). Decreased feed consumption during combined mycotoxises has been reported (Kubena et al., 1997; Raju and Devegowda, 2000). The lower FCR was noted with these mycotoxins have been mediated through decreased nutrient utilisation.

HSCAS supplementation improved body weight, feed intake and FCR in the AF fed groups. These data agree with previous results of the protective effects of HSCAS compound (Ledoux et al., 1999). The addition of HSCAS at 1% resulted in no significant protection against toxicity of T-2 agrees with previous work of Chestnut et al., 1992. MGM significantly improved body weight, feed intake and FCR. These beneficial effects might be attributed to its growth promotive effect and ability to trap the mycotoxins irreversibly (Devegowda et al., 1996).

Liver, kidney and gizzard weights were increased by AF and AF+T-2. T-2 increased the relative weights of liver and gizzard. The results are in accordance with findings of Raju and Devegowda, 2000; Arvind et al., 2003. The increase in the relative weight of gizzard is in accordance with earlier studies (Kubena et al., 1990), which may be due to the results of severe inflammation and thickening of mucosal layer.
Table 1. Effect of individual and combined toxicity of AF and T-2 toxin with and without Mycosorb and HSCAS on body wt, FCR and relative organ wt (g/kg live wt) at 35 days of age.

<table>
<thead>
<tr>
<th>Mycotoxin</th>
<th>Mycosorb (1 Kg / ton)</th>
<th>HSCAS (10Kg/ ton)</th>
<th>Body wt (g)</th>
<th>FCR</th>
<th>Liver</th>
<th>Kidney</th>
<th>Thymus</th>
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<sup>a-f</sup> Means within each column followed by common superscript do not differ significantly (P<0.05)

Relative weights of thymus and bursa of Fabricius were significantly reduced by dietary treatments. These reductions in size of these organs might have been due to necrosis and cellular depletion by the mycotoxins. The two mycotoxins exerted potentiated depressing effects on bursa and thymus weight when fed in combination than in isolation, suggesting additive toxic effects among them on lymphoid organs (thymus and bursa); similar results were reported by Raju and Devegowda (2002).

The mode of action of MGM in restoring the organ weights is not clear. It is thought to trap the mycotoxin molecule in its glucosamann matrix, which prevents its absorption from GIT and thereby minimises its toxic effects. The basic mechanism for protection against the toxicity of AF appears to involve sequestration of AF in the GIT and chemisorption of AF. Improvement was highly significant in MGM supplemented groups. HSCAS was found effective in counteracting adverse effects of AF only on organ weights. Chestnut et al. (1992) reported the ineffectiveness of HSCAS against T-2 on organ weights. The antibody titres of ND and IBD were significantly reduced in all mycotoxin treated groups. MGM significantly improved antibody titres against both vaccines. Raju and Devegowda (2002) reported the similar results. HSCAS supplementation significantly improved the ND and IBD titre in only AF fed groups. The counteraction results against ND and IBD by HSCAS for AF earlier reported by Barmese et al. (1990).

V. CONCLUSION

The results indicate that supplementation of Mycosorb is beneficial in preventing the individual and combined toxicity of aflatoxin and T-2 toxin in commercial broilers, while HSCAS is only beneficial against aflatoxin.
REFERENCES