Journal of Animal and Veterinary Advances 6 (8): 917-919, 2007
ISSN: 1680-5593

The Effects of Saccharomyces Cerevisiae on Performance and Biochemical Parameters in Broiler Chicks During Aflatoxicosis

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Abstract: The amelioration of aflatoxicosis in broiler chicks was examined by the dietary addition of Saccharomyces Cerevisiae (SCE). Saccharomyces cerevisiae incorporated into the diet at 1 g kg^{-1} was evaluated for its ability to reduce the deleterious effects of 1 and 2 ppm Aflatoxins (AF) on Ross broiler chicks from 1 days to 42 days of age. The AF treatments significantly decreased feed consumption and body-weight gain and increased feed conversion ratio ($p<0.05$). Serum cholestrol, total protein and albumin decreased significantly ($p<0.05$) in diets contaminated with aflatoxin. Compared to controls, the addition of SCE to an AF-containing diet significantly reduced the deleterious effects of AF on body-weight gain, feed conversion ratio, cholestrol, albumin and total protein. The AF fed groups had higher serum activities of the enzymes LDH and AST and decreased activity of ALP. The addition of SCE to an AF-containing diet reversed the effect of the toxin on the activities of serum enzymes. These results suggest that SCE reduced the adverse effects of AF and should be helpful in a solution to the aflatoxicosis problem in poultry.

Key words: Effest of saccharomyces carevisiae, performance, biochemical parameters, broiler chicks, aflatoxicosis

INTRODUCTION

Afatoxins (AF) are toxic compounds produced in grains by the fungi *Aspergillus favus* and *A. parasiticus*. Afatoxicosis in poultry is characterized by weakness, anorexia with lower growth rate, poor feed utilization, decreased egg production, increased susceptibility to environmental and microbial stressors and increased mortality (Bailey *et al*., 1998; Kubena *et al*., 1998). Afatoxicosis is also associated with biochemical, haematological and pathological changes. The liver is the target organ of afatoxins and hepatobiliary damage is associated with alterations in liver enzyme functions. As aflatoxin often contaminates poultry feed, there is a need for a comprehensive tool to counter this problem. Recent biotechnological progress has opened new avenues for tackling this problem. *Saccharomyces cerevisiae* was found to have beneficial effects in poultry during mycotoxicosis(Stanley *et al*., 1993). A study was conducted to determine the efficacy inclusion of *S. cerevisiae* in the decreasing the effects of aflatoxin on performance and biochemical parameters of broiler chickens.

MATERIALS AND METHODS

In this study, 480 day-old male chicks (Ross 308) were randomly assigned to pens with 20 chicks in each. The study was a completely randomized design with four replications of each of the following. Birds were fed a balanced diet, based on corn and soybean meal, formulated according to the recommendations of the National Research Council (1994). Treatments: A: Control without aflatoxin, B: Contain 1g kg^{-1} SCE, C: Contain 1 ppm Aflatoxins (AF)., D: 1 ppm AF + SCE (1g kg^{-1})., E: 2 ppm aflatoxins., F: Aflatoxins (2 ppm) plus SCE (1 g kg^{-1}).

Aflatoxins were produced on rice following inoculation with fungal spores (6.5×10^6 -7.0×10^6) of a toxigenic *A. parasiticus* species as described by Shotwell *et al*. (1966). Aflatoxin content of the rice was determined by TLC and HPLC based on the procedure described by Wilson and Romer (1991). Birds were inspected daily and their body weight and feed consumption was recorded weekly and daily, respectively. Feed intake, mean body weight gain and feed conversion ratio were calculated. Blood samples were collected from the wing vein of birds at the age of 21 day (n = 240) and 42 day (n = 240) and

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serum separated for total protein, albumin and cholesterol analysis. Serum enzymes, namely Lactate Dehydrogenase (LDH), aspartate Amino Transferase (AST) and Alkaline Phosphatase (ALP) were measured using commercial kits (Zist Chimi, IR) on an auto-analyzer (Technicon RA-1000). Data were analyzed by the General Linear models procedure of SAS Institute (1982). Means for treatments showing significant differences in the analysis of variance were compared using Duncan's multiple range tests. All statements of significance are based on the probability level of 0.05.

RESULTS

The results show (Table 1) that inclusion of SCE to AF contaminated-rations were improved feed conversion ratio and body weight ($p<0.05$). Serum total protein and albumin decreased significantly ($p<0.05$) in diets contaminated with AF. The addition of SCE to the AF-containing diets decreased the effects of AF on feed intake ($p< 0.05$).

The results of biochemical parameters presented in Table 2 show that the cholesterol level significantly reduced at the age of 21 days and the decrease was intensified in birds after 42 days ($p< 0.05$) in groups C and E due to dietary afatoxin. In chickens given SCE treated afatoxin contaminated feed, the level of cholesterol was within the normal range. As shown in Table2, plasma total protein together with albumin levels was found to be significantly ($p<0.05$) decreased in chickens fed afatoxin-containing diet. Chickens fed SCE in feed (B) showed no recovery in plasma total proteins as well as albumin levels. It was observed that in chickens of groups C and E given dietary afatoxins, these changes were more significant in chickens fed diet with higher afatoxin levels (diet E).

Effects of SCE on blood serum enzymes are shown in Table 3. Serum lactate dehydrogenase as well as aspartate amino transferase activities were found to be elevated ($p < 0.05$) in chickens fed afatoxin contaminated feed (Table 3). The addition of SCE to the AF- containing diets resulted in compensation of toxic effects of AF on these enzymes. Nevertheless, serum alkaline phosphatase was found to be inhibited in afatoxin treated Chickens. The addition of SCE to the AF-containing diets significantly improved the decrease in activity of ALP caused by AF.

Table 1: Comparison of performance parameters in chicks fed different rations

Treatment	Body weight gain (g day^{-1})	Dietary feed intake (g day^{-1})	Feed conversion ratio
A	38.3 ±.0.6^{a}	75.4±1.8^{a}	1.97±0.05^{a}
B	38.6±2.2^{a}	74.5±2.2^{a}	1.93±0.02^{a}
C	32.7±1.2^{b}	70.3±2.8^{b}	2.15±0.05^{b}
D	37.9±0.8^{a}	76.5±2.4^{a}	2.02±0.09^{a}
E	28.5±1.1^{b}	65±1.7^{c}	2.28±0.07^{b}
F	36.2±1^{a}	76±1.3^{a}	2.1±0.06^{ab}

Experimental groups are as shown in Table 1. Feeding started from the first day of housing and parameters calculated on 42 days of age. Data presented as mean±S.E.M. Mean values in same column without common letters (a-c) differ significantly ($p<0.05$)

Table 2: Comparison of serum biochemical parameters in chicks fed different rations

	Cholesterol (g L^{-1})		Total Protein (g dL^{-1})		Albumin (g dL^{-1})	
Treatment	Day 21	Day 42	Day21	Day 42	Day21	Day42
A	132±5.5^{a}	145.7±8^{a}	2.58±0.26^{a}	3.76±0.23^{a}	0.77±0.82^{a}	1.4±0.20^{a}
B	128±6.4^{a}	146.8±7^{a}	2.7±0.28^{a}	3.82±0.29^{a}	0.82±0.96^{a}	1.38±0.21^{a}
C	89.5±5.2^{b}	133.8±6^{b}	1.78±0.26^{b}	2.45±0.37^{b}	0.54±0.92^{b}	0.92±0.20^{b}
D	127±3.7^{a}	140.5±8^{a}	2.47±0.28^{a}	3.65±0.28^{a}	0.72±0.89^{a}	1.32±0.18^{a}
E	85.5±2.9^{b}	126.5±12.7^{b}	1.65±0.27^{b}	2.3±0.22^{b}	0.43±0.96^{b}	0.77±0.14^{b}
F	124.5±3.8^{a}	136±11.2^{ab}	2.4±0.23^{a}	3.57±0.24^{a}	0.71±0.86^{a}	1.29±.16^{a}

Data are mean±S.E.M. of 10 analyses carried out on samples obtained from 10 individual birds. Chickens were examined at two stages of growth when they were either 21 or 42 days old. Means in the same column without common letters (a-c) differ significantly ($p < 0.05$)

Table 3: Serum enzymes in chickens fed different dietary rations

	LDH (U L^{-1})		AST (U L^{-1})		ALP (U L^{-1})	day 21
Treatmentas	Day 42	day21	Day 42	day21	Day42	
A	227.5±6.8^{a}	223±15^{a}	223±5^{a}	255.5±20^{a}	4500±200^{a}	4450±225^{a}
B	226±7.9^{a}	214±6^{a}	219±4^{a}	250±21^{a}	4450±280^{a}	4320±220^{a}
C	272±6.5^{b}	246±11^{b}	260±5^{b}	305.5±36^{b}	3720±450a^{b}	3400±250^{b}
D	224.5±6.5^{a}	213±15^{a}	227.5±7^{a}	265±18^{a}	4200±300^{a}	4160±270^{a}
E	284.5±12.5^{b}	261±9^{b}	278±6^{c}	325±14^{c}	3220±240^{c}	3150±150^{b}
F	235.5±8.5^{a}	217±17^{a}	235.5± 7^{a}	280±38^{ab}	4050±280^{ab}	3860±170^{ab}

Data are mean±S.E.M. of separate analyses carried out on 10 samples obtained from individual chickens. Enzymes measured at two stages of growth, viz. 21 and 42 days after treatment. U, one unit is equivalent to 1 imole of lactate, oxaloacetate, pyruvate, or inorganic phosphate released per minute at 25°C for LDH, AST and ALP, respectively

DISCUSSION

Aflatoxicosis is an important problem in poultry and livestock industry due to its profound effects on growth and the frequent contamination of feed by these mycotoxins. Mycotoxin producing fungi are responsible for significant financial losses encompassing a broad spectrum of crop and farm animals and extending through the food chain to the consumer (Shane, 1994). Every year a significant percentage of the world's grain and oilseed crops are contaminated with hazardous mycotoxins, such as afatoxin. Unfortunately, discontinuing the feeding of afatoxin contaminated grain is not always practical, especially when alternative feedstuffs are not readily available or affordable. Thus, these toxins frequently are detected in animal feed can cause significant production losses in animals. Dersjant-Li *et al.* (2003) reported that the rate of body weight gain in pigs and broilers is reduced as a function of the levels of afatoxin in the diet. They suggested that with each mg kg^{-1} increase of afatoxin in broiler diets depresses growth rate by 5%. Our results showed that inclusion of *S. cerevisiae* in rations reduced the effects of afatoxin in broilers.

This was achieved by comparing different parameters related to afatoxicosis as well as the production efficiency of broilers. Data presented in this study showed that most of the plasma parameters were found to be affected by afatoxin but remained within normal range in chickens given Saccharomyces cerevisiae. Unlike the non-enzymatic parameters, marker enzymes particularly lactate dehydrogenase and aspartate amino transferase showed more dependency on the concentration and duration of the exposure to afatoxins. These data suggest that serum enzymes particularly AST and LDH can be used as indices for investigating the performance of chickens challenged with afatoxins. Decreased serum ALP occurred because of afatoxin intoxication whereas, it was unaffected in chickens fed diet containing SCE (Table 3). It has been suggested that he nutritional deficiency induced by afatoxin can lead to disruption of the activities of digestive enzymes and absorption of essential nutrients (Bolden and Jensen, 1985). Impaired nutrient absorption and reduced pancreatic digestive enzyme production due to afatoxin (Swamy and Devegowda, 1998) may play important role in alteration of the production parameters. At the end of rearing period (42 days) chickens fed normal diet (afatoxin-free) exhibited normal dietary intake (g day^{-1}), body weight gain (g day^{-1}) and feed conversion ratio, whereas in case of chickens fed two different dietary doses of afatoxins the FCR was elevated significantly. These results suggest that SCE reduced the adverse effects of AF and should be helpful in a solution to the aflatoxicosis problem in poultry.

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