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The Efficacy of Aflatoxin and Mycosorb Adsorbent on Blood Parameters, Proventriculus Weight and Length and Gizzard Erosion in Broiler Chickens

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ABSTRACT

Aflatoxins (AFs) are groups of toxins of fungus that are mainly produced in Aspergillus parasiticus. This study was conducted in order to evaluate the prohibitory effect of mycosorb adsorbent from aflatoxin toxicity. The experiment was carried out with 400 broiler chickens. Treatment 1 was fed the basal ration treatment 2 containing 1ppm AFs, treatment 3 received the feed containing 1ppm AFs and 0.25% Mycosorb adsorbent and treatment 4 was given the feed containing 0.25% Mycosorb adsorbent. Results have shown that 1ppm AFs in diet in comparison to control treatment caused significant increase in gizzard weight and damaged to some of blood factors at the end of rearing ($p>0.05$). In contrast enlargement of proventriculus was increased significantly in both (21 and 42) rearing period ($p<0.05$) as well as deteriorated effect on gizzard (gizzard erosion) was recognized. Level of 0.25% Mycosorb on Diet Company by 1ppm AFs could not compensate harmful effects of AFs on percentage of gizzard weight in the end of rearing period but it returned the harmful effect of AFs on most of blood parameters. No significant reaction was shown on percentage weights, gizzard erosion, proventriculus enlargement and blood parameters, ($p>0.05$) by 0.25% Mycosorb diet. The results of this study have shown that presence of AFs (1ppm) in diet of broiler chickens has deteriorated effects on gizzard erosion, proventriculus enlargement and some blood factors.

Keywords: *Aflatoxins; Mycosorb adsorbent; Chickens; Proventriculus; Gizzard*

INTRODUCTION

Aflatoxins are secondary metabolites which are secreted by fungi that grow on food materials like wheat, grain, corn and other things. The main producer of aflatoxins is *Aspergillus* genus and especially *A. parasiticus*, *A. flavus* and *A. nomius*. Among 17th metabolites known as aflatoxins, AF B1 is the most common in cereals which is one of the most toxic aflatoxins [1,2].

Aflatoxins (AFs) have high importance because of their different biological and biochemical effect on human and animal health care [3,4]. Disease caused by AFs is called Aflatoxisuse. Significant changes of Aflatoxisuse are done on blood, carcass, liver, kidney and then on lymphatic tissues. At first cultivations of human and poultry liver cells, AFs can have bilateral effect on RNA, DNA and inter cell proteins. Liver cells are the most important aim cells for toxic actions of AF B1 [5]. Mycosorb is an organic and natural combination which is separated from inter wall of ferment and its construction consists of a 3-chain spiral with wide adsorbent flat and a number of different adsorbent places. Since some modifications are done on the structure of this Glucomanan, its combination capacity and tendency has gone raise. Experiments done on modified Glucomanan (MG) has shown that this organic combination is effective on decrease of AF individual and

combined consequences, Acratoxy (A) and Toxin (T-2) in broiler chickens [6]. Nowdays, aflatoxins are one the most important issues in poultry science, because of the influences they have on chickens which decrease the quality of poultry productions and it costs a lot of expenses for farmers (personal communication). The experiment has been designed to evaluate the effect of AF on broiler chickens and ability of Mycosorb adsorbent to prevent the toxicity effect of AF.

MATERIALS AND METHODS

The study was executed in 2010. 400 broiler chickens were randomly divided into 16 cages. In this study, both dietary rations of energy and protein were used. Experiment periods consist of beginning period (0-21 days) and growth period (22-42 days). After day 7, experimental treatments were taken on chicks. This study was done randomly with 4 treatments of 4 repetitions (Table 1). The first group used as control group and received just dietary ration, the second group had 1ppm AF, the third group fed by 1ppm AF plus 0.25% mycosorb adsorbent and the forth group received only 0.25 mycosorb adsorbent.

Table 1: Combination of dietary ration in beginning and growth period (percentage).

Beginning period	**Growth period**							
	Ration 1	**Ration 2**	**Ration 3**	**Ration 4**	**Ration 1**	**Ration 2**	**Ration 3**	**Ration 4**
Corn grain	56.36	56.36	56.36	56.36	67.37	67.37	67.37	67.37
Soya seed	32.94	32.94	32.94	32.94	26.94	26.94	26.94	26.94
Fish powder	3.5	3.5	3.5	3.5	2	2	2	2
Soya oil	3.54	3.54	3.54	3.54	1.62	1.62	1.62	1.62
Pca_2	0.97	0.97	0.97	0.97	0.74	0.74	0.74	0.74
Oyster	1.18	1.18	1.18	1.18	1.29	1.29	1.29	1.29
Salt	0.26	0.26	0.26	0.26	0.27	0.27	0.27	0.27
Vitamin supplementary	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Organic supplementary	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
AF deteriorated corn1	-	0.325	0.325	-	-	0.325	0.325	-
Mycosorb adsorbent	-	-	0.25	0.25	-	-	0.25	0.25
Filler material2	0.75	0.43	0.18	0.5	0.75	0.43	0.18	0.5
Dry material	90.67	90.27	90.36	90.46	87.08	86.88	86.73	87.62
Raw protein	21.61	21.66	21.7	21.58	19.2	18.91	19.05	19.25
Raw fat	7.91	7.75	7.59	7.59	6.53	6.69	6.45	6.8
Raw fiber	3.99	3.82	3.68	3.91	4.35	4.72	4.51	4.75
Note: 1. 0.325 grams of deteriorated corn contain 1ppm AF 2. Chaff is used as a filler material								

In order to prepare AF, standard *Aspirjilus Paraziticus* ATCC-13473 was chosen (Pasteur Institution, Iran). AFs of cultivated samples were separated through AF separation of ELISA (Enzyme Link Immuno Sorbent Assay) [7].

At the end of weeks 3 and 62 chicks were randomly chosen from each pane in order to be slaughtered after weighting percentage of body's different part on the basis of carcass weight and proventriculus length (cm). Before slaughtering, blood samples were obtained from brachial vein and centrifuged (3000 rpm) in order to get serum. Serums have been analyzed for Total Protein (TP), Albumin, Globulin, Aspatate aminotransferase (AST), glucose, triglyceride and cholesterol by ELISA set.

Statistical analysis: The data were analyzed *via* SAS (Statistical Analyses Software) and GLM (General Linear Model). The median of treatments were compared through Duncan method in error possibility of 5% [8].

RESULTS AND DISCUSSION

However results of study showed that feeding broiler chicks by diet containing AF 1ppm will lead to relative weighting in day 42 in contrast to chicks fed by control diet, its effect was not statistically meaningful (Table 2). This result emphasized preview reports of lacking efficacy of AF dietary on relative weight of proventriculus in broiler chicks [9].

Table 2: Efficacy of experimental treatments on proventriculus and gizzard weight, proventriculus length and gizzard erosion of 42 day-old chickens.

Treatment	Proventriculus weight	Gizzard weight	Proventriculus length	Percentage of gizzard erosion
Control	0.35^{a} + 0.05	1.57^{b}+ 0.16	3.57^{b} + 0.21	0.00^{a} + 0.00
AF	0.41^{a} +0.05	1.75^{a}+ 0.16	3.79^{a} + 0.18	1.24^{a} + 1.26
AF+Mycosorb	0.42^{a} +0.04	1.72^{a}+ 0.17	3.67^{ab} + 0.15	1.10^{a} + 1.35
Mycosorb	0.39^{a} +0.03	1.46^{b}+ 0.15	3.55^{b} + 0.12	0.00^{a} + 0.00
P	0.3977	0.0067	0.0201	0.3543
C.V.	0.0891	0.122	5.152	191.11
SEM	0.03	0.05	0.05	0.5
Note: Similar letters in each column show lack of significant contrast in 5% error level. SD µ+:Means +Standard Deviation, SEM: Standard Error Mean, C.V: Coefficient Variance				

Adding 1ppm AF to dietary will results in relative gizzard weighting of broiler chicks in contrast to control dietary fed ones which were meaningful (Table 2). This result is concordant with other results of chicks fed by AF containing dietary. Adding 0.25% Mycosorb to dietary containing AF 1ppm did not have meaningful effect on decreasing damaging efficacy of AF on gizzard weight at the end of experiment but, it could compensate this negative effect of AF on gizzard weight in broiler chicks receiving dietary containing AF in contrast to control treatment.

Feeding chicks by dietary of AF 1ppm caused enlargement of proventriculus in days of 21, 42 ($p<0.05$) in contrast to group of control treatment; The amounts of enlargement were 2.96+0.23 in the first period of experiment and 3.79+0.18 in the second period. The lowest amount of enlargement has been seen in the mycosorb used group with 2.58+0.15 in the first period of experiment and 3.55+0.12 in the second period (Tables 2 and 3). This study showed that AF caused the enlargement of proventriculus. The gizzard weights have not significant differences in the 21-day old chicks, but the highest weight in the 42-day old chicks belonged to AF treated group (1.75+0.16) and the lowest weight belonged to the group which treated only with mycosorb (1.46+0.15) ($P<0.05$) (Table 2). However adding AF 1ppm resulted in erosion of gizzard but it was not statistically significant ($p>0.05$). Some studies showed that Mycotoxins and fish powder will cause gizzard dissolution in broiler chicks. Erosion process consists of oxidation of mercury ingredients fat and producing free radicals or very reactive oxygen molecules. These radicals are superoxide $(O2)^{2-}$, hydrogen peroxide (H_2O_2) and hydroxyl radical (HO-). One of toxic effecst of this radical is gizzard erosion. When Mycotoxins are adsorbed in body and entered blood, they can return mouth and gizzard via saliva and will cause the erosion of cell wall of these parts.

Table 3: Efficacy of experimental treatments on proventriculus and gizzard weight, proventriculus length and gizzard erosion of 21 day-old chickens.

Treatment	Proventriculus weight	Gizzard weight	Proventriculus length	Percentage of gizzard erosion
Control	0.66^{a} +0.08	2.59^{a} +0.26	2.63^{b} +0.22	0.00^{a} +0.00
AF	0.79^{a} +0.07	2.64^{a} +0.31	2.96^{a} +0.23	0.73^{a} + 1.29
AF+Mycosorb	0.78^{a}+0.06	2.62^{a} +0.09	2.79^{ab} +0.15	0.72^{a} +0.64
Mycosorb	0.76^{a} +0.08	2.58^{a} +0.19	2.58^{b} +0.15	0.00^{a} +0.00
P	0.8529	0.6929	0.0181	0.5129
C.V.	0.1027	0.1388	6.311	272.95
SEM	0.0328	0.081	0.08	0.32
Note: Similar letters in each column show lack of significant contrast in 5% error level. SD µ+: Means +Standard Deviation, SEM: Standard Error Mean, C.V: Coefficient Variance				

1ppm of AF had significant effect in all of blood parameters which were investigated but glucose. The total protein level was 2.21 in AF used group while the highest level was 3.10 in control group, the highest albumin concentration was in control group (1.52) but AF plus mycosorb reduced it to 0.87. The globulin amount was 1.62 in mycosorb treated group, higher than the other groups, in the contrast the lowest amount (1.12) was in the AF (only) affected group. The highest amount of Aspartate aminotransferase has been seen in the AF treated group (273) and the lowest amount has been seen in the mycosorb treatment group (215). The highest triglyceride and cholesterol level were in the control group respectively 60.43 and 111.60, meanwhile the lowest level were in the AF treatment group by 42.53 and 78.46 (Table 4).

Table 4: Efficacy of experimental treatments on Total Protein (TP), Albumin (AL), Globulin (GLO), Aspatate aminotransferase (AST), Glucose (GLU), Triglyceride (TRI) and Cholesterol (CHOL) of 42 day-old chickens.

Treatment	**TP**	**AL**	**GLO**	**AST**	**GLU**	**TRI**	**CHOL**
Control	3.10^{a}	1.52^{a}	1.59^{a}	217^{a}	295^{a}	60.43^{a}	111.60^{a}
AF	2.21^{b}	1.09^{bc}	1.12^{b}	273^{b}	276^{a}	42.53^{b}	78.46^{b}
AF+Mycosorb	3.01^{a}	0.87^{c}	1.42^{a}	220^{a}	258^{a}	57.34^{a}	106.25^{a}
Mycosorb	3.08^{a}	1.00^{bc}	1.62^{a}	215^{a}	264^{a}	58.41^{a}	102.87^{ab}
P	0.0246	0.0324	0.0316	0.0457	0.0531	0.249	0.0264

Mycosorb adsorbent showed good ability on prevention of AF's damage on blood factors, almost it returned the effect of AF on all blood items but it only could not affect significantly on albumin reduction which have been caused by AF. The results of our study are in agreement with the results in study of Eraslan et al, they reported decrease in serum parameters but they found that AF increases the glucose level which this part is in contrast of our finding. Bauer and Grunkemeie showed that yeast cell wall have the potentional to be used as adsorbent for mycotoxins. The macromolecules like polysaccharides (mainly glucomanan), lipids and proteins in the cell wall of yeast shows various and easy accessible adsorption sites which can compensate by different adsorption mechanisms with mycotoxins, e.g. ionic, hydrogen bonding or hydrophobic interaction. I. Hashmi et al, found that 1 percent of yeast sludge can improve the harm of AF on serum total protein and albumin.

CONCLUSION

In general results of this study shows that presence of AF in dietary ration of broiler chickens in the level of 1ppm will have damaging effects on broiler chicks' gizzard and proventriculus and blood parameters, thus on flock performance. According to this study utilizing Mycosorb adsorbent has decreased these damaging effects to some extent, and the highest impact was on blood biochemical parameters. More studies are needed with different percentages and adsorbents in order to find a solution to cope with this dilemma.

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