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EFFECT OF SOME NATURAL FEED ADDITIVES ON PERFORMANCE AND IMMUNE RESPONSE OF YOUNG CHICKENS FED AFLATOXIC DIETS.

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SUMMARY

The main objectives of this work were to investigate; 1- the response of a local Egyptian chicken strain (Inshas) to aflatoxicosis (AF), 2- the effectiveness of using three anti-aflatoxic agents with different mode of actions. The three agents which given continuously for 25 wks(4-28 wks) are a) Hydrated sodium calcium aluminosilicate (HSCAS)as an adsorbent which demonstrated a high affinity for aflatoxins, b) Mannan oligosaccharide (Bio-Mos®) as a biological derivative, c) Radish extract (RE) as an antioxidant agent rich in peroxidase enzyme. A total number of eight hundred and ten unsexed Inshas day old chicks were divided into nine experimental groups of 90 chicks each (three replicates/each group) being: control and 8 dietary treatments as follows: (T1) Basal diet + AF(1.0mg total AF/kg diet), (T2) Basal diet + AF + Bio-mos (1.0g/kg diet), (T3) Basal diet + AF + RE(10g/kg diet), (T4) Basal diet +AF + HSCAS (0.5%), (T5) Basal diet + AF + Bio-mos + RE, (T6) Basal diet + AF + Bio-mos + HSCAS, (T7) Basal diet +AF+RE + HSCAS, (T8) Basal diet + AF + Bio-mos + RE + HSCAS and (T9) Basal diet (control).

Characteristics investigated included: Live body weight, feed consumption and efficiency of feed utilization: relative weight of internal organs (bursa of Fabricius, the thymus gland, spleen, liver), residual AF in the liver, muscles and eggs; immune respectivelyonse against NBVD

Results obtained could be summarized as follow:

1. All traits studied were adversely affected by AF treatment.
2. The three anti–AF agents studied showed significant beneficial effects in ameliorating the adverse effects resulting from AF administration.
3. In most cases, the best protective effects were obtained with MOS and its combinations followed by HSCAS.
4. Radish extract (RE) seemed to be less effective than the other two agents.
5. In many cases, RE antagonized the action of MOS or HSCAS.
6. In conclusion, using anti-AF agents (MOS, HSCS or their combination) have beneficial effects in ameliorating the adverse effects resulting from AF administration.

***Keywords**: poultry, aflatoxin, Bio mos, HSCS, radish extract, immunity.*

INTRODUCTION

Mycotoxins are highly toxic secondary products of the metabolism of some fungi mainly belonging to *Aspergilus, penicillium*, and *Fusarium spp.* Toxic syndromes caused by mycotoxin ingestion by humans and animals are indicated as mycotoxicosis.(Galvano *et al., 2001*).

No doubt exists concerning the negative economic impact of mycotoxins. However, the main toxic effects are carcinogenicity, genotoxicity, teratogenicity, nephrotoxicity, hepatoxicity, reproductive disorders, and immunosuppression. Charmely *et al.* (1995) and Garcia *et al.* (1997) evidenced that economic losses occur at all levels of food and feed production, including crop and animal production, processing, and distribution. Even during favorable climatic periods, millions of dollars are lost as a consequence of crop contamination. For all these reasons, prevention, decontamination, and detoxification of mycotoxins have been considered issues of great importance.

A variety of physical, chemical and biological approaches to counteract the aflatoxin problem have been reported by (Ramos and Hernandez., 1991).

Many specialists are of the opinion that the best approach for decontamination should be degradation by biological matters giving a possibility for removal of aflatoxin (AF) under mild condition, without using harmful chemicals and without significant losses in nutritive value and palatability of detoxified feed and feedstuffs (Bata and Lasztity, 1999).

Among the natural oxidizing agents, plant peroxidases such as lignin peroxidase from white rot fungi, *Phanerochaete chrysosporium*, has been reported to oxidise a wide range of toxins, including polycyclic aromatics and polychlorinated phenols (Georgiou, 1987).

Recent studies made with *Saccharomyces cerevisiae* (SCE) also showed significant improvements on food consumption, body-weight gain and feed conversion ratio in aflatoxicosis cases in quail chicks (Yildirim and Parlat, 2003). The beneficial effects of SCE have been later attributed to mannan oligosaccharide (MOS) derived from cells wall of SCE. MOS also showed considerably high binding ability (80 to 97%) with AF *(Mahesh and Devegowda, 1996)* and it has been preferred for detoxification of AF in poultry species.

Studies have never stopped to evaluate the efficacy of the available detoxification methods and to develop recent innovations in this field to reduce the bioavailability of mycotoxins to poultry and farm animals.

This research was designed to investigate the response of a local Egyptian chicken strain (Inshas) to aflatoxicosis and the effectiveness of using three anti-aflatoxic agents in AF-contaminated diets either singly or in combination. The three agents investigated are hydrated sodium calcium aluminosilicate (HSAS), Mannan oligosaccharide (Bio-Mos®) and Radish extract (RE).

MATERIALS AND METHODS

The current study was carried out at the Poultry Research Station and the laboratories belonging to the Animal and Poultry Research Institute, Agricultural Research Center, Ministry of Agriculture during the period from 1st of June to the last of November 2005.

A total number of 810 unsexed vaccinated Inshas day-old-chicks were weighed, wing banded and randomly divided into nine experimental groups of 90 chicks each (three replicates / each group). The chicks were housed in floor pens with an evenly decreasing day length from 24 hours in the first week to 11 hours at growing period (13-20wk) then 17 hours at laying period (21-28wk). The composition of experimental diets offered to

chicks at starter (4-12 wk), grower (13-20 wk) and layer (21-28 wk)are listed in Table(1). The birds were placed in a room maintained at a constant temperature of 28±3 °C and a relative humidity of 70±3% .Food and water were always available *ad libtum*. Body weight, body weight gain and average feed consumption were determined individually to the nearest gram at four weeks intervals up to the 28th week of age, also feed conversion was determined. At 6th wk of age internal organs (spleen, bursa of Fabricious and thymus gland) were collected carefully, weighed and calculated as a percentage of body weight. Liver, meat and egg samples were analyzed for aflatoxin content methods according to Association of Official Analytical Chemists (A.O.A.C, 2000) methods. The results obtained were statistically analyzed using the general linear model procedure of the SPSS programme (SPSS ,1988). Comparison among treatment was mode using Duncan's Multiple Range Test (Duncan, 1955). Statements of statistical significance are based on ($P<0.05$).

Protection percentage:

For any parameter studied, to compare the anti-aflatoxic effects achieved by the different agents studied, a protection percentage was calculated as follows;

$$\text{Protection percentage} = \frac{X-Y}{Y} \times 100$$

where, X = change of AF – group (T1) from control (T9),
and Y = change of any other group (T2,.....T8) from control.

Experimental design:

The experimental design consisted of nine dietary treatments as follows:

Treatment	Type of treatment
T1	**Basal diet + AF (1.0mg total AF/kg diet)**
T2	**Basal diet + AF + Bio-mos (1.0g/kg diet)**
T3	**Basal diet + AF + RE(10g/kg diet)**
T4	**Basal diet + AF + HSCAS(0.5%)**
T5	**Basal diet + AF+ Bio-mos + RE**
T6	**Basal diet + AF + Bio-mos +HSCAS**
T7	**Basal diet + AF + RE + HSCAS**
T8	**Basal diet + AF + Bio-mos + RE + HSCAS**
Control	**Basal diet (control)**

AF (aflatoxin); Bio-mos (mannan oligosaccharide); RE (radish extract); HSCAS (hydrated sodium calcium aluminosilicate). The chicks were maintained on these treatments from 4 weeks to 28 week of age.

Available culture of *Aspergillus parasiticus* NRRL 2999 (Poultry Science Dept. Maryland Univ., USA) was used for the production of aflatoxin on rice by the method of Shotwell *et al.* (1966) and as modified by West *et al.* (1973).

The **MOS** preparation used in these studies was the commercial product Bio-Mos ® produced by Alltech, Nichola Siville, Kentucky, USA. It was supplied at the rate of 1.0g/kg of feed equivalent and mixed. The product contains yeast cell wall fragments derived from *Saccharomyces cerevisiae*. The cell wall fragments are obtained by centrifugation from a yeast culture. The pellet containing the yeast cell wall fragments is then washed and spray dried.

Radish extract (RE) was prepared by cutting the root of radish into chips and then processed in a blender, Braun multipress MP32, Germany. The juice was collected in glass

cups and then mixed with the experimental diet at the rate of 10g/kg diet.

HSCAS is a commercial product of the Integrated World Enterprises Co. USA was used. The chemical composition of HSCAS was detailed (analyzed by manufacturer) as follows: Silcon oxide (64.7%), Aluminum oxide (15.5%), Oxides of Iron, Magnesium, Calcium, Sodium, Potassium (8.89%) and moisture (10.9%). HSCAS was white crystals, fine powder and usually added to the diet (0.3 to 0.5%) as recommended by the manufacturer. In this study, HSCAS was added at the rate of 0.5 %.

RESULTS AND DISCUSSION

Body weight:

Data presented in Table (2) shows the effect of the different dietary treatments on live body weight (LBWT).

Birds fed the AF-supplemented diet showed dramatically ($P \leq 0.001$) suppressed LBW and BWG since the first month of treatment onwards. At the end of the 16 th wk of treatment, average live body weight change of AF-treated birds hardly reached (45.2 %) of the control group.

Generally, it could be seen that the three AF-detoxifying agents applied and their combinations significantly ameliorated the deleterious effect of AF on LBWT. However, the three agents significantly varied ($P \leq 0.001$) regarding to their protective efficacy. MOS preparation has the greatest detoxifying capability compared to the other agents and causing more than (95%) protection recorded at the end of the treatment period. In this respectivelyect , the protection percentage due to HSCAS inclusion was about (72.2 %) followed by that for RE (65.7 %).

On the other hand, adding MOS preparation in combination with HSCAS or using the three agents together impaired the beneficial effect of MOS preparation alone. When MOS was added together with RE to the aflatoxicated diet no ultra-beneficial effect could be obtained as compared to adding MOS. Similar results have been reported by many other researchers (Verma *et al.*, 2004; Hassan, 2005 and Qota *et al.*, 2005).

Mechanisms suggested for the deleterious effect of AFB1 on body weight include inhibition of ribonucleic acid (dRNA) and deoxyribonucleic acid (DNA) synthesis (Rogers and Newberne, 1967), as well as decreased RNA polymerase activity (Gelboin *et al.*, 1966). Consequences of partial inhibition of RNA and DNA synthesis involve reduced protein synthesis, which would depress growth.

Feed conversion:

Results in Table (3) indicated that birds fed AF-treated diets recorded the worst feed conversion while, birds fed AF-treated diets and supplemented with AF-detoxifying agents (MOS,RE or MOS+RE) recorded the best feed conversion compared with the other treatments and equal feed conversion to the control group. This may be due to the decrease of the amount of feed consumption and body weight gain

Relative weight of internal organs:

Lymphoid organs:

Bursa of Fabricius (BF): Results in Table (4) proved that after 2 wks of feeding the birds AF- contaminated diet, the relative weight was significantly reduced to reach about 33% of its value in control group. Adding MOS to AF- contaminated diet was found to help in overcoming this negative effect of AF. The relative weight of the bursa in birds

treated with AF + MOS was insignificantly different from the control group. In this respectively, the addition of RE or HSCAS to AF-contaminated diet resulted in relative improvement and the BF weight came in the middle between the values obtained in AF- and control groups, but did not significantly differ from any of them. In case of AF+ RE groups the relative weight of bursa was about 66% of control and nearly double that of AF- group records. Correspectivelyonding values for HSCAS groups were 60% and 180% respectively. The best results were obtained with AF+ MOS+ RE group which reached 370% of AF-group and 123% of control, meanwhile the least effective combination was AF+RE+HSCAS being about 190% of AF- group and 63% of control records. The addition of MOS+RE+HSCAS to AF-contaminated diet gave the same effect obtained when MOS was added alone.

The thymus: Results in Table (4) showed that feeding birds AF- contaminated diet lead to a significant atrophy of these glands throughout the whole experiment. The relative weight of the glands in AF-treated birds was only about 32-94.2% of that for control. The three anti-aflatoxin agents applied caused variable levels of protection against the toxin. After 2 wks of treatment the highest protection rate was obtained with (AF + MOS) and (AF + MOS + RE +HSCAS) groups (= 94.2) followed by (AF + MOS + HSCAC) and (AF + MOS + RE) consequently (= 88.4% and 78.2%, respectively) and the least values were seen in groups received the AF- contaminated diet provided with RE and/or HSCAS.

The spleen: Results in Table (4) after 2 wks of consuming the AF-contaminated diet the relative weight of the spleen reached about double the normal value of control birds. All the additives studied completely or partially ameliorated this negative effect of AF on the spleen and the protection percentage values ranged between 122% (AF + HSCAS group) and 67% (AF + RE group), but in general the best results were observed in groups given MOS alone or together with the other two agents being 96.3% , 111%, 100% and 111% for (AF + MOS), (AF + MOS + RE), (AF + MOS + HSCAS) and (AF + MOS + RE + HSCAS), respectively.

Dietary AF was found to cause a significant atrophy of bursa of Fabricius and thymus glands. Meanwhile, it resulted in enlargement of the spleen. The atrophy of bursa of Fabricius has also been reported by (Azzam and Gabal, 1997 and Peroz and Rivera, 2003). Reduced thymus relative weight was previously observed by Raju *et al.* (2005) and Qota *et al.* (2005). It has been postulated that the loss of weight and regression of bursa of Fabricius and the thymus could be the result of loss of lymphoid tissue and infolding of epithelium, and in the thymus there is a loss of cortex (Riddell, 1987). Spleenomegaley due to dietary AF has been mentioned by Kubena *et al.* (1998).

The gross enlargement of the spleen may indicate the incidence of destruction of lymphocytes followed by edema within and around follicles and in some cases by associated hemorrhage. In addition, an increase in germinal centers and pyroninophilic cells in the spleen is observed (Riddell, 1987).

The Liver: Like the response observed with the spleen, dietary AF caused significant hepatomegaly throughout the experiment where the relative weight of the liver in birds fed AF-contaminated diet reached 140.7% (after 2wk) of control values Table (6). The beneficial effects of the 3 agents studied to overcome the negative effects of AF were clear since the first weeks of the experiment. After two weeks of treatment, the protection percentage ranged between 64.5% and 90.9% with no significant differences among the three agents or their combinations.

Results obtained herein confirm those reported by Verma *et al.* (2004) who concluded that AFB1 caused increased liver relative weight.

The increase in the relative weight of livers induced by AF has been attributed to the increase in accumulation of liver fat contents as a result of interference of aflatoxin with lipid metabolism (Qota, 2003), which produces the characteristic, enlarged, friable, fatty livers associated with aflatoxicosis in broiler (Ibrahim *et al.*, 1998).

Residual AF in the liver, muscles and eggs:

Samples analyzed at the end of the experiment for residual AF showed that AF was mostly accumulated in the liver and eggs, while muscles gave negative results, nearly free from AF Table (5). There are great variation in the results of previous workers regarding to the values of residual AF in the different body tissues of birds (Abusree *et al.*, 1999; Arulmozhi *et al.*, 2002; Oliveira *et al.*, 2003).

These highly inconsistent findings could be probably due to (a) naturally contaminated feeds or to diets containing different aflatoxin varieties, with different levels of toxicity; (b) the different techniques applied to detect the residual AFB1 and /or its metabolites as well as (c) species of birds investigated.

Both MOS (T2) and HSCAS (T4) caused 100% protection against accumulation of AF detected in T1. The least protection values were those caused by RE alone (T3) or combined with HSCAS (T7) in case of liver being 29.1% and 31.4% respectively.

In egg samples, protection was 100% except for T3, T5 and T7 being 28.6%, 64.3% and 66.1% respectively.

Immune response:

Results concerning immune response of birds against Lasota as influenced by the different dietary treatments are given in Table (6).

It is clearly evident that AF significantly impaired the natural immunity of birds against viral invasions. Average antibody titer records in AF-treated groups (T1) was always significantly less than those for control groups reaching about 30-37% of it.

All additives investigated (except T7) overcame this negative effect of AF and lead to a protection percentage ranging between 57% and 75% (primary) and about 72% - 87% (secondary) with MOS groups (T2, T5, T6, T8). The lowest protection percentage was that for RE + HSCAS (T7) and RE (T3) groups giving only 25% and 50% (primary) and 28.3% and 43.5% (secondary) protection, respectively.

The immunosuppressive effect of aflatoxin has been related to its direct inhibition of protein synthesis, including those with specific functions such as immunoglobulins IgG, IgA, inhibition of migration of macrophages, interference with the hemolytic activity of complement, reduction in the number of lymphocytes through its toxic effect on the bursa of Fabricius and impairment of cytokines formation by lymphocytes (Campbell *et al.*, 1983; Azzam and Gabal, 1998).

In conclusion, using anti-AF agents (MOS, HSCS or their combination) in poultry diets have beneficial effects in ameliorating the adverse effects resulting form AF administration.

REFERENCES

Abusree, Y. H., S. G. K. Genedy, N. M. El-Naggar, and E. M. A. Qota (1999). Effect of feeding aflatoxin diets with and without decontaminating a genets on its residues in tissues, reproductively and semen quality of local chicken strains. Egypt. Poult. Sci., 19 (II): 379-394.

Arulmozhi, A., K. Varghese, P.K. Ismadl, P. A. Peethambarar, and K. M. Ramachandran (2002). Aflatoxin residues in tissues of broiler chicken. Indian Vet. J., 79 : 901-903.

Association of Official Analytical Chemists (2000). Official Methods of Analysis. 17th Assoc, Office. Anal., Chem.. Maryland, USA.

Azzam, A. H., and M. A. Gabal (1997). Interaction of aflatoxin in the feed and immunization against selected infections diseases. 1. Infectious bursa disease. Avian Pathology, 26: 317-325.

Azzam, A. H., and M. A. Gabal. 1998. Aflatoxin and immunity in layer hens. Avian Pathology. 27: 570-577.

Bata, A., and R. Lasztity (1999). Detoxification of mycotoxin- contaminated food and feed by microorganisms. Trends in Food Science and Technology. 10: 223:228.

Campbell, M. L., JR, J. D. may, W. E. Huff, and J. A. Doerr. 1983. Evaluation of immunity of young broiler chickens during simultaneous aflatoxicosis and ochratoxicosis. Poult. Sci. 62: 2138-2144.

Charmely. L. L., H. L. Trenholm. D. B. Prelusky, and A. Rosemburg (1995). Economic losses and decontamination. Nat. Toxins, 3: 199-203.

Duncan, D. B.(1955). Multiple rang and multiple F-test. Biometrics, 11: 1-42.

Galvano, F., A. Piva, A. Ritieni, and G. Galvno (2001). Dietary strategies to counteract the effects of mycotoxins: Areview. Journal of Food Protection, 64: 120.131.

Garcia, R. P., C. L. Padilla, M. Sidik, B. M. Rejesus, R. P. Garcia, B. R. Champ, M. Bengston, O. S. Dharmaputa, and H. Halid (1997). Mycotoxins and its significance in the implementation of general agreement on tariff and trade (GATT). In proceedings of the Symposium of Pest Management for Stored Food and Feed, Bogor, Indonesia, September 5-7th 1995. Biotrop Special Publication 59: 33-51.

Gelboin, H. V., J. S. Wortham, R. G. Wilson. M. A. Fredman, and G. N. Wogan (1966). Rapid and marked inhibition of rat liver RNA polymerase by aflatoxin B1. Science, 154:1205-1206.

Georgiou, G. (1987). Fungal enzymatic process for detoxification of hazardous waste site chemicals. Am. Chem. Soc., 30 : 197-203.

Hassan, R. A. (2005). Capability of mannan-oligosaccharide (Bio-Mos®), organic selenium and hydrated sodium calcium aluminosilicate to detoxify aflatoxicosis for growing local chickens.1. Performance, some internal organs and blood constituents.27-29 September 2005 Sakha, Kafr El-Sheikh, Egypt.559-574.

Ibrahim, I. K., K. M. T. Al- Joubory, and A. M. Shareef (1998). Reducing aflatoxicosis in growing chicks by dietary sodium bentonite. IPAJ. Agric. Res., 69 : 119-122.

Kubena, L.F., R.B. Harvery, R.H. Balley , S.A. Buckley, and G.E. Rottinghaus (1998). Effects of a hydrated sodium calcium aluminosilicate (T-Bind™) on mycotoxicosis in young broiler chickens. Poult. Sci., 77:1502-1509.

Mahesh, B. K., and G. Devegowda (1996). Ability of aflatoxin binders to bind aflatoxin in contaminated poultry feed – an *in vitro* study- proceedings of the 20th Worlds Poultry Congress, New Delhi, 4: 296.

NRC. (1994). Nutrient requirements of poultry. 9th ed. Natinal Acadeny press, Washigton, D. C., U. S. A.

Oliveira, C. A. F., J. F. Rosmaninho , A. L. Catro, P.Butkeraitis, T. A. Reis, and B. Correa (2003). Aflatoxin residues in eggs of laying Japanese qualifier long-Term administraction of rations containing low levels of aflatuxin B1. Food. Additives and Contaminants, 20 (7): 648-653.

Perozo, F., and S. Rivera (2003). Effect of aflatoxin B_1 exposure and selenium supplementation on immune response in broilers. Indian Vet., J. 80: 1218-1221.

Qota, E. M. A. (2003). Hydrated sodium calcium aluminosilicate effects on some mineral and vitamin status during aflatoxicosis in growing turkey. J. Agric. Sci. Mansoura .Univ., 28 (3): 1729-1743.

Qota, E. M. A., M. N. Ali, R. A. Hassan, and M. K. Abou- Elmagd (2005). Detoxification of aflatoxin contaminated local chickens diets using aluminosilicate, sodium sup hate and peroxidese enzyme. 3rd international poultry conference 4-7 Apr. 2005 Hurghada , Egypt , 303-325.

Raju, M. V. L. N., S. V. Rama-Rao, K. Radhika, and A. K. Panda (2005). Effect of amount and source of supplemental directory vegetable oil on broiler chickens exposed to aflatoxicosis. Bri. Poult. Sci. ,46 (5) : 587-594.

Ramos, A. J., and E. Hernondez (1991). Reduction delusiveness deaflatoxins Y otars micotoxinas enalimentos mediante meto dos Fisicos, quimicos Y biologicos. Alimentaria, 225: 45-55.Cited by Ramos, A. J.and E. Hernondez. 1997.

Ramos, A. J., E. Hernondez (1997). Prevention of aflatoxicosis in farm animals by means of hydrated sodium calcium aluminosiocate addition to feedstuffs : A review. Animal Feed Science. Technology. 65: 197-206.

Riddell, C. (1987). Avian histopathology. By American Association of Avian pathologists . Inc. All. Rights reserved.

Rogers, A. E., and P. M. Newberne (1967). The effects of aflatoxin B1 and dimethylsufoxide on thymidine uptake and mitosis in rat liver. Cancer Res. 27:855-864.

Shotwell, O. L., C. V. Hesseltine, R. D. Stubblefield, and W. G. Sorenson (1966). Production of aflatoxin on rice. Appl. Microbi., 14: 425-429.

SPSS, (1988) SPSS /PC+ V. Z. O. for the IBM Pc/ XT / AT and PS / Z. Marija and Morusis. Chicago, IL : Soil. Science Society of America, Inc.

Verma, J., T. S. Johri, B. K. Swain and S. Ameena (2004). Effect of graded levels of aflatoxin, ochratoxin and their combinations on the performance and immune response of broilers. Bri. Poult. Sci., 45 (4): 512-518.

West, S. W., R. D. Wyatt, and P. B. Hamilton (1973). Improved yield of aflatoxin by incremental increase of temperature. Appl. Microboil. 25: 1018-1019.

Yildirium, J., and S. S. Parlat (2003). Effects of dietary addition of live yeast (*Saccharomycas cerevisiae*) on hatching traits, testis and ovary weights of Japanese quail (Coturrix coturnix Japonica) in aflatoxicosis. Archiv fur Geflug el kunde. 67:208-211.

Table (1): Composition and calculated analysis of experimental diets.

Ingredients,%	Starter 4-12 wk	Grower 13-20 wk	Laying 21-28 wk
Yellow corn	62.3	63.7	63.00
Soybean meal (44%)	32.1	17.6	27.1
Wheat bran	---	15.1	---
Dicalcium phosphate	1.9	1.0	1.8
Limestone	1.8	0.74	6.7
Premix*	0.3	0.3	0.3
NaCl	0.3	0.3	0.3
DL-Methionine	0.1	0.07	0.14
Sand	1.2	1.19	0.66
Total	**100**	**100**	**100**
Calculated analysis**			
Crude protein, %	19.66	15.76	17.52
ME (kcal/kg)	2806.56	2725.30	2718.51
Calcium, %	1.20	0.88	3.02
Available phosphorus, %	0.45	0.40	0.40
Methionine ,%	0.44	0.34	0.44
Lysine,%	1.09	0.76	0.95
CF,%	3.71	4.34	3.36

**Vitamin and mineral premix was added as 3 kg/ton of diet and supply 1 kg of diet with: Vitamin A 12000 IU;Vit. D 2200 IU; Vit.E 10 mg; Vit k3 2mg; Vit B1 1mg; Vit B2 5mg; Vit B6 1.5 mg Vit B12 10 Mcg; Nicotinic acid 30 mg; Folic acid 1 mg; Pantothenic acid 10 mg; Biotin 50 Mcg; Choline chloride 500 mg; Copper 10 mg; Iron 30 mg; Manganese 60 mg; Zinc50 mg; Iodine 1mg; Selenium 0.1mg and Cobalt 0.1mg.*

***Calculated according to NRC (1994).*

Table (2): Effect of mannanoligosaccharide (MOS), radish extract (RE) and hydrated sodium calcium aluminosilicat (HACAS) and their Combinations on live body weight (g) of birds fed diet containing 1 mg total aflatoxin (AF)/ kg diet.

Treatment	Average body weight (g)					Change from control 16 wks of Treatment	Protection% 16 wks of treatment
	Initial BWT (4wks of age)	4 wks of treatment (8wks of age)	8 wks of treatment (12wks of age)	12 wks of treatment (16wks of age)	16 wks of treatment (20wks of age)		
T1 (AF)	167.6±6.09	370.7±7.19^{C}	662.4±16.23^{D}	896.2±32.37^{D}	997.2±22.41^{E}	-45.2	0
T2 (AF+MOS)	169.2±5.92	489.2±13.58^{A}	877.0±20.26^{B}	1460.6±28.75^{AB}	1780.0±71.91^{AB}	-2.19	95.15
T3 (AF+RE)	164.2±5.09	429.2±14.86^{B}	752.7±17.67^{C}	1189.2±53.13^{C}	1537.7±58.73^{CD}	-15.5	65.70
T4 (AF+HSCAS)	164.9±5.19	435.1±14.26^{B}	773.8±33.44^{C}	1190.0±73.96^{C}	1591.4±75.57^{C}	-12.56	72.23
T5 (AF+MOS+RE)	165.8±3.92	485.2±14.55^{A}	860.6±23.75^{B}	1367.6±35.91^{AB}	1667.5±61.44^{AB}	-8.37	81.46
T6 (AF+MOS+HSCAS)	164.7±5.91	476.2±14.49^{A}	870.4±18.59^{B}	1380.0±46.42^{AB}	1603.3±62.06^{BC}	-11.9	73.67
T7 (AF+RE+HSCAS)	168.7±3.99	413.6±7.40^{B}	741.3±2.69^{C}	1102.1±24.18^{C}	1394.0±64.62^{D}	-23.4	48.22
T8 (AF+MOS+RE+HSCA	165.5±6.37	485.7±12.52^{A}	871.7±24.14^{B}	1342.7±37.48^{B}	1620.0±43.48^{BC}	-10.98	72.69
Control	164.1±6.04	513.5±9.87^{A}	933.0±16.24^{A}	1493.3±42.48^{A}	1820.0±58.80^{A}	0	100

A,B,...: Means in the same column followed by different letters are significantly different at P≤0.05.

Table (3): Effect of mannanoligosaccharide (MOS), radish extract (RE) and hydrated sodium calcium aluminosilicat (HACAS) and their combinations on feed conversion at different ages of birds fed diet containing 1 mg total aflatoxin (AF) /kg diet.

Treatment	Feed conversion (g. feed/ g. gain)				Total feed conversion	Change from control %	Protection %
	4 -0wks age of 4 wks of treatment	4 -0wks age of 8 wks of treatment	4 -0wks age of 12wks of treatment	4 -0wks age of 16wks of treatment			
T1 (AF)	4.6±0.15^{A}	4.4±0.31^{A}	7.6±1.30^{A}	7.0±0.46	4.5±0.22^{A}	-40.6	0
T2 (AF+MOS)	3.7±0.15^{C}	3.3±0.17^{B}	2.8±0.18^{B}	8.8±1.70	2.9±0.13^{C}	9.3	120
T3 (AF+RE)	3.6±0.17^{C}	4.4±0.50^{A}	4.3±0.58^{B}	6.4±1.02	3.1±0.21^{BC}	3.1	106.6
T4 (AF+HSCAS)	4.3±0.31^{AB}	3.9±0.31^{AB}	3.8±0.29^{B}	6.5±0.89	3.2±0.18^{BC}	0	100
T5 (AF+MOS+RE)	3.6±0.19^{C}	3.4±0.15^{B}	2.9±0.15^{B}	6.4±1.00	3.0±0.12^{C}	6.2	113.4
T6 (AF+MOS+HSCAS)	3.9±0.29^{Bc}	3.4±0.17^{B}	3.2±0.27^{B}	9.5±1.66	3.3±0.18^{BC}	-3.1	93.4
T7 (AF+RE+HSCAS)	3+0.16^{ABC}	3.7+0.10^{AB}	4.3+0.28^{B}	7.9+1.48	3.7+0.17^{B}	-15.6	66.7
T8 (AF+MOS+RE+HSCAS)	3.7±0.12^{C}	3.8±0.31^{AB}	3.2±0.16^{B}	8.6±0.87	3.3±0.09^{BC}	-3.1	93.4
Control	3.6±0.14^{C}	3.5±0.19^{B}	3.2±0.22^{B}	6.4±0.29	3.2±0.15^{BC}	0	100

A,B,...: Means in the same column followed by different letters are significantly different at P≤0.05.

Table (4): Relative weight (mean ± S.E) of liver, spleen, thymus and bursa of Fabricius) as influenced by dietary AF and the treatment with each of Bio-mos, RE, HSCAS and their combinations.

Treatment	At the age of 6 wk after (2 wk of treatment)			
	Liver	Spleen	Thymus	Bursa
T1 (AF)	3.8 ± 0.15^{A}	0.55 ± 0.24^{A}	0.22 ± 0.05^{D}	0.10 ± 0.05^{C}
T2 (AF+MOS)	3.0 ± 0.19^{B}	$0.29\pm0.05_{B}$	$0.65\pm0.22_{A}$	0.27 ± 0.14^{AB}
T3 (AF+RE)	3.0 ± 0.42^{B}	0.37 ± 0.14^{B}	0.40 ± 0.12^{CD}	0.20 ± 0.07^{BC}
T4 (AF+HSCAS)	2.9 ± 0.20^{B}	0.22 ± 0.14^{B}	0.44 ± 0.20^{BC}	0.18 ± 0.13^{BC}
T5 (AF+MOS+RE)	2.77 ± 0.23^{B}	0.25 ± 0.06^{B}	0.54 ± 0.11^{ABC}	0.37 ± 0.53^{A}
T6 (AF+MOS+HSCAS)	2.8 ± 0.31^{B}	0.34 ± 0.11^{B}	0.61 ± 0.18^{AB}	0.27 ± 0.14^{AB}
T7 (AF+RE+HSCAS)	3.1 ± 0.45^{B}	0.28 ± 0.14^{B}	0.41 ± 0.24^{BCD}	0.19 ± 0.05^{BC}
T8 (AF+MOS+RE+HSCAS)	2.8 ± 0.47^{B}	0.25 ± 0.14^{A}	0.65 ± 0.15^{A}	0.27 ± 0.17^{AB}
Control	2.7 ± 0.38^{B}	0.28 ± 0.06^{B}	0.69 ± 0.07^{A}	0.30 ± 0.05^{AB}

A,B,..: Means in the same column followed by different letters are significantly different at P≤0.0

Table (5): Effect of mannanoligosaccharide (MOS), radish extract (RE) and hydrated sodium calcium aluminosilicat (HACAS) and their combinations on the residual AF of birds fed diet containing 1 mg total aflatoxin (AF) kg-1 diet

Treatment	Liver (ppb)	Egg (ppb)	Muscles (ppb)
T1 (AF)	23.33 ± 1.92^{A}	38.03 ± 1.15^{A}	undetectable
T2 (AF+MOS)	undetectable	undetectable	undetectable
T3 (AF+RE)	16.55 ± 1.14^{B}	27.16 ± 0.58^{B}	undetectable
T4 (AF+HSCAS)	undetectable	undetectable	undetectable
T5 (AF+MOS+RE)	1.07 ± 0.58^{C}	13.58 ± 0.58^{C}	undetectable
T6 (AF+MOS+HSCAS)	2.06 ± 0.58^{C}	Undetectable	undetectable
T7 (AF+RE+HSCAS)	16.00 ± 0.58^{B}	12.88 ± 0.58^{C}	undetectable
T8 (AF+MOS+RE+HSCAS)	15.00 ± 0.58^{B}	undetectable	undetectable
Control	undetectable	undetectable	undetectable

A,B,...: Means in the same column followed by different letters are significantly different at P≤0.05.

Table (6): Effect of mannanoligosaccharide (MOS), radish extract (RE) and hydrated sodium calcium aluminosilicat (HACAS) and their combinations on the immune response antibody titre against Lasota of birds fed diet containing 1 mg total aflatoxin (AF) kg-1 diet.

Treatment	Before vaccination	After 7 days	After 15 days
T1 (AF)	1.3 ± 0.33^{D}	2.0 ± 0.58^{D}	2.7 ± 0.33^{E}
T2 (AF+MOS)	3.3 ± 0.33^{AB}	4.3 ± 0.33^{ABC}	6.3 ± 0.33^{AB}
T3 (AF+RE)	1.7 ± 0.33^{CD}	4.0 ± 0.58^{BC}	4.7 ± 0.33^{CD}
T4 (AF+HSCAS)	2.3 ± 0.33^{BCD}	4.7 ± 0.33^{ABC}	5.7 ± 0.33^{BC}
T5 (AF+MOS+RE)	2.7 ± 0.33^{BC}	4.7 ± 0.67^{ABC}	6.7 ± 0.58^{ABC}
T6 (AF+MOS+HSCAS)	2.3 ± 0.33^{BCD}	$4.3\pm0.33A^{BC}$	6.0 ± 0.33^{AB}
T7 (AF+RE+HSCAS)	1.3 ± 0.33^{D}	3.0 ± 0.58^{CD}	4.0 ± 0.58^{DE}
T8 (AF+MOS+RE+HSCAS)	3.3 ± 0.33^{AB}	5.0 ± 0.58^{AB}	6.0 ± 0.58^{ABC}
Control	4.3 ± 0.33^{A}	6.0 ± 0.58^{A}	7.3 ± 0.67^{A}

A,B,... Means in the same column followed by different letters are significantly different at P≤0.05.

تأثير بعض الإضافات الغذائية الطبيعية على الكفاءة الإنتاجية، بعض القياسات الفسيولوجية و الاستجابة المناعية للدجاج النامي المغذى على علائق تحتوى على سموم فطرية

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استخدم عدد ٨١٠ كتكوت أنشاص عمر يوم وزعت على ٩ معاملات تجريبية وكل معاملة تحتوى على ٩٠ كتكوت فى ٣ مكررات وكانت مدة التجربة ٢٥ أسبوع(٤- ٢٨ أسبوع) لدراسة

١. مدى تأثر كتاكيت السلالات المحلية المصرية (أنشاص) بالتسمم الفطري الغذائي.
٢. مدى فاعلية استخدام ثلاث مواد مضادة للسموم الفطرية تختلف فى طريقة فعلها. والمواد الثلاثة التي شملتها الدراسة هي:

أ - سليكات الصوديوم والكالسيوم والألمونيوم (HSCAS) كمادة إدمصاص للسموم الفطرية.

ب - مانان عديد التسكر (Bio – Mos (R)) كمادة ذات أصل بيولوجي

جـ- عصارة درنات الفجل (RE) كمادة مضادة للأكسدة غنية فى محتواها من إنزيم البيروكسيديز.

وقد اشتملت التجربة على(٩) معاملات غذائية هي كما يلي:-

المعاملة الأولى: أعطيت العليقة الأساسية + الأفلاتوكسين (١.٠ مللجم/كجم عليقه).

المعاملة الثانية: أعطيت العليقة الأساسية + الأفلاتوكسين + Bio – Mos (١.٠جم/كجم عليقه)

المعاملة الثالثة: أعطيت العليقة الأساسية + الأفلاتوكسين + RE (١٠.٠ جم/كجم عليقه)

المعاملة الرابعة : أعطيت العليقة الأساسية + الأفلاتوكسين + HSCAS (٠.٥٪)

المعاملة الخامسة: أعطيت العليقة الأساسية + الأفلاتوكسين + Bio –Mos + RE.

المعاملة السادسة : أعطيت العليقة الأساسية + الأفلاتوكسين + HSCAS.

المعاملة السابعة : أعطيت العليقة الأساسية + الأفلاتوكسين + HSCAS + RE.

المعاملة الثامنة : أعطيت العليقة الأساسية + الأفلاتوكسين + HSCAS +RE + Bio-Mos

المعاملة التاسعة: وهى المجموعة المقارنة حيث أعطيت العليقة الأساسية فقط دون أى إضافات.

وقد تم خلال التجربة دراسة الصفات التالية : وزن الجسم الحي ، معدل استهلاك الغذاء ، كفاءة التحويل الغذائي ، الوزن النسبي لبعض الأعضاء الداخلية (كيس فابريشيوس ، غدة الثيموس ، الطحال ، الكبد والاستجابة المناعية ضد فيروس النيوكاسل ، نسبة الأفلاتوكسين المتبقى فى كل من الكبد والعضلات و البيض.

ويمكن تلخيص أهم النتائج المتحصل عليها في النقاط التالية :

١. أثرت تغذية الطيور على علائق ملوثة بالفلاتوكسين تأثيرا سلبيا على كافة الصفات المدروسة.

٢. أدى استخدام المواد الثلاثة المدروسة معنويا إلى تخفيف هذه الآثار السلبية لدرجة كبيرة.

٣. في معظم الصفات كانت أفضل الصفات الوقائية تلك التي نتجت عن استخدام Bio-Mos وتوليفاته يلي ذلك HSCAS.

٤. ظهر أن آثار درنات الفجل كانت أقل المواد المدروسة فاعلية.

٥. في كثير من الحالات أظهرت عصارة درنات الفجل فعلا مضادا لكل من Bio – Mos او HSCAS.

و بناءاً على النتائج التى حصلت إليها هذه الدراسة يمكن التوصية باستخدام Bio – Mos إذا ما كان متاحاً كمادة وقائية و فعالة فى حالات تلوث العلائق بالأفلاتوكسينات ويليه فى الفاعلية HSCAS ز هذا ولم يكن هناك ميزة إضافية لإستخدام المركبين معاً فى معظم الصفات و ذلك عند الأخذ فى الإعتبار الجانب الإقتصادى كذلك أوصى الباحث بأنة فى المناطق التى يتوافر بها الفجل بكميات كبيرة وبتكلفة محدودة يمكن تقطيع وفرم جزورة وتقديمه طازجا للطيور كإضافة غذائية وقائية لما يحتوية من إنزيمات متعدده الفوائد.