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REDUCING THE TOXICITY OF AFLATOXIN B_1 BY DIFFERENT ADSORBENTS IN FISH

Shehata, S.A. *; M.S. Mohamed and G.A. Mohamed****
* Animal Production Department, Fac. of Agric., Zagazig Univ., Egypt
** Aquaculture Research Lab. Abbassa, Abo-Hamad, Egypt

ABSTRACT

Reduction of aflatoxicosis in Nile tilapia (*Oreochromis niloticus*) fish was exmined by adding eight commercial adsorbents from Egyptian market to aflatoxin B_1 contaminated diets in a feeding trial for 8 weeks. Twenty hundred and ten growing Nile tilapia (*Oreochromis niloticus)* fish were assigned to ten experimental diets. There were 3 replicate glass aquariums of 7 fish / replicate. The 1st diet served as a control (commercial diet) (C), the 2nd one was contaminated with 9 mg aflatoxin B_1 / Kg diet (A) and the other experimental diets contained the same level of aflatoxin B_1 plus 0.5% of adsorbents from I to VIII . Adsorbent I was modified yeast cell wall, II was bentonite, III was tri - star , IV was mycobond, V was egy - tox, VI was moldstop super, VII was fungstat-k and VIII was moldstop mycobind plus.

Aflatoxin B_1 caused significantly ($P \leq .05$) loss in live body weight which was 6.09; 11.25; 17.34 and 22.87% of the treated fish at 2 , 4 , 6 and 8 weeks, respectively. Mortality rate increased significantly ($p \leq 0.05$) (47.62 % versus 4.76% for the control) by aflatoxin. Also, aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activites increased significantly by aflatoxin but the total protein and albumin decreased.

Adding the adsorbents caused significantly ($P \leq .05$) reduce the toxic effect of aflatoxin on loss of body weight (the improvement ranged from 14.53 to 95.57%) according to the kind of adsorbent and experimental duration. Also significantly ($P \leq .05$) decrease in the mortality rate and improved the blood parameters ($p \leq 0.05$) were caused by adsorbents.

These results suggested that adding adsorbents specially adsorbent IV (Mycobond) and VI (mold stop super) to fish diet contaminated with aflatoxin B_1 had benifical effects in fish feeding.

INTRODUCTION

Aflatoxins are mycotoxins produced as secondary metabolites by *Aspergillus flavus* and *Aspergillus parasitcus* (Cheeke and Shull,1985).Todays it is estimated that mor than 25% of the world cereals are contaminated with know mycotoxins (Devegowda *et al.*, 1998). In Egypt, the aflatoxins and other mycotoxins are frequently detected in feedstuffs (Abdelhamid, 1990 &1993a, Abdelhamid *et al.*,1996 and Aziz *et al.*, 1997). The problems with mycotoxins do not end in feed refusal or redution of animal performance but many of these mycotoxins transfere into the meat or milk (Devegowda *et al.*, 1998).

The common effect of aflatoxicosis includes poor growth, anemia, impaired blood clotting, sensitivity to bruising, damag of liver and other organs, decreased immune response, increased mortality (Lovell,1991 and Abdelhamid *et al.*,1997 and 2002 a&b). Also, mycotoxins had carcinogenicity,

hepatitis, nephritis, dermatitis and genacologic forms (Abdelhamid and Dorra,1993 and Abdelhamid *et al* .,2002 a,b &c and 2003).

Many different methods (physical, chemical and biological techniques) were carried out for detoxification of mycotoxins (Abdelhamid, 1993 b and Abdelhamid *et al*., 2002 & 2003 a, b, d). The most applied method for protecting animals against mycotoxicosis is the utilization of adsorbents mixed with the feed which are supposed to bind the mycotoxins efficiently in the gastrointestinal tract (Nowar *et al*., 1996; Huwig *et al*., 2001; Abd El-Baki *et al*., 2002 and Abdelhamid *et al*., 2002 c & 2003 and Shehata, (2002). Modified yeast cell wall mannanoligosaccharide (MOS) is based on an esterified glucomannan derived from the cell wall of a selected strain of *Saccharomyces cervisiae*. It causes stimulation of specific immune system, increased antibody titer values against infection and adsorption of mycotoxins (Devegowda *et al* ., 1998 and Shehata ,2002).

The present study was carried out to evaluate the efficiency of 8 commerical adsorbents to aflatoxin B_1 contaminated diet in reducing the aflatoxicosis in fish.

MATERIALS AND METHODS

The exprimental work of this study was carried out in-door wet Lab. In the Aquaculture Research Lab., Abbassa, Abo-Hamad, Egypt. *Asperiglus flavus* MD 341, was obtained from the Central Lab. of Residues in Aagric. Products, Agric. Pesticides Research Centre, Dokki, Egypt, for production of the aflatoxin B_1 . *A. flavus*_ was grown on yeast extract sucrose (YES) containing 2% yeast extract and 20% sucrose. The substrate was dispensed in conical flask. The flasks were then autoclaved for 15 minutes at 121 C^0, then cooled and inoculated with spore suspension and incubated for 9 days at 25 – 29 C0. Aflatoxin was extracted from liquid media according to Davis et al (1966). Aflatoxin concentration was determined using the methods Shih and Marth (1969) and A.O. A. C. (1984). The media was found to contain aflatoxin B1 alone. Twenty hundred and ten Nile tilapia (*Oreochromis niloticus*) were randomly assigned to each of ten dietary treatments (Table 1) (21 fish in each). For each of ten treatments there were 3 replicate glass aquarium of 7 fish per aquarium for a total of 21 fish/ treatment. Eight commercial adsorbents in market in Egypt were tested. Adsorbents at a rate of 0.5% were added to ground commercial diet and pelleted agin. Commercial diet Product of Factory of General Organization for Fish Development was used in the exp. it consisted of fish meal, soybean meal, meat meal, yellow corn, bone meal, mixture of vitamins and minerals. The chamical composition was adopted according to A.O.A.C. (1980). Filterate of A. flavus sprayed on pelleted diets to obtain 9 mg/kg feed. The dimensions of each glass aquarium were 150 X 50 X 50 cm. This glass aquariums were supplied with dechlorinated tap water and continous aeration was adapted by using an air pump and airstones.Water temperature was 22°C ± 2°C. Sediment was filtered by siphon method daily and water was completely changed every 3 days.

Table (1): Experimental treatments

No.	Treatments
1-	Control (commercial diet) (C)
2-	Control contaminated with aflatoxin B_1 (9 mg/kg) (A)
3-	A + 0.5% adsorbent I (Modified yeast cell wall)
4-	A + 0.5% adsorbent II (Benontite)
5-	A + 0.5% adsorbent III [Tri star (organic acid and silicate salts)]. Each Kg contain 300g formic acid, 150g probionic acid, 300g glutofid, 150 g precipitate of silica, 100 g calcium carbonate. German Co. for Vet. Medicine and Feed Additives.
6-	A + 0.5% adsorbent IV [Mycobond (natural mineral compound with a high adsorption and binding capacity)]. Product of Optivite International Ltd, Main Street, Laneham, Retford, Notts, United Kingdom .
7-	A + 0.5% adsorbent V [Egy-Tox (adsorption for toxin and fungcidal)]. It contain gentiana CA, MG,K,Al_2SLo_3 . Product of Egyption - Holand Co.
8-	A+ 0.5% adsorbent VI [Moldstop super (used for control the molds and adsorption of its mycotoxin)]. Each Kg contain 200g calcium probionate, 100g Kaolin, 100g aluminum silicate, 10g copper sulphite. Product of Smart Vet.
9-	A + 0.5% adsorbent VII [Fungstat- k (contains mixtures of organic acids and silicate salts)]. Product of Pharma Swede – Egypt.
10-	A + 0.5% adsorbent VIII [Moldstop mycobind plus (composed of 50% : propionic acid, ammonium propionate, natural extracts, emulsifiers, antioxidant (BHA) and 50 % : unique combination of specially selected carriers with mycobinding activity- HSCAS, completed by amorphus silicum dioxide. Product of IMPEX TRACO (Beligum), Sole agent : NILE VET .

The fish were fed 2 times a day (900 and 1600 h.) at a rate of 2% of the total body weight (as recomonded by Parrel et al., (1986). The fish were weighted every two weeks for 8 weeks. At the end of experiment 6 fish from each treatment (2 fish/ replicate) were scarificed for collection of the blood. Blood was take from the caudal vein using sterilized syringe for seperating serum. Serum was analysed for total protien, albumin, aspartate aminotransferase (AST) and alanine aminotransferase (ALT) using commercial kits purchased from Diamond Diagnostics Company, Egypt.

Data of the experiment were statistically analyzed according to Snedecor and Cochran, (1982). Significant differences between treatment means were tested by Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

1- Chemical composition:

The chemical composition for commerical diet as dry matter basis was 80.00, 30.00, 8.50, 3.93, 37.57, 20.00 for OM, CP, CF, EE, NFE and Ash, respectively.

2- Growth performance:

Data presented in Table (2) showed that aflatoxin B_1 caused a significantly loss in live body weight (40.09 g at 8 weeks versus 48.52 g at start of exp.).

Table (2) : The effect of aflatoxin B_1 (9 mg/kg diet) on fish performance and its modification by adsorbents

Parameters	Weeks	Treatments									
		Control	Aflatoxin	Afl+ I	Afl+ II	Afl+ III	Afl+ IV	Afl+ V	Afl+ VI	Afl+ VII	Afl+ VIII
Live body weight (g)	Initial	47 73±1 85	48.52±2.33	47 64±1 67	48.86±3.07	47.86±1 70	48 91±1.47	47.26±1 84	47.53±1.76	47 72±1 99	48 23±2 26
	2 weeks	48 63±1 94 a	45.67±2.19 c	46.24±1.63 b	46.61±2.95 b	46.66±1 61 b	48.76±0 41 a	46.69±1.66 b	47 28±1.76 b	47 27±1 82 b	46 48±2 58 b
	4 weeks	49 43±1 98 a	43.87±2.16 e	44.84±1.65 d	45.61±3.19cd	45 76±1.70 cd	48 28±1.47 b	46.26±1.84 c	47.53±1.76 b	46.87±1 99 c	45 23±2 26 d
	6 weeks	50 53+1 89 a	41 77±2.00 f	43.04±1 49 e	44 71±3 12de	44.71±1 62 d	47.75±1.18 b	45.54±1.56 cd	48.03±1.76 b	46.27±1 90 c	43 55+2 81 e
	8 weeks	51 98±1 89 a	40.09±2.02 e	42.15±1.53 d	44 01±3 11 c	43.73±1 56 cd	47.42±1 23 b	44.70±1.70 c	48.55±1.87 b	45 38±2 05 c	42 38±2.93 d
Change in body weight (%)	2 weeks	0	-6.09	-4.91	-4.15	-4 05	0 27	-3.99	-2.78	-2 80	-4.42
	4 weeks	0	-11.25	-9.29	-7.73	-7.42	-2.33	-6.41	-4.00	-5.18	-8.50
	6 weeks	0	-17.34	-14.82	-11.52	-11.52	-5.50	-9.88	-4.95	-8.43	-13.81
	8 weeks	0	-22.87	-18.91	-15.33	-15.87	-8.77	-14.01	-6.60	-12.70	-18.47
Improvment of body weight by adsorbents (%)	2 weeks	-	-	19.38	31.86	33.50	104.43	34.48	54.35	54 02	27.42
	4 weeks	-	-	17.42	31.29	34.04	79.29	43.02	64.44	53.96	24.44
	6 weeks	-	-	14.53	33.56	33 56	68.28	43.02	71.45	51.38	20.36
	8 weeks	-	-	17.32	32.97	30.61	61.65	38.74	71. 14	44.47	19.24
	Average	-	-	17.16	32.42	32.93	78.41	39.82	65.35	50.96	22.87
Body weight gain (g / 2 weeks)	2 weeks	0 90±0 09a	-2.85±0.15e	-1.40±0 03c	-2 25±0.31d	-1.20±0 09c	-0.15±0.09b	-0.57±0 26b	-0.25±0.05b	-0 45±0 17b	-1 75±0 33cd
	4 weeks	0 80±0 05a	-1.80±0.09f	-1.40±0 13ef	-1.00±0 26e	-0 90±0 09de	-0.48±0.18cd	-0.43±0 18c	0.25±0.09b	-0.40±0 05cd	-1 25±0.25e
	6 weeks	1 10±0 13a	-2.10±0.17e	-1.80±0 26e	-0.90±0.09cd	-1.05±0 17d	-0.53±0.16c	-0.72±0 09cd	0.50±0.09b	-0.60±0 09cd	-1 68±0.16e
	8 weeks	1 45±0 05a	-1.68±0 08f	-0 89±0.05de	-0.70±0 08d	-0.98±0 16de	-0.33±0.09c	-0.84±0.16de	0.52±0.09b	-0.89±0 19de	-1 17±0.12e
	Average	1.06±0.02a	-2.11±0.08g	-1.37±0 08f	-1.21±0.11ef	-1.03±0 08e	-0 23±0.06c	-0.64±0 06d	0.26±0.02d	-0.59±0 04d	-1.46±0.18f
Relative growth rate (%) (RGR)	2 weeks	1 89±0 11a	-5.87±0.09e	-2.94±0 07c	-4.60±0.55d	-2.51±0.09c	-0.31±0.17b	-1.21±0 53b	-0.53±0.11b	-0.94±0.30b	-3 63±0.88cd
	4 weeks	1 65±0.06a	-3.94±0.27e	-3.03±0.30de	-2.15±0.74cd	-1.93±0.25cd	-0.98±0.42bc	-0.92±0.38b	0.53±0.18a	-0.85±0.10bc	-2 69±0.60d
	6 weeks	2 23±0 35a	-4.79±0.18e	-4.01±0.51e	-1.97±0.10cd	-2 29±0 34d	-1.10±0.38c	-1.56±0.19cd	1.05±0.21b	-1.28±0 21c	-3 71±0.59e
	8 weeks	2 87±0 14a	-4 02±0.32f	-2.07±0 18de	-1.57±0.20cd	-2.19±0 33de	-0 69±0 2c	-1.84±0.40de	1.08±0.15b	-1.92±0 44d	-2 69±0.48e
	Average	2 16±0.08a	-4.66±0.05f	-3.01±0 16de	-2.57±0.31de	-2.23±0 16d	-0.77±0.19c	-1.38±0.10c	0.53±0.05b	-1 25±0.11c	-3.20±0 60e
Mortality rate (%) (MR)		4 76±4 77d	47.62±4.77a	9.53±4.77cd	9.53±4.77cd	28.57±8.26b	9.53±4.77cd	19 05±4.77bc	9.53 ± 4.77cd	19.05±4 77bc	19.05±4.77bc

Means in the same row bearing different letters differ significantly ($p \leq 0.05$).

RGR = Final live body weight – Initial live body weight / Initial live body weight x 100

MR = No.of fish at start of exp. - No.of fish at end of exp. / No.of fish at start of exp. X100

The bad effects of aflatoxin B_1 on growth performance (live body weight, body weight gain and relative growth rate) agreed with the findings of Jantrarotai and Lovell (1990) who reported that channel catfish fed 10 mg aflatoxin B_1/Kg feed for 10 weeks had shown a significant decrease in growth rate. Also, EL-Said, (1997) rerorted that 3 mg aflatoxin / Kg diet of *Oreochromis_aureaus* for 90 days caused a clear growth depression, were the loss in body weight gain was 4.33%. However, the effect of mycotoxin on fish depends on potency of mycotoxin, dose, species and strain of the fish, state of health, stage of life, temperature of the water and presence or absence of substances that can modify the toxicity (El-Said, 1997). The decrease of growth rate by aflatoxin may be due to disturbances of one or more basic metabolic processes (carbohydrate, lipid or protein metabolise) in the liver and loss of appetite (Cheeke and Shull, 1985). Also, it might be due to detoxification process in the body utilizing glutathione enzymes. Glutathione is partly composed of methionine and cystein, hence this detoxification process depletes the metabolic availabilty of methionine leading to poor growth and feed efficiency (Devegowda *et al.*, 1998).

Addition of the adsorbents reduced ($P \leq 0.05$) the toxic effect of aflatoxin B_1. Since, the average body weight gain (g / 2 weeks) ranged from + 0.26 to – 1.46 versus – 2.11 without adsordents. The average improvement in body weight gain for the total period as % from aflatoxin B_1 alone was 78.71; 65.35; 50.96; 39.82; 32.93; 32.42; 22.87 and 17.16 for adsorbents IV ; VI ; VII ; V ; III ; II ; VIII and I, respectively. Generally, the diminished effect of aflatoxin on body weight ranged from 14.53 to 95.57% according to the kind of adsorbent and experimental duration. However, the best results were obtained by adding adsorbent IV. Diminished effect of the adsorbents on body weight gain agreed with the findings of Araba and Wyatt, (1991) who reported that 0.5 and 1% HSCAS diminished growth inhibitory effect on broiler chickens by 38 and 84%. Also, Kubena *et al.*, (1988) reported high diminshing effect (55 to 100%). Bentonite (0.5 and 1%) reduce the inhibitory effect of aflatoxin on growth rate of broiler chickens by 46 and 84% (Araba and Wyatt , 1991) and 87 and 89% for pigs (Lindemann *et al.*, 1993). MOS redued the liver cholesterol and liver fat levels which increased by aflatoxin (Park *et al.*, 1996). These results indicate that MOS decrease the aflatoxin effect. Reducation of aflatoxin effect by MOS may be due to its effect on stimulating the specific immune system (Savage *et al.*, 1996).

However, the differences between adsorbents in their ability to reduce mycotoxin toxicity depend on type and concentration of mycotoxin, the adsorbents, grinding diameter (Ramos and Hernandez, 1996 and Lemke *et al.*, 1998). The most important feature of the adsorption is the physical structure of the adsorbent, i.e the total charge and charge distribution, the size of the pores and the accessible surface area. On the other hand , the properties of the adsorbent molecules, the mycotoxins, like polarity, solubility, size, shape and in case of ionized compounds charge distribution and dissocation constants play a significant role too (Huwig *et al.*, 2001) .

3- Mortality rate:

The mortality rate (Table 2) was significantly increased ($p \leq 0.05$) in fish fed aflatoxin B_1 contaminated diet (47.62% in comparison

with 4.76% for control). These results agreed with reported by El-Said, (1997) who reported that 3 mg aflatoxin/kg feed caused 16.76% mortality in *Oreochromis niloticus* after 90 days. The incidence of death may be due to the disturbance of organs function, since, the aflatoxicosis caused liver neoplasm, necrosis of hepatocytes and degenerative changes in pancreatic and kidney tissues of rainbow trout (Halver, 1967). Also, Lovell, (1991) reported that aflatoxin caused damage of liver and other organs, thereby caused poor growth, anemia, impaired blood clotting, sensitivity to burising, decreased immune responsiveness and increased mortality. Also, liver tumor, necrosis and basophilia of hepatocytes, largement of blood sinusoids in the kidney, accumulation of iron pigments in the intestinal mucosa and epithelium and necrosis of gastric glands can be caused. Post mortem examination for fish fed aflatoxin B_1 contaminated diet showed, pale liver with congested patches and pin point hemorrhages or yellowish in color. Distended gall bladder was noticed with pale kidney. These findings agreed also with the post morten lesions described by El-Said (1997).

Addition of adsorbents reduced ($p \leq 0.05$) the mortality rate. The reduction in mortality rate by adsorbent I, II & IV, was > VI, VII & VIII > III. Generally, all adsorbents reduced the mortality rate. Since, it ranged from 9.53 to 28.57% versus 47.62 % for aflatoxin alone. Although, the adsorbent I reduce the mortality rate the improvement in body gain was in low magnitude, these results may be due to its ability on stimulation of the immunity system (Savage *et al.*, 1996 and Shehata, 2002). These results for mortality agreed with the findings of Kubena *et al.*, (1991) who found that 0.5% HSCAS caused 68% decrease in the mortality rate of growing male turkey poults by aflatoxin. Also, Abd El-wahhab, (1996) reported that no mortality occurred in pregnant rats dosed orally with aflatoxin B_1 (2 mg/kg body weight) during gestation days 6-13 when combined with 0.5% HSCAS in comparison with 9% for aflatoxin alone. The decrease mortality rate by adsorbents may be due to there ability for absorption of mycotoxins in the gastrointestinal tract and thereby decreasing toxic effects on animals (Galvano, *et al.*, 2001).

4- Blood parameters :

Data of blood parameters determination are shown in Table (3). Total protein and albumin concentrations were significantly decreased in fish fed aflatoxin contaminated diet. These results agree with the results obtained by Mamdouh (1996) who found decrease in serum total protein of *Oreochromis niloticus* fed on ration containing 1, 2 and 3 ppm aflatoxin B_1 for 21,42 and 63 days. Also, El-Said (1997) reported that 1.5 and 3 mg aflatoxin/kg diet for 90 days decreased serum total protein for *Oreochromis aureaus*. The decrease in total protein and albumin may be attributed to: aflatoxin interaction with protein synthesis and cellular integrity in liver (Patterson, 1976), plasma proteins are used for energy production during pollutant toxicity or in increasing of protein catabolism induced by stress in order to supplementary energy (Mazeaud *et al.*, 1977 and Pfeifer and Weber, 1979), and binding of aflatoxin with DNA which lead to inhibition of DNA synthesis and RNA formation which is responsible for protein synthesis (Mamdouh, 1996).

Table (3) : The effect of aflatoxin B_1 (9 mg/kg diet) on serum constituents of fish and its modification by adsorbents

Parameters	Treatments									
	Control	Aflatoxin	Afl+ I	Afl+ II	Afl+ III	Afl+ IV	Afl+ V	Afl+ VI	Afl+ VII	Afl+ VIII
Total protein (g/dl)	4.29±0.04a	3.07±0.22b	3.11±0.29b	3.77±0.24ab	3.55±0.22b	3.69±0.12ab	3.62±0.06b	3.33±0.01b	3.11±0.28b	3.21±0.22b
Index	100	71.56	72.49	87.88	82.75	86.01	84.38	77.62	72.49	74.83
Albumin (g/dl)	2.97±0.09a	2.40±0.25c	2.47±0.03bc	2.80±0.15ab	2.47±0.17bc	2.40±0.06c	2.40±0.12c	2.43±0.03c	2.40±0.21c	2.53±0.19bc
Index	100	80.81	83.16	94.28	83.16	80.81	80.81	81.82	80.81	85.19
AST (u/l)	29.50±1.26cd	38.67±1.20a	34.67±1.45ab	33.67±0.67bc	28.33±1.86d	33.33±0.88bc	32.00±1.72bcd	28.33±2.67d	33.00±1.16bcd	35.67±0.67ab
Index	100	131.08	117.53	114.14	96.03	112.98	108.47	96.03	111.86	120.92
ALT (u/l)	7.00±0.29b	8.83±0.88a	8.60±0.38a	6.50±0.29b	6.17±0.33b	6.33±0.33b	6.83±0.17b	6.67±0.17b	6.75±0.14b	6.40±0.21b
Index	100	126.14	122.86	92.86	88.14	90.43	97.57	95.29	96.43	91.43

Means in the same row bearing different letters differ significantly ($p \leq 0.05$)

Addition of adsorbents increased or improved ($p \leq 0.05$) the total protein and albumin. The total protein as % from the control ranged from 87.88 to 72.49% versus 71.56% for aflatoxin B_1 without adsorbent. Also, the albumin with adsorbents ranged from 94.28 to 80.81% versus 80.81 % for aflatoxin alone.

Aspertate aminotransferase (AST) and alanine aminotransferase (ALT) enzymes increased significantly ($p \leq 0.05$) in fish fed aflatoxin B_1 contaminated diet. These results agreed with the findings of Carpenter *et al.*, (1995) on rainbow trout; Mamdouh (1996) on *Oreochromis niloticus* and El-Said (1997) on *Oreochromis aureaus*. The increase in AST and ALT levels indicated to damage of the liver and probably kidney. Evidence for acute aflatoxin B_1 nephrotoxicity was provided by distended gall bladders indicating disrupte osmoregulation (i,e. water retention) as reported by Carpenter *et al.*, 1995).

It could be concluded from the results of this work that adding 0.5% adsorbents specially adsorbents IV (Mycobond) VI (mold stop super) to a diet contaminatad with 9 mg aflatoxin B1/kg may provide a safe and practial method for reduction of aflatoxicosis in fish.

REFERENCES

Abd El-Baki, S. M.; M. S. Nowar; E. A. Hassona; S. M. Bassuny and S. A. Shehata (2002): Clay in animal nutritium : 10- Detoxification of aflatoxin B_1 by tafla in rabbit feeds. Pro. 3rd Scientific Conf. Rabbit Production in Hot Climates, 8-11 October. pp: 557-567.

Abdelhamid, A.M.(1990): Occurance of some mycotoxins (aflatoxin, ochratoxin A, citrinin, zearalenone and vomitoxin) in various Egyptian feeds, Arch. Anim. Nutr. 40: 647-664.

Abdelhamid, A.M.(1993 a): Mycotoxins in local foods and feeds. The 4th Symposium of Food Pollution, 15-16 Nov., pp: 46-57 (In Arabic).

Abdelhamid, A.M.(1993 b): Decontamination of aflatoxins-contaminated foods by some physical means. J. Egypt. Ger. Soc. Zool., 12 (A): 191-208.

Abdelhmid, A. M. and Dorra, T. M. (1993): Effect of feedborne pollution with some mycotoxins combinations on broiler chicks. Arch. Amin. Nutr. 44:29-40.

Abdelhamid, A.M. ; F.F. Khalil and M.A. Ragab (1996): Survey of aflatoxin and ochratoxin occurrence in some local feeds and foods. Proc. of Conf. on Food Borne Contamination and Egyptian's Health, Mansoura, Nov. 26-27,pp:43-50.

Abdelhamid, A.M. ; F.F. Khalil and M.A. Ragab (1997): Problem of mycotoxins in fish production. Proc. 6th Conf. of Anim., Poult.,and Fish Nutrition. El-Menia, Nov. 1997. (Abs.) pp: 349-350 [Egypt. J. Nutr. & Feeds 1 (1) 63-71, 1998]

Abdelhamid, A.M. ; F.F.M. Khalil; M.I. El- Berbary; V.H. Zaki and H.S. Husien (2002 a): Feeding Nile tilapia on Biogen to detoxify aflatoxic diets. Proc. 1st Ann. Sc. Conf. Anim. & Fish Prod., Mansoura 24 - 25 Sep., pp: 207-230.

Abdelhamid, A.M. ; F. I. Maguz;M.F.E. Salem; A. A Mohamed and M.K. Mohsen (2002b): Effect of dietary graded levels of aflatoxin B_1 on growth performance and biochemical, chromosomal and histrogical behaviour of Nile tilapia, *Oreochromis niloticus*. Proc.1st Ann. Sc. Conf. Anim. & Fish Prod., Mansoura 24 - 25 sep., pp:231-250.

Abdelhamid, A.M. ; M. A. Ragab and A. F. El-Shaieb (2002c). The use of tafla or aluminosilicate for alleviating toxic effects of aflatoxin-contaminated diets of growing rabbits. Pros. 1st Ann. Sc. Conf. Anim. & Fish Prod., Mansoura 24 - 25 Sep., pp:389-413.

Abdelhamid, A.M.; A. E. Sallam; G. A. Abd Ellah and S. H. El-Samra (2002 d): Effect of feeding male rats on aflatoxic diets without or with medicinal herbs (thyme, safflower, ginger, black cumin, and / or garlic). Proc.2nd Conf. on Foodborne Contamination and Egyptian's Health, Abril 32-24, Mansoura Fac. of Agric., pp: 99-121.

Abdelhamid, A.M. ; A. I. Mehrim and F. F. Khalil (2003): Detoxification of aflatoxin-contaminated diet of tilapia fish using dietary supplementation with egg shell, petafin, clay or silica. Proc 1st Egypt. –Syrian Con., 8-11 Dec., Minia.

Abd El- Wahhab, M. A. (1996): Effect of aflatoxin B_1 treatment on pregnancy, newborn and quality of milk produced from mammals. Ph. D. Thesis, Ain Shams Univ.Fac. of Agric. Egypt.

Araba, M. and R. D. Wyatt, (1991): Effects of sodium bentonite, hydrated sodium calcium aluminosilicate Novasil ™ and ethacal on aflatoxicosis in broiler chickens. Poult. Sci. 70 (suppl. 1),6.)

Association of Official Agricultural Chemists (A.O.A.C.) (1980): Official Methods of analysis (13th ed.) Washington, S.D.C.

Association of Official Analytic Chemistry (A.O.A.C.) (1984): Ed.William Horzitw, 13 ed. Publisher,Washigton, S.A.

Aziz,N.H.; E.S. Attia and S.A. Farag, (1997): Effect of gamma irradiation on the natural occurance of fusarium mycotoxins in wheat, flour and bread. Die Nahrung, 41 (1):34-37.

Carpenter, H.M.; Q. Zhang; C. El-Zahr; D.P. Selivonchick; D.E. Brock and L.R. Curtis (1995): *In vitro* and *in vivo* temperature modulation of hepatic metabolism and DNA adduction of aflatoxin B_1 in rainbow trout. J. Biochm. Toxicol., 10(1): 1-10 .

Cheeke, P.K. and L.R. Shull (1985): Natural Toxicants in Feeds and Poisonous Plants, PP. 393-476. AVI Publishing Company, Westport, C.T.

Davis, N. D.; U.L. Dioner and D.W. EL- Dridge (1966) : Production of aflatoxins B_1 and G_1 by *Aspergillus flavus* in a semi synthetic medium . Appl. Microbiol ., 14 : 378- 380 .

Devegowda, G.; M.V.L.N., Raju; N. Afzali and H.V.L.N. Swamy (1998): Mycotoxins picture worldwide: Novel solutions for their counteraction. In. T.P. Lyons and K.A. Jacques (Eds.) Biotechnology in the Feed Industry PP. 241-255. Proc.of Alltech's 14th. Annual Sympoisum, Nottingham,U.K.

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

El-Said, M.E.F. (1997):Physiological responsiveness of fresh water fish to food contamination. M.S.c. Thesis, Zagazig Univ. Fac. of Science, Egypt.

Galvano,F.; A. Piva; A. Ritieni and G. Galvano (2001): Dietary strategies to counteract the effects of mycotoxins:a review. J. of Food Protection, 64 (1): 120-131.

Halver, J.E. (1967): Crystalline aflatoxin and other vectors for trout hepatoma. US fish Wildl. Ser.Rep., 70:78-102.

Huwig,A., S. Freimund; O. Kappeli and H. Dutler (2001): Mycotoxin detoxification of animal feed by different adorbents. Toxicology Letters,122:179-188.

Jantrarotai, W. and R.T. Lovell (1990): Subchronic toxicity of dietary aflatoxin B_1 to channel catfish. J. Aquatic Anim. Health, 2:248-254.

Kubena, L.F.; R.B. Harvey; T.D. Phillips and W.E. Huff (1988): Modulation of aflatoxicosis in growing chickens by dietary addition of a hydrated sodium calcium aluminosilicate. Poul. Sci. 67(suppl. 1). 106.

Kubena, L.F.; W.E. Huff ; R.B. Harvey; A.G. Yersin; M.H. Elissalde; D.A. Witzel; L.E. Giroir; T.D. Phillips and H.D. Petersen (1991): Effects of hydrated sodium calcium aluminosilicates on growing turkey poults during aflatoxicosis. Poult. Sci. 70:1823-1830.

Lemke,S.L.; P.G. Grant and T.D. Phillips (1998): Adsorption of zearalenone by organophilic montmorillonite clay. J. Agric. Food Chem. 46 : 3789-3796.

Lindemann, M.D.; D.J.Blodgett; E.T. Kornegay and G.G. Schurig (1993): Potential ameliorators of aflatoxicosis in weanling / growing swine. J. Anim, Sci. 71:171-178.

Lovell, R.T. (1991): Mycotoxin in fish feeds. Feed Mangement,42 (11):42-44.

Mamdouh, M.A. (1996): Immunotoxiciological studies on the effect of aflatoxin in *Oreochromis niloticus*. Med. Jurisprudence and Toxicol., Fac. Vet. Med., Zagazig Univ.

Mazeaud, M.M.; F. Mazeaud and E.M. Donaldson (1977): Primary and secondary effects of stress in fish . Some new data with a general review. Trans. Am. Fish. Soc., 106 : 201-212.

Nowar, M.S.; E.M. Hassona and M.I. Abd El- Rahim (1996): Aflatoxicosis in rabbits : 2- prevention of aflatoxicosis in growing rabbits by addition of tafla to aflatoxin naturally contaminated diet. Proc. Food. Borne Contamination and Egyptian's Health, Univ. of Mansoura, Nov. 26-27, PP. 97-110.

Park, T.W.; C.I. Kim and V.G. Stanley (1996): Effect of dietary aflatoxin and *Bio-MOS on* cholesterol and basic nutrient content of broiler chicken meat. *Annual Meeting of the Institute of Food Technology,* New Orleans. 22-26 June.

Parrel, P.; I. Ali and J. Lazard (1986) : Le dèveloppement de *l'aqua culture an Niger : un exemple de* elevaga de Tilapia en zone saheliene, *Bois et forèts des Tropiques, 212,71.*

Patterson, D.S.P. (1976): Structure, metabolism and toxicity of aflatoxin. Cab. Nutr. Diet (suppl.2) : 71-78.

Pfeifer, K.F. and L.J. Weber (1979) : The effect of carbon tetrachloride on the total plasma protein concentration of rainbow trout *Salmo gairdneri* . Com. Bioch. and Physiol., 64c : 37-42.

Ramos, A.J. and E. Hernandez (1996): In vitro aflatoxin adsorption by means of a montmorillonite silicate. A study of adsorption isotherms. Anim. Feed Sci . Technol. 62, 263-269.

Savage, T.F.; P.F. Cotter and E.I. Zakrzewska (1996): The effect of feeding a mannanoligosaccharide on immunoglobulins, plasma IgG and bile IgA of Wrolstad MW male turkeys. Poult. Sci. 75 (suppl. 1) :S 129.

Shehata, S.A. (2002): Detoxification of mycotoxin contaminated animal feedstuffs. Ph.D Thesis, Zagazig Univ.Fac of Agric., Egypt.

Shih,C.N. and E.H. Marth (1969): Improved procedures for measurment of aflatoxins with thin layer chromatography and fluorometory. J. Milk. Food Technol., 32:213-217.

Snedecor, G.W. and W.G. Cochran (1982): Statistical Methods. 7th Edition. Iowa State Univ. Press Ames, U.S.A.

تقليل سمية الأفلاتوكسين B_1 بالمواد المدمصة المختلفة فى السمك

* صبرى عبد الحافظ شحاتة ،** محمد صلاح محمد ، **جمال عبد الناصر محمد

* قسم الإنتاج الحيواني – كلية الزراعة – جامعة الزقازيق – مصر

** معمل بحوث الزراعات المائية – العباسة – أبو حماد – مصر

تم دراسة تقليل تسمم أسماك البلطي النيلي بالأفلاتوكسين B_1 بواسطة إضافة العديد من المواد المدمصة المنتشرة في مصر (٨ مواد) إلى العليقة الملوثة في تجربة تغذية لمدة ٨ أسابيع . أستخدمت ٢١٠ سمكة بلطي نيلي متوسط وزنها عند البداية ٤٧جم، تم تقسيمها على عشرة معاملات (٢١ سمكة في كل معاملة) واحتوت كل معاملة على ٣ مكررات، في كل مكرره ٧ سمكات . المعاملة الأولى غذيت على عليقة تجارية (كونترول) ، المعاملة الثانية غذيت على عليقة ملوثة بالأفلاتوكسين B_1 (٩ملجم / كجم عليقة)، والمعاملات الثمانية المتبقية احتوت نفس المستوى من الأفلاتوكسين B_1 + ٠,٥ % من المواد المدمصة المختلفة التي تم دراستها. المادة المدمصة الأولى كانت جدر خلايا الخميرة المحسنه ، المادة الثانية هي البنتونيت ، المادة المدمصة الثالثة تراي ستار ، المادة الرابعة ميكوبوند ، المادة الخامسة ايجي توكس ، المادة السادسة مولد ستوب سوبر ، المادة السابعة فنجستات – ك ، المادة الثامنة مولد ستوب ميكوبايند بلس.

الأفلاتوكسين B_1 عند اعطاؤه في عليقة السمك أحدث انخفاض معنوي في وزن الجسم . الإنخفاض في وزن الجسم الحي كنسبة منوية كان ٦,٠٩ ، ١١,٢٥، ١٧,٣٤ ، و ٢٢,٨٧ % عند الأسبوع٢، ٤ ، ٦ ، ٨ على التوالي. زيادة معنوية في نسبة النفوق حدثت نتيجة تناول الأفلاتوكسين B_1 حيث كانت النسبة ٤٧,٦٢% مقارنة بـ ٤,٧٦% للكنترول . كما حدثت تغيرات معنوية في مكونات الدم حيث زاد نشاط انزيمات الاسبرتيت أمينوترانزفيريز AST وكذلك الألانين أمينوترانزفيريز ALT ، بينما انخفض تركيز البروتين الكلي والألبيومين .

إضافة المواد المدمصة قللت التأثيرات السامة للافلاتوكسين معنويا حيث أحدثت : تقليل تأثير الأفلاتوكسين B_1 على وزن الجسم بمقدار ١٤,٥٣ إلى ١٠٤,٤٣% على حسب نوع المادة المدمصة وطول فترة التجربة . كما أحدثت انخفاض معنوى في نسبة النفوق عند إضافة المواد المدمصة وكذلك تحسن معنوى في مكونات الدم .

هذه الدراسة تقترح إضافة المواد المدمصة خاصة المادة الرابعة (ميكوبوند) والمادة السادسة (مولد ستوب سوبر) لعلائق الأسماك الملوثة بالأفلاتوكسينB_1 لتقليل السمية .