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HYDRATED SODIUM CALCIUM ALUMINOSILICATE EFFECTS ON SOME MINERAL AND VITAMIN STATUS DURING AFLATOXICOSIS IN GROWING TURKEY

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ABSTRACT

An experiment was conducted to evaluate effects of hydrated sodium calcium aluminosilicate (HSCAS) and aflatoxin (AF) without or with added minerals and vitamins on turkey performance, apparent mineral retention, tissues component and AFB1 residues. A total number of 420 unsexed day old White Holland turkey chicks were divided into 12 groups (5 replicates of 7 chicks each). Three factors of the feeding program were investigated in a factorial (3x2x2) arrangement. Three levels (0, 0.5, 1%) of HSCAS and two levels (0, 1.25 ppm) of AF without or with added 0.25% calcium (Ca), 0.13% available phosphorus (AP), 20 ppm zinc (Zn), 20 ppm manganese (Mn) and vitamin A (1200 IU/kg) were incorporated into practical corn-soybean meal basal diet and fed from 1 to 35 days old. The results obtained indicated that adding AF singly to basal diet showed many effects ($P < 0.05$ or 0.01), it decreased body gain (28%), feed intake (15%), bursa of Fabricius and thymus glands weight (%), meat fat and glycogen contents, and blood hemoglobin, total proteins, total lipids and cholesterol constituents. While mortality rate, feed to gain ratio, relative liver (66%), kidneys and spleen weights, liver fat content (141%), and serum alanine aminotransferase (ALT) and aspratate aminotransferase (AST) activities were increased and there was AFB_1 residues in meat (25.4 ng/g) and liver (93.4 ng/g) tissues for basal diet contained AF singly. Inclusion of 0.5 or 1% HSCAS to AF diets diminished and recorded similar protections about 45-74% against AF effects on different traits cited above. While raising level of minerals and vitamin A with AF diets had a negative effect ($P<0.05$) on aflatoxicosis. Inclusion of HSCAS at both levels singly to basal diet unaltered ($P < 0.05$) growth performance values and tissues component, except Zn and Mn apparent retention and their contents in tibia, toe and liver, and also vitamin A content in liver were decreased ($P < 0.05$ or 0.01). The effects of 1% HSCAS were more severe ($P < 0.05$) than those of 0.5%, while adding AF with HSCAS diets had not altered ($P < 0.05$) these effects of HSCAS. Raising level of studied minerals and vitamin A with basal diet had negative effect, but these added nutrients with HSCAS diets negated all adverse effects occurred by both levels of HSCAS on Zn, Mn and vitamin A status. Both ash, Ca, P apparent retention and their contents in tibia and serum were unaffected ($P < 0.05$) in the present study. It can be concluded that although the recommended 0.5% HSCAS for binding AF unaltered turkey growth performance values, raising level of some minerals and vitamins with HSCAS diets is very essential to compensate the deficiencies of these nutrients utilization.

Keywords: Aflatoxins, aluminosilicate, mineral and vitamin status, turkey, performance, tissues analysis, residues.

INTRODUCTION

Aflatoxin has elicited the greatest public health concern of all mycotoxins because of its widespread occurrence in several grains as corn which comprises 50-60% of poultry diets (Philips *et al.*, 1988), in addition to the role of aflatoxins in the etiology of primary hepatocellular carcinoma has been proved (Wiled *et al.*, 1990). Depression 6-30% of chick growth (Smith *et al.*, 1993; Edrington *et al.*, 1997; Genedy *et al.*, 1999), impairment of feed efficiency (Kubena *et al.*, 1995; Abdelhamid *et al.*, 1995a), and higher mortality rate (Edrington *et al.*, 1993); Kubena *et al.*, 1995) by aflatoxicosis caused very high economic loses. Inhibition of metabolism and immunity system by aflatoxicosis casues increasing liver fat 60% of dry weight (Smith and Hamilton, 1970) which enlarged liver size 2 to 3 times occurred liver damage (Sims *et al.*, 1970), and decreasing the synthetic power of albumin and globulin (Abd El-Hamid *et al.*, 1992). The HSCAS at 0.5% in the diets has been shown to reduce aflatoxicosis in chickens (Scheideler, 1993; Abo-Norage *et al.*, 1995; Genedy *et al.*, 1999) and in turkey (Kubena *et al.*,1995). The HSCAS binds AF *in vitro* (Phillips *et al.*, 1988; Scheideler, 1993). Thus, the efficacy of these additives probably lies in their ability to bind AF in the intestine, rendering the toxin unavailable for absorption (Southern *et al.*, 1994). The positive charge deficiencies on phyllosilicate create the potential for sorbing positively charged or cationic compounds including minerals (Theng, 1974). Ingestion of HSCAS to broilers does not improve skin pigmentation (Brake, 1987) and reduce zinc utilization (Chung *et al.*, 1990). The sorbent additives (HSCAS) have raised questions about their effects on utilization of some minerals and vitamins, although Chung and Baker (1990) with P, Chung *et al.*, (1990) with riboflavin, and Southern *et al.* (1994) with Ca and P, have reported that HSCAS does not impair the nutrient utilization. Use of HSCAS for AF control requires study of the possible effects of this material on utilization of essential nutrients. The purpose of the present study was to evaluate effects of dietary HSCAS and aflatoxins without or with added some minerals and vitamin A during 1-35 days old on turkey growth performance, apparent minerals retention, tissues component and AFB_1 residues.

MATERIALS AND METHODS

The present study was carried out at Mehallet Moussa Animal Production Research Station during April-May 2002 and the chemical analyses were partly completed at Sakha Animal Production Research Laboratories, Animal and Poultry Research Institute, ARC, Ministry of Agriculture. This study was designed to study the effects of HSCAS on some mineral and vitamin status during aflatoxicosis in growing turkey.

Birds, diets and management: A total number of 420 unsexed day-old White Holland turkey chicks were wing banded, individually weighed and randomly distributed into 12 experimental groups (5 replicates of 7 chicks each). Chicks were housed, on the day of hatch, in electrically heated starting batteries in environmentally controlled room. The treatment groups were randomly assigned to 60 pens (70x50x40 cm) of 5 pens per treatment. Three factors of the feeding program were investigated in a factorial (3x2x2) arrangement. Three levels (0, 0.5, 1%) of HSCAS and two levels (0, 1.25 ppm) of AF without (-) or with (+) added 0.25% Ca, 0.13% AP, 20 ppm Zn, 20 ppm Mn and 1200 IU/kg of vitamin A were incorporated into practical corn-soybean meal diets which cover nutrient requirements of young turkey (Table 1). Diets and water were offered *ad. lib.* during experimental period 1-35 days old. Individual body weight and feed intake for each pen were measured weekly and feed to gain ratio was calculated. Mortality rate was recorded daily.

Procedures: Aflatoxin was produced via fermentation of rice by *Aspergillus parasiticus* NRRL 2999 as described by Shotwell *et al.* (1966) and modified by West *et-al.* (1973). Fermented rice was autoclaved, dried and ground to a fine powder which was analyzed for its AF content by method of Nabney and Nesbitt (1965) as modified by Wiseman *et al.*(1967). Very little amount of AF about 3 µg/kg was detected in the basal diet. The AF in rice powder was extracted by chloroform then incorporated into basal diets and confirmed by HPLC to provide the desired level of 1.25 mg AF per kg diet. The HSCAS is chemical compound that contains silicon oxide (64.7%), aluminum oxide (15.5%), and oxides of iron, magnesium, calcium, sodium and potassium (8.9%). It is white crystals, fine powder and purchased (12 LE/kg) from Integrated World Enterprises Co.

Sampling and analysis: The total excreta was collected during 33-35 days of the experiment. Feed intake was recorded starting 24 h before the collection time and ending 24 h before the end of the collection. The excreta samples were dried in a stainless steel oven at 60°C. At the end of the experiment (5 weeks old), 3 turkey from each treatment having average body weight around the treatment were slaughtered. Toe samples were obtained by severing the middle toe through the joint between the second and third tarsal bones from the distal end. The right and left middle toes of each slaughtered bird were pooled, dried at 105°C to a constant weight, then ashed at 600°C for 3 h. Right and left tibias were also collected, cleaned of all soft tissues, then dried, and ashed. The ash from toes and tibias was solubilized with nitric and perchloric acids (5: 3, v:v), and diets, excreta and liver were wet acid digested with the nitric and perchloric acids mixture (A.O.A.C., 1990). Minerals content of different digested ash samples were measured with an atomic absorption spectrophotometer (Model 5100 PC, perkin-Elmer-Nor Walk, CT 06859-0200), then calculated on DM basis. Protein and fat contents in dried meat and liver samples (A.O.A.C., 1990), vitamin A (as retinol) content in fresh liver (Thompson *et al.*, 1971), and AFB_1 residues in fresh meat (breast, thigh) and liver (Stubblefield *et al.*, 1982) were measured. Blood hemoglobin (Kampen and Zijlestra, 1961), serum total proteins (Henry *et al.*, 1974), total lipids (Chlabrol and Charonnat, 1973), cholesterol (Watson, 1960), Ca (Sendroy, 1944), P (Gomorri, 1942), alanine aminotransferase (ALT) & aspertate aminotransferase (AST) enzymatic activities (Reitman and Frankel, 1957) were estimated by colorimetric methods using commercial kits. Analysis of variance was performed on data using the General Linear Models (GLM) procedure of the Statistical Analysis System (SAS, 1994). Significant differences among treatment means were separated by Duncan's new multiple range test (Duncan, 1955) with 5% level of probability.

Table 1. Composition of the experimental* turkey diets from 1 to 35 days old.

Ingredients %	Hydrated Sodium Calcium aluminosilicate (HSCAS) 0%		0.5%		1%	
	Added Ca , AP , Zn , Mn , Vit. A					
	(-)	(+)	(-)	(+)	(-)	(+)
Yellow corn	48.13	48.13	48.13	48.13	48.13	48.13
Soy been meal , 48%	34.50	34.50	34.50	34.50	34.50	34.50
Corn gluten meal , 62%	9.90	9.90	9.90	9.90	9.90	9.90
Dicalcium phosphate	2.80	3.80	2.80	3.80	2.80	3.80
Limestone	1.35	1.45	1.35	1.45	1.35	1.45
Vit.+ Min. Mix[1].	0.30	0.30	0.30	0.30	0.30	0.30
Nacl	0.30	0.30	0.30	0.30	0.30	0.30
DL- methionine	0.15	0.15	0.15	0.15	0.15	0.15
L-lysine	0.35	0.35	0.35	0.35	0.35	0.35
HSCAS	–	–	0.5	0.5	1.0	1.0
Zn So_4. H_2O (20% Zn)	–	0.01	--	0.01	--	0.01
Mn So_4. H_2O (20% Mn)	--	0.01	--	0.01	–	0.01
Sand	2.22	1.10	1.72	0.60	1.22	0.10
Vitamin A (1200 IU/ kg)	-	+	-	+	-	+
Calculated values[2]:						
ME , kcal / kg	2843	2843	2843	2843	2843	2843
Meth . + Cys . , %	1.06	1.06	1.06	1.06	1.06	1.06
Lysine ,%	1.22	1.22	1.22	1.22	1.22	1.22
Av. phosphorus (AP) ,%[2]	0.62	0.75	0.62	0.75	0.62	0.75
Determined values[3]						
Crud protein , %	27.11	27.11	27.11	27.11	27.11	27.11
Calcium (Ca) , %	1.20	1.45	1.20	1.45	1.20	1.45
Total phosphorus. (TP) ,%	0.91	1.04	0.91	1.04	0.91	1.04
Zinc (Zn) , ppm	68	88	68	88	68	88
Manganese (Mn) , ppm	61	81	61	81	61	81
Ash , %	9.11	9.11	9.06	9.10	9.12	9.09
Vitamin A , IU/ kg [4]	6012	7105	6012	7205	6012	7205

[1]Vitamins and minerals mixture provide per kg of diet: vit.A(as retinyl acetate), 4000 IU; vit. E (as α -tocopherol acetate), 20 IU; K_3, 3 mg; D_3, 2500 ICU; Riboflavin, 10 mg; Calcium pantothenate, 12 mg; Niacin, 20 mg; Choline chloride, 50 mg; B_{12}, 10 µg; B_6, 3 mg; Thiamian, 3 mg; Folic acid, 1 mg ; biotin, 0.5 mg.

Trace minerals (mg/kg of diet): Mn, 35; Zn, 40; Fe, 35; Cu, 10; Se, 0.6; Ethoxyquin,3.

[2]Calculated values based on NRC,1994.

[3]Determined analysis based on chemical analysis (AOAC,1990).

[4]Vitamin A was determined according to method of Erdman *et al.* (1973).* The six diets were contaminated or not with aflatoxin at 1.25 mg per kg diet to formulate 12 experimental diets .

RESULTS AND DISCUSSION

Growth performance and apparent minerals retention:

Results of turkey body gain, feed intake and feed to gain ratio (1-35 days old) showed similar trend and a significant impairments by AF diets (Table 2). Adding AF singly with basal diet decreased ($P < 0.01$) body gain (28%) and feed intake (15%), and increased ($P < 0.05$) feed to gain ratio (19%) and mortality rate (to 14.3%) during 1-35 days old (Table 2). The AF effects on growth performance values were ($P < 0.05$) diminished (but not similar to control) by inclusion of 0.5 or 1% HSCAS to AF diets. Both levels of HSCAS recorded similar ($P < 0.05$) protection about 58% for body gain and 71-73% for feed intake against effects of AF singly with basal diet.

Table 2. Growth performance (1-35 days old) and apparent mineral retention (33- 35 days old) of White Holland turkey as affected by dietary treatments fed from 1 to 35 days old

Dietary treatment[1]			Performance (1-35 days old)				Mineral retention[2] (33-35days old)			
HSCAS %	AF ppm	Ca, Ap Zn , Mn Vit . A	Body gain (g)	Feed intake (g/bird)	Feed: gain ratio	Mort-ality (%)	Ca (%)	P (%)	Zn (%)	Mn (%)
0	0	-	534^a	1351^a	2.53^b	8.6	34.2	32.8	35.5^a	34.8^a
0	0	+	541^a	1347^a	2.49^b	5.7	33.9	32.4	34.8^a	33.9^a
0	1.25	-	383^c	1153^c	3.01^a	14.3	33.6	31.4	34.4^a	34.1^a
0	1.25	+	390^c	1165^c	2.99^a	14.3	32.7	32.1	34.7^a	34.7^a
0.5	0	-	538^a	1350^a	2.51^b	8.6	32.9	31.2	30.0^b	29.8^b
0.5	0	+	536^a	1345^a	2.51^b	5.7	33.2	32.6	34.7^a	33.8^a
0.5	1.25	-	470^b	1298^b	2.76^{ab}	14.3	32.8	31.8	31.2^b	30.6^b
0.5	1.25	+	471^b	1295^b	2.75^{ab}	11.4	33.1	32.0	33.9^a	34.4^a
1	0	-	536^a	1352^a	2.52^b	8.6	32.1	31.9	27.2^c	26.3^c
1	0	+	538^a	1350^a	2.51^b	8.6	33.4	31.8	34.6^a	33.8^a
1	1.25	-	470^b	1293^b	2.75^{ab}	11.4	31.9	31.1	28.1^c	26.9^c
1	1.25	+	469^b	1289^b	2.75^{ab}	11.4	32.5	32.2	34.3^a	34.5^a
SEM			1.35	2.91	0.01	–	0.19	0.20	0.17	0.21
Significance			**	**	*	–	NS	NS	*	*

Means within each column with no common superscripts differ significantly (p<.05). Ns=not significant . * Significant at (p<0.05). ** Significant at (p<0.01) .

[1]Dietary hydrated sodium calcium aluminosilicate (HSCAS), aflatoxin (AF),and added (+) 0.25% calcium (Ca), 0.13% available phosphorus (AP), 20 ppm zinc(Zn), 20ppm manganese(Mn),and 1200IU/kg of vitamin A (Vit.A).

[2]Apparent retention(based on total collection from days 33 to 35) =[nutrient intake (g) - excreted nutrient (g)]/nutrient intake (g) x 100.

Each mean represents 5 pens of 6 or 7 birds each .

A negative effect, on growth performance traits, was shown with groups fed diets (Free AF) contained HSCAS at both levels, added minerals and vitamin A, or both of them. Also, raising level of minerals and vitamin A in the diets contained AF without or with HSCAS did not alter (P < 0.05) AF effects on growth performance (Table 2). Many authors (Smith *et al.*, 1993; Edrington *et al.*, 1997; Genedy *et al.*, 1999) showed similar deteriorations in growth performance traits by AF contaminated diets, Abdelhamid *et al.* (1995a) failed to control of aflatoxicosis by adding some minerals and vitamins to AF diets. The inhibition of metabolism and immunity system by aflatoxicosis may explain the present impairments as those observed by Smith and Hamilton (1970). The present results confirmed those of Kubena *et al.* (1995), Abo-Norage *et al.* (1995) and Genedy *et al.* (1999). They showed with different poultry species that adding 0.5% HSCAS to basal diet did not differ growth performance traits, but diminished AF effects on both body gain, feed intake and feed conversion when added to contaminated diets. Regarding effect of dietary present treatments on apparent minerals retention based on total collection during 33-35 days of the experiment, it showed different responses (Table 2). Both Ca and TP retentions did not differ among turkey groups fed basal diet without or with present treatments. There was a significant (P < 0.05) decrease in the apparent retention of Zn about 16 and 23%, and Mn about 14 and 24% with groups fed basal diet contained 0.5 and 1% HSCAS singly, respectively. The effects occurred by 1% HSCAS on both minerals retention were (P < 0.05) more severe than those occurred by 0.5% level. The deficiencies in both Zn and Mn utilization were negated and similar to the control value by raising levels of Ca, AP, Zn, Mn and vitamin A in diets contained either 0.5 or 1% HSCAS singly or with AF. Adding AF with basal diets, or with other present treatment diets, unchanged (P < 0.05) apparent mineral retention values during collection period 33-35 days old (Table 2). Similarly, the decrease utilization of Zn as a result of HSCAS ingestion was shown also by Chung *et al.* (1990). The positive charge deficiencies on phyllosiliciate, create the potentiality for sorbing positively charged or cationic compounds as minerals may explain their utilization deficiencies as shown by Theng (1974). A negative response of Ca, P utilization by dietary HSCAS, in the present study, was also shown by Chung and Baker (1990) and Southern *et al.* (1994). However, the present results are not in harmony with those of Roland *et al.* (1985) and Balard and Edwards (1988) with improvement of Ca utilization, and Edwards (1988) with P utilization decrease, for diets contained HSCAS.

Organs and glands weight and tibia physical measurements:

Data of 5 weeks old turkey relative organs and glands weight of live weight showed a significant (P < 0.01) effect with AF diets. While those of tibia width (mm), length (cm) and weight (%) were unaffected by dietary treatments fed from 1 to 35 days old (Table 3). Adding AF singly to turkey basal diet, for 5 weeks, increased (P < 0.01) relative weights of liver (66%), kidneys (67%) and spleen (74%), and decreased those of thymus (52%) and bursa of Fabricius (47%) glands (Table 3). The AF effects on relative organs and glands weight were (P < 0.01) diminished (but not similar with control) by inclusion of HSCAS to diets contained AF without or with added minerals and vitamins studied. Both a 5 and 1% HSCAS had similar (P < 0.05) protections, against effects occurred by basal diet contained AF singly, on liver, about 66-67%, and other relative organs and glands weight. While inclusion of HSCAS at both levels, raising level of studied minerals and vitamin A, or both of them in the basal diet had negative effect (P < 0.05) on studied organs and glands weight. Also, studied minerals and vitamin A failed to alter AF effects on organs and glands when they were added with diets contained AF singly or plus HSCAS (Table 3). The present results are in agreement with those of Giroir *et al.* (1991), Edrington *et al.* (1997) and Genedy *et al.* (1999) who showed similar alterations in relative organs and glands by aflatoxicosis. Increasing liver weight in the present study may be due to the accumulation increase of fat in this organ , cited follow, as a result of interference of AF with lipid metabolism as explaind by Smith and Hamilton (1970). While decreasing bursa of Fabricius and thymus glands weight may be attributed to the depletion of follicular lymphocytes (Abd El-Hamid *et al.*, 1992). The protection of HSCAS against AF effect on organs and glands was also observed by Kubena *et al.* (1993), Abo-Norage *et al.* (1995) and Genedy *et al.* (1999). The same authors also found that 0.5% HSCAS with basal diet had negative affect on organs and glands weight. The present results confirmed those of Abdelhamid *et al.* (1995a) and Ghazalah *et al.* (1995) when they failed to control aflatoxicosis by some minerals or vitamins.

Table 3. Relative organs and glands weight of body weight and tibia measurements of 5 weeks old White Holland turkey as affected by dietary treatments fed from 1 to 35 days old .

Dietary treatment[1]			Organs and glands wt. (%)					Tibia		
HSCAS %	AF ppm	Ca , Ap Zn, Mn Vit . A	Liver	Kidneys	Spleen	Thymus	bursa of Fab-ricius	Width mm	Length Cm	Weight %
0	0	-	2.92^c	1.21^c	0.19^c	0.33^a	0.34^a	5.69	7.81	0.38
0	0	+	2.90^c	1.19^c	0.18^c	0.32^a	0.34^a	5.73	7.89	0.37
0	1.25	-	4.85^a	2.02^a	0.33^a	0.16^c	0.18^c	5.81	7.96	0.39
0	1.25	+	4.79^a	2.01^a	0.34^a	0.17^c	0.19^c	5.67	7.68	0.38
0.5	0	-	2.94^c	1.18^c	0.19^c	0.31^a	0.35^a	5.48	7.59	0.36
0.5	0	+	2.91^c	1.21^c	0.18^c	0.32^a	0.33^a	5.62	7.91	0.39
0.5	1.25	-	3.58^b	1.70^b	0.29^b	0.26^b	0.28^b	5.71	7.74	0.38
0.5	1.25	+	3.62^b	1.68^b	0.27^b	0.27^b	0.27^b	5.69	7.69	0.37
1	0	-	2.95^c	1.18^c	0.18^c	0.33^a	0.34^a	5.41	7.55	0.36
1	0	+	2.92^c	1.20^c	0.19^c	0.31^a	0.35^a	5.73	7.83	0.36
1	1.25	-	3.56^b	1.69^b	0.28^b	0.26^b	0.29^b	5.80	7.79	0.39
1	1.25	+	3.63^b	1.68^b	0.26^b	0.25^b	0.28^b	5.69	7.70	0.38
SEM			0.09	0.03	0.001	0.002	0.003	0.11	0.26	0.002
Significance			**	**	**	**	**	NS	NS	NS

Means within each column with no common superscripts differ significantly (p<.05).
Ns=not significant. **Significant at (p<0.01).
[1]Dietary hydrated sodium calcium aluminosilicate (HSCAS), aflatoxin (AF),and added (+) 0.25% calcium (Ca), 0.13% available phosphorus(AP), 20ppm zinc(Zn),20ppm manganese (Mn), and 1200IU/kg of vitamin A (Vit .A)

Meat and liver components and their aflatoxin residues:

Results of 5 weeks old turkey meat and liver chemical analyses showed a significant effect, except meat protein content (%) was unaltered, by dietary treatments fed from 1 to 35 days old (Table 4). Adding AF to basal diet for 5 weeks decreased ($P < 0.05$) meat fat (30%) and glycogen (28%) contents, increased ($P < 0.01$) liver fat (141%) content, and deposited AFB_1 residues about 25.4 ng/g in meat and 93.4 ng/g in liver fresh tissues (Table 4). While liver contents of vitamin A and Zn showed a negative response with AF singly in the basal diet. Inclusion either 0.5 or 1% HSCHS to AF diets, negated (similar to control) meat fat and glycogen decreases, and alleviated ($P < 0.05$, but not similar with control value) liver fat increases and AFB_1 residues in both meat and liver tissues, occurred by AF with basal diet. Both 0.5 and 1% HSCAS recorded similar protections, against AF effects, on meat and liver analyses. While, raising level of studied minerals and vitamin A in the AF diets failed to alter AF effects on meat and liver analyses (Table 4). There was a significant adverse effects occurred by HSCAS at both levels singly on Zn and vitamin A contents in liver. Inclusion of HSCAS to basal diet decreased liver Zn ($P < 0.01$) and vitamin A ($P < 0.05$) contents about 15.3 and 15% by 0.5% level, and about 29.3 and 26.2% by 1% HSCAS, respectively. There was a significant difference ($P < 0.05$) between both HSCAS levels effect, while AF had negative effect, on liver Zn and vitamin A contents. The adverse effects, occurred on liver Zn and vitamin A contents by both levels of HSCAS, were negated (similar with control value) by raising level of studied minerals and vitamin A in the diets contained HSCAS without or with AF (Table 4). The present study confirmed those of Inova *et al.* (1985), Ali *et al.* (1993) and Abdelhamid *et al.* (1995b) who reported similar alterations in meat and liver components by aflatoxicosis. The higher fat content in liver and its lower in meat by AF diets, which could be attributed to inhibited RNA synthesis, caused a marked increase of fat in the liver (Smith and Hamilton, 1970). Similarly, Trucksess *et al.* (1983), Sova *et al.* (1984) and Hegazy and Edris (1991) detected AFB_1 residues in meat and liver tissues of birds fed a contaminated diets. Increasing accumulation AFB_1 in the liver than meats, in the present study, was observed also by Rizk *et al.* (1993), Abdelhamid *et al.* (1995b) and Genedy *et al.* (1999). The protection effect, for HSCAS on meat and liver analysis against aflatoxicosis, occurred in the present study, was also observed by Scheideler (1993) and Genedy *et al.* (1999). The HSCAS sorbed AF selectively during the digestive process, which rendered most of the AF unavailable for absorption from the gastrointestinal tract (Harvey *et al.*, 1991). Liver Zn content was reported by Schell and Kornegay (1994), to be a sensitive measurements to evaluate the Zn status. Liver vitamin A content is a far better response criterion for assessing vitamin A status (Ames and Harris, 1956) because liver represents about 70-90% of the body stores of vitamin A (Wolf, 1984). The present study confirmed those of Brake (1987) with liver vitamin A content by HSCAS diets. However, Chung *et al.* (1990) failed to find a significant effect on liver vitamin A content with dietary HSCAS.

Table 4. Meat and liver chemical analysis of 5 weeks old White Holland turkey as affected by dietary treatments fed from 1 to 35 days old.

Dietary treatment[1]			Meat analysis				Liver analysis			
HSCAS %	AF PPm	Ca, Ap Zn, Mn Vit. A	Protein %[2]	Fat %[2]	Glycogen mg /100 g[2]	AFB_1 ng/g[3]	Fat %[2]	Vit. A µg/g[3]	Zinc µg/g[2]	AFB_1 ng/g[3]
0	0	-	74.2	16.8 [a]	223[a]	-***	19.4 [c]	18.7 [a]	79.6 [a]	-***
0	0	+	73.9	16.9 [a]	219[a]	–	20.2 [c]	19.2 [a]	81.8 [a]	–
0	1.25	-	76.3	11.7 [b]	161[b]	25.4 [a]	46.8 [a]	18.4 [a]	78..3[a]	93.4 [a]
0	1.25	+	76.9	11.8 [b]	163[b]	24.8 [a]	44.7 [a]	17.9 [a]	79.1 [a]	91.9 [a]
0.5	0	-	73.1	17.2 [a]	225[a]	–	21.9 [c]	15.9 [b]	67.4 [b]	–
0.5	0	+	72.4	16.6 [a]	217[a]	–	20.3 [c]	17.8 [a]	80.4 [a]	–
0.5	1.25	-	74.8	14.3[ab]	187[ab]	14.1[b]	33.8 [b]	15.8 [b]	66.9 [b]	46.2 [b]
0.5	1.25	+	75.7	14.1 [ab]	191[ab]	13.6 [b]	32.6 [b]	17.6 [a]	78.6 [a]	42.8 [b]
1	0	-	75.2	16.9[a]	215[a]	–	19.8 [c]	13.8 [c]	56.3 [c]	–
1	0	+	73.6	17.4[a]	228[a]	–	20.6 [c]	18.1 [a]	80.5 [a]	–
1	1.25	-	76.4	14.2[ab]	186[ab]	12.2[b]	34.1 [b]	14.0 [c]	55.8 [c]	43.1 [b]
1	1.25	+	75.2	13.9[ab]	194[ab]	11.9 [b]	32.8 [b]	17.8 [a]	78.7 [a]	41.6 [b]
SEM			0.76	0.11	1.98	0.46	0.80	0.86	0.88	0.39
Significance			Ns	*	*	*	**	*	**	*

Means within each column with no common superscripts differ significantly ($p<.05$).
Ns=not significant . * Significant at ($p<0.05$) . Significant at ($p<0.01$) .**
[1]Dietary hydrated sodium calcium aluminosilicate (HSCAS), aflatoxin (AF),and added (+) 0.25% calcium (Ca), 0.13% available phosphorus (AP), 20 ppm zinc (Zn) ,20 ppm manganese (Mn), and 1200 IU/kg of vitamin A (Vit .A)
[2] Analysis on DM basis .
[3] Analysis on fresh basis .
***** No detecting of aflatoxin $_{B1}$**

Tibia and toe mineral contents:

Concentrations (%) on DM basis of ash, Ca and P in tibia, and those of ash in toe of 5 weeks old turkey did not differ (P < 0.05) between birds fed basal diet and those fed other diets (Table 5). There was a significant (P < 0.01) decrease in tibia Zn either (µg/g) or (µg/tibia), tibia Mn (µg/g), and toe Zn (µg/g) contents about 14.6, 15.4, 11 and 15.7% by inclusion of 0.5 %, and about 26, 27.5,. 26.4 and 28.8% by 1% HSCAS singly to basal diet, respectively (Table 5). There was a significant difference (P < 0.05) between effects of 0.5 and 1% HSCAS, while AF had a negative effect on tibia and toe analysis (Table 5). The adverse effects occurred on tibia and toe analysis by both levels of HSCAS were negated (similar with control value) by raising level of studied minerals and vitamin A in the diets contained HSCAS without or with AF (Table 5). The present study confirmed those of Chung *et al.* (1990) who found that the total tibia Zn was decreased about 5 and 14% by diets contained 0.5 and 1% HSCAS, respectively, and this decrease in the total tibia Zn as well as Zn concentration in tibia was linear (P < 0.05) with increasing HSCAS in the diets. Also, the negative response of tibia Ca, P and ash contents with diets contained 0.5 and 1% HSCAS was observed by Suthern *et al.* (1994). However, a decrease content of tibia P (Edwards, 1988) and tibia ash (Scheideler, 1993), and unalter total and concentration of Mn in tibia (Chung *et al.*, 1990, and Suthern *et al.*, 1994), with HSCS diets, are different with the present results. The protection effect of dietary studied minerals and vitamin A against decreases of Zn, Mn and vitamin A contents in body tissues, in the present study, may be due to compensate the deficiencies of these nutrient utilization occurred by HSCAS. The present results confirmed those of Scheideler (1993) who showed that bone ash was not affected with AF diets. However, Abdelhamid *et al.* (1995b) observed an increase in tibia magnesium with aflatoxic cocks.

Table 5. Tibia and toe chemical analysis (DM basis) of 5 weeks old White Holland turkey as affected by dietary treatments fed from 1to 35 days old.

Dietary treatment[1]			Tibia analysis						Toe analysis	
HSCAS %	AF PPm	Ca,Ap Zn,Mn Vit.A	Ash %	Ca %	P %	Zn µg/g	Zn µg/tibia	Mn µg/g	Ash %	Zn µg/g
0	0	-	43.8	19.7	8.91	192 [a]	273[a]	4.36[a]	12.8	98.1[a]
0	0	+	44.6	20.3	9.42	198 [a]	278[a]	4.48[a]	13.1	99.8[a]
0	1.25	-	42.9	19.6	8.84	189 [a]	269[a]	4.41[a]	12.7	98.7[a]
0	1.25	+	43.3	18.8	9.36	191[a]	271[a]	4.62[a]	13.2	99.0[a]
0.5	0	-	41.9	20.6	8.78	164[b]	231[b]	3.88[b]	12.5	82.7[b]
0.5	0	+	43.7	18.7	9.74	191[a]	268[a]	4.59[a]	13.3	97.5[a]
0.5	1.25	-	42.1	17.3	8.94	166[b]	238[b]	3.86[b]	12.4	83.1[b]
0.5	1.25	+	43.8	18.1	9.67	194[a]	272[a]	4.40[a]	13.1	96.9[a]
1	0	-	41.6	19.3	8.58	142[c]	198[c]	3.21[c]	12.2	69.8[c]
1	0	+	44.0	17.9	9.79	188[a]	265[a]	4.39[a]	13.1	96.6[a]
1	1.25	-	42.7	18.5	8.61	141[c]	197[c]	3.18[c]	12.5	68.9[c]
1	1.25	+	43.9	20.4	9.96	191[a]	268[a]	4.38[a]	13.2	98.2[a]
SEM			0.48	0.31	0.19	1.15	2.36	0.10	0.19	0.64
Significance			Ns	Ns	Ns	**	**	**	Ns	**

Means within each column with no common superscripts differ significantly (p<.05).
Ns=not significant. **Significant at (p<0.01).
[1]Dietary hydrated sodium calcium aluminosilicate (HSCAS), aflatoxin (AF), and added (+) 0.25% calcium (Ca), 0.13% available phosphorus (AP), 20 ppm zinc (Zn), 20 ppm manganese (Mn), and 1200IU/kg of vitamin A(Vit .A)

Blood constituents:

Data of turkey blood hemoglobin, serum total protein, total lipids, cholesterol, AST and ALT at 5 weeks old were influenced ($P < 0.05$ or 0.01) with AF diets, while those of Ca, P constituents had negative response with dietary studied treatment (Table 6). Adding AF singly to basal diet decreased ($P < 0.01$) hemoglobin (33%), total protein (34%), total lipids (20%) and cholesterol (36%) contents, and increased ($P < 0.05$) AST (38%) and ALT (42%) activities in blood (Table 6). These AF effects on blood were alleviated ($P < 0.05$, but not similar with control values) by inclusion of HSCAS with AF diets. There was no differences ($P < 0.05$) between 0.5 and 1% HSCAS in their protection effects against aflatoxicosis on blood constituents. While inclusion of HSCAS at both levels to basal diet, and also raising levels of studied minerals and vitamin A in the basal diet or in other treatment diets, did not alter blood constituents value (Table 6). Similar alterations in blood constituents by aflatoxicosis were observed also by Abo-Norage *et al.* (1995), Abdelhamid *et al.* (1995b) and Ghazalah *et al.* (1995). Decreasing serum total lipids, in the present study, may be due to the interference of AF with lipid metabolism as those reported by Hamilton *et al.* (1972) who explained that lipid transport is inhibited some how by aflatoxicosis. Which could account for the accumulation of lipids in the liver and their decreases in the serum, as a result of aflatoxicosis. While decreasing serum proteins may be due to the decreasing of the synthetic power of albumin and globulin in the liver by aflatoxicosis (Abd El-Hamid *et al.*, 1992). The present results confirmed also those of Kubena *et al.* (1995), Abo-Norage *et al.* (1995) and Genedy *et al.* (1999) who observed that HSCAS reduced AF effects on blood criterion.

Table 6. Blood serum constituents of 5 weeks old White Holland turkey as affected by dietary treatments fed from 1 to 35 days old.

Dietary treatment[1]			Hemo-globin g/100ml	Total Protein g / 100 ml	Total Lipids g/ L	Cholest-erol mg /100ml	Ca mg/ 100ml	P mg/ 100ml	AST IU/L	ALT IU/L
HSCAS %	AF PPm	Ca, AP Zn,Mn Vit. A								
0	0	-	12.61^{a}	4.66^{a}	7.31^{a}	166.8^{a}	12.63	6.28	24.7^{c}	11.3^{c}
0	0	+	12.57^{a}	4.63^{a}	7.21^{a}	167.1^{a}	12.75	6.23	23.3^{c}	10.8^{c}
0	1.25	-	8.46^{c}	3.06^{c}	5.84^{c}	106.8^{c}	12.56	6.14	34.1^{a}	16.0^{a}
0	1.25	+	8.51^{c}	3.10^{c}	5.81^{c}	108.2^{c}	12.60	6.34	34.7^{a}	16.2^{a}
0.5	0	-	12.64^{a}	4.71^{a}	7.18^{a}	167.7^{a}	12.71	6.27	24.5^{c}	11.1^{c}
0.5	0	+	12.55^{a}	4.60^{a}	7.24^{a}	173.2^{a}	12.58	6.39	25.3^{c}	10.6^{c}
0.5	1.25	-	10.71^{b}	3.80^{b}	6.54^{b}	137.6^{b}	12.80	6.18	29.7^{b}	13.7^{b}
0.5	1.25	+	10.65^{b}	3.83^{b}	6.62^{b}	138.2^{b}	12.64	6.27	30.2^{b}	14.2^{b}
1	0	-	12.85^{a}	4.69^{a}	7.19^{a}	171.0^{a}	12.51	6.30	23.4^{c}	10.4^{c}
1	0	+	12.63^{a}	4.74^{a}	7.26^{a}	168.6^{a}	12.73	6.18	24.1^{c}	11.1^{c}
1	1.25	-	10.69^{b}	3.82^{b}	6.43^{b}	137.5^{b}	12.42	6.26	30.2^{b}	14.2^{b}
1	1.25	+	10.64^{b}	3.81^{b}	6.58^{b}	138.1^{b}	12.77	6.36	29.7^{b}	14.6^{b}
SEM			0.10	0.02	0.03	0.71	0.08	0.04	0.12	0.10
Significance			**	**	**	**	Ns	Ns	*	*

Means within each column with no common superscripts differ significantly (p<.05).
Ns=not significant . * Significant at (p<0.05) . ** Significant at (p<0.01) .
[1]Dietary hydrated sodium calcium aluminosilicate (HSCAS), aflatoxin (AF),and added (+) 0.25% calcium (Ca), 0.13% available phosphorus (AP), 20 ppm zinc (Zn), 20 ppm manganese (Mn), and 1200IU/kg of vitamin A (Vit .A)

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تأثير مركب هيدرات الصوديوم والكالسيوم والألومنيوم سيليكات على ثبات بعض العناصر المعدنية والفيتامينات عند تسمم علف كتاكيت الرومى النامى بالأفلاتوكسينات

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أجريت هذه الدراسة باستخدام ٤٢٠ كتكــوت رومــي هولنــدي ابيــض عمــر يــوم موزعــة إلى ١٢مجموعة × ٥مكررات لدارسة تأثير إدخـــال مركــب الالومنيــوم ســيليكات (صفــر،٠,٥، ١%) والافلاتوكسينات(صفر، ١,٢٥ مليجرام/ كجــم علــف) بــدون او مــع إضافــة٠,٢٥% كالســيوم و٠,١٣% فوسفور متاح و٢٠ جزء في المليون من كل الزنك والمنجنــيز و١٢٠٠ وحــدة دوليــة/ كجــم علــف من فيتامين أ وذلك إلى الأعلاف فى تصميم عــاملى (٣×٢×٢) خــلال ١- ٣٥ يــوم مــن العمــر علــي الأداء ومعدل الاستفادة الظاهرى من العناصر المعدنية ومكونات أنســجة اللحــوم والكبــد وعظــام التبيــا والاصابع والدم وكذلك الافلاتوكسينات المحتجزة في أنسجة الطيور . وكـــانت أهــم النتــائج كـــالآتي:

١- أدى تلوث علف الاساس بالافلاتوكسينات بدون معـــاملات اخــرى الــى إنخفــاض معــدل الزيــادة في وزن الجسم (٢٨ %) والعلـــف المـــأكول (١٥%) وتدهــور كفــاءة تحويــل العلــف وزيــادة معدل النفوق وتضخم الكبد والكليتين والطحـــال وضمــور حوصلــة فبريشــيوس وغــدة الثيمــوس وإنخفاض تركـــيز الدهـــون والجليكوجيـــن فـــى اللحـــوم وانخفــاض وتركــيز البروتينــات الكليــة والـــهيموجلوبين والدهـــون الكليــة والكوليســترول فــى الــدم وزيــادة تركــيز الدهـــــون فــــي الكبد(١٤١%) وزيادة نشاط أنزيمــي AST&ALT فــى الســيرم وترســيب افلاتوكســين ب١فــى انسجة الكبد (٩٣,٤نانوجرام/ جرام) واللحـــوم (٢٥,٤ نــانوجرام /جــرام)

٢- لوحظ معدل حماية وتحسن معنوى فى جميع الصفـــات المتـــاثرة بالافلاتوكســينات يــتراوح مــابين ٤٥- ٧٤% حسب استجابة كل صفة وذلـــك بإضافــة مركــب الألمونيــوم ســيليكات بمعــدل ٠,٥ و١% (لا يوجد اختلاف بين المســـتويين فـــى كفــاءة الحمايــة) فـــي الأعــلاف المحتويــة علــى الافلاتوكسينات فى حين لــــم تســجل العنــاصر المعدنيــة والفيتامينــات المضافــة فــي الأعــلاف الملوثة اى تغير في هذه التأثيرات على الصفـــات المختلفـــة.

٣- أظهرت الأعلاف المحتوية على مركب الالومنيوم سيليكات بـــدون معــاملات أخــرى عــدم تغــير فى قيم الزيادة لوزن الجسم والعلــف المــأكول وكفــاءة تحويــل العلــف ومعــدل النفــوق ومعــدل الاستفادة الظاهرى من العناصر المعدنية وكذلك تركيزهـــا فـــي الأنســجة المختلفــة مــاعدا الزنــك والمنجنيز وفيتامين أ فقد تـــأثرا حيــث انخفــض معــدل الاســتفادة الظـــاهري للزنــك والمنجنــيز وتركيزهما فى عظام التبيا والأصابع وفي الكبــــد وكذلــك انخفــض تركــيز فيتــامين أ فـــي الكبــد وكانت هذه الانخفاضات معنوية واكثر ضـــرلوة مــع مســتوى١% عــن٠,٥% ألمونيــوم ســيليكات ولم تؤثر إضافة الافلاتوكسينات في الأعلاف المحتوية علـــي مركــب الألمونيــوم ســيليكات علــى هذه التغيرات فى الزنك والمنجنيز وفيتـــامين أ.

٤- تلاشت جميع الاثار الجانبيـــة لمركـــب الالومنيـــوم ســـيليكات علـــى كـــل مـــن الزنـــك والمنجنـــيز وفيتامين أ وذلك برفع مستوى بعض العناصر المعدنية وفيتـــامين أ فـــى الأعـــلاف المحتويـــة علـــى مركب الالومنيوم ســـيليكات بـــدون او مـــع الافلاتوكســـينات فـــى حيـــن ان رفـــع مســـتوى هـــذه العناصر المعدنية وفيتامين أ فى علف الاساس ليس له تاثير فـــي هـــذه الدراســـة.

٥- لم يتأثر كل من معدل الاستفادة الظاهري للرماد والكالســيوم والفوســفور الكلــي وكذلــك تركــيزهم في العظام والـــدم ومقـــاييس طـــول وقطـــر ووزن عظـــام التبيـــا ومحتـــوى الـــبروتين فـــى الـــدم بالمعاملات تحت الدراســـة.

وتوصـــى هـذه الدارسـة بأنــه علـى الرغــم مــن أن المسـتوى ٠,٥% لمركــب هيـدرات الصوديــوم و الكالســيوم و الألومنيــوم ســيليكات والموصـــى بـــه لخفــض ســمية الافلاتوكســينات لا تؤثــر علــى اداء الرومـــى إلا أنـــه مـــن المـــهم جـــدا رفـــع مســتوى بعــض العنـــاصر المعدنيـــة والفيتامينـــات فـــى الأعـــلاف المحتوية عليها لتعويض النقص فى معدل الاستفادة من هذه العنـاصر.