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Impact of Some Feed Additives on Zaraibi Goats Performance and Blood Profile Fed Aflatoxin Contaminated Diets

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Abstract: Thirty five growing male Zaraibi kids aged about 100 days and weighed in average 14.41±2.45 kg, were divided according to their live body weight (LBW) into five similar groups (7 animals each). The diet fed was naturally contaminated with Aflatoxin (AFB_1), 15.98 μg/kg DM in concentrate feed mixture (CFM) and 103.27 μg AFB_1/kg DM in clover hay (CH). Kids were distributed according to body weight into 5 similar groups, that received 5 dietary treatments, G1: diet naturally contaminated with AFB_1 (control), G2: control + 1% Hydrated sodium calcium alumino-silicate (HSCA), G3: control +1% HSCA + 1% Propionic acid (PA), G4: control +1% HSCA + 0.5% gentian violet (GV) and G5: control +1% HSCA + 0.5% GV + 1% PA. The feeding experiment lasted for 120 days. The digestibility coefficients values of CP, CF, EE, NFE and feeding values of (R3, R4 and R5) diets were higher than that of supplemented with HSCA or control diets (R2 & R1). Contaminated-diet plus 1% HSCA + 0.5 % GV + 1% PA, recorded higher digestibility coefficients values for all nutrients especially CP, EE and NFE than the other diets. Average DM intake expressed as daily DM intake or TDN and DCP% was significantly higher ($P<0.05$) with kids fed diet supplemented with HCAS + 0.5% GV+ PA (R5), followed by HCAS (R2), HCAS + PA (R3) and HCAS+ GV (R4) than those fed the control diet (R1). The average daily gain (ADG) was significantly ($P<0.05$) increased in Zaraibi kids treated rations (R2, R3, R4 and R5) than those fed the control ration (R1). In addition, using HSCA alone either with propionic acid or gentian violet improved ADG by about 43.06, 47.75, 46.64 and 52.24%, respectively. Feed efficiency expressed as DMI and/ kg gain, was better ($P<0.05$) in kids received treated diets with HSCA + GV. + propionic acid (R5), followed by HSCA + PA (R3), HSCA + GV. (R4) and R2 (HSCA), respectively, than R1. Serum total protein (STP), albumin and globulin of R2, R3, R5 and R5 had a significant ($P<0.05$) higher values than control diet. significant increase ($P<0.05$) in the mean values of serum transaminases activities (ALT & AST), urea-N, creatinine and Cholesterol concentrations, for growing Zaribi kids fed the contaminated diet (R1) compared to kids fed contaminated diets plus HSCA (R2) or HSCA plus PA (R3), HSCA + GV (R4) or diet with HSCA + GV + PA (R5). The results of hematological parameters, indicated that the values of hemoglobin (Hb), red blood cells (RBC's), MCH, MCHC and lumphocytes cells were reduced with contaminated diet (R1) than in the other treatment groups and the differences were significant in Hb, RBC's and lymphocytes. It is concluded that adding 1% Hydrated sodium calcium alumino-silicate (HSCA), 1% Propionic acid (PA) and 0.5% gentian violet (GV), was superior in detoxification than adding additives to the contaminated rations growing male Zaraibi kids. All could improve digestibility coefficients, average daily gain and both feed efficiencies. It could also increased excretion of AFB_1 and OA in feces.

Key words: Aflatoxin · Gentian violet · Clay · Zaraibi goat · Feed contamination · Digestibility · Detoxification

INTRODUCTION

Aflatoxins are secondary fungal metabolites produced by *Aspergillus flavus and A. parasiticus* groups. Aflatoxin B_1 (AFB_1) has been reported to be the parent compound of the common toxins [1]. The presence of mycotoxins in feeds may decrease feed intake and affect animal performance. In addition, the possible presence of toxic residues in edible animal products (milk, meat, offal), may have some detrimental effects on

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human health. This toxin is known to be hepatotoxic, nephrotoxic and carcinogenic to wide variety of animals [2, 3]. The current effects of AF in livestock have been well documented and may include hepatotoxicosis, immunosuppression, reduced growth and performance, carcinogenicity, or death [4,5,6]. Contamination of feedstuffs with these toxins in particular has caused severe economic problems for livestock producers and may create potential health risks by the transmission of toxins and/or their metabolites from livestock to human through consumption of meat, milk or eggs [7]. Although sheep and goats are generally considered to be more resistant to AF than other species, they can yield to the toxic effects of AF and depressed weight gain and death in growing animals that can be of economic importance [8, 9]. Some recent tools used for the detoxification of AF is supplementing diets with chemical or physical compounds [10]. Since the 1960's, gentian violet has been marketed for use as a mold inhibitor and fungus growth in animal feed at a level of up to 8 ppm [11]. The Food and Drug Administration's Center for Veterinary Medicine [12] is proposing to declare gentian violet a food additive and a new animal drug when added to animal feed. Gentian violet (methylrosaniline chloride) is a mixture of crystal violet (hexamethyl-pararosaniline chloride) and methyl violet (pentamethylrosani- line chloride). These compounds belong to a class of dyes related by molecular structure known as di and tri-amino-phenyl-methane. Hagler [11] and Tindall [13] summarize the need for uses of Propionic a naturally volatile organic acid as preservatives, especially mold inhibitors in animal feeds. Therefore practical and least cost-effective methods to detoxify AF-contaminated feedstuffs are in great demand. Gentian violet if supplemented with sodium bentoite will act as Antifungal agent against mycotoxicosis [14]. Also, Natural clays adsorb the toxic materials and excrete it in feces [15].

The present study was undertaken to: 1) examine the effect of feeding natural AF-contaminated diet on feed intake, body weight gain, feed efficiency and blood biochemistry and hematology of growing Zaraibi kids: 2) determine the ability of propionic acid, gentian violet and hydrated sodium calcium alumino-silicate (HSCA) on preventing the negative effects associated with feeding the contaminated rations.

MATERIALS AND METHODS

Animals and Feeding: The present study was conducted at El-Serw Experimental Research Station, Animal Production Research Institute and Animal Health Research Institute, Agriculture Research Center, Egypt. Thirty five growing male Zaraibi kids aged about 100 days and weighed in average 14.41±2.45 kg, were divided according to their live body weight into five similar groups (7 animals each). Animals were weighted at the beginning then every two weeks. The diet fed was naturally contaminated with Aflatoxin AFB_1 15.98 µg/kg DM in concentrate feed mixture (CFM) and 103.27 µg AFB_1/kg DM in clover hay (CH). Kids were distributed according to body weight into 5 similar groups, that received 5 dietary treatments, G1- Diet naturally contaminated with aflatoxin (control), G2: control + 1% Clay (Hydrated sodium calcium alumino-silicate), G3: control +1%Clay + 1% Propionic acid, G4: control +1%Clay + 0.5% Gentian violet and G5: control +1% Clay + 0.5% Gentian violet +1% Propionic acid. Chemical composition of the experimental diets was illustrated in Table 1.

The feeding experiment lasted for 120 days. Throughout the feeding experiment, kids were fed the respective rations according to NRC [16] of goats and the amount of concentrate feed mixture (CFM) and clover hay (CH) were estimated to cover 60% and 40% of dry matter requirements.

Clay was bought from Al-Ahram Co. for Mining and Natural Fertilizers, Giza, Egypt. The above additives were added to the rations at the total daily intake. The rations were offered twice daily at 8 am and 4 pm. Water was available all times. Animals were kept under routine veterinary care throughout the experimental period and the clinical symptoms were recorded.

Table 1: Chemical composition of the experimental diets, %

	Chemical composition (Dry matter basis)						
Item	DM	OM	CP	EE	CF	NFE	Ash
Concentrate feed Mixture (CFM)*	89.50	91.45	15.66	3.63	12.15	60.01	8.55
Berseem hay (BH)	89.19	88.81	13.46	1.37	32.12	41.86	11.19
Ration	89.38	90.39	14.78	2.73	20.14	52.74	9.61

*Concentrate feed mixture (CFM) consists of 40% yellow corn grain, 23% undecorticated cotton seed meal, 21% wheat bran, 7% soybean meal, 5% molasses, 2.5% limestone powder and 1% common salt

Digestibility Trials: Five digestibility trails were conducted using acid insoluble ash (AIA) method according to Van Keulen and Young [17], to evaluate the experimental rations, each lasted for 22 days, of which the first 15 days were considered as a preliminary period followed by 7days for samples collection. Also, water consumption was determined.

Feedstuffs and Feces Samples: During collection period of each digestibility trail, samples of feeds and feces were collected and stored at (-18 to -20°C) until analysis.

Blood Samples: Blood samples were collected from each lamb from the jugular vein of Zaraibi kids for 3 successive days 4 hrs post feeding. Samples were collected three times through the experiment starting from the end of the fourth month with one month interval. The whole blood was immediately directed to hematological and biochemical estimation. Additional blood samples were centrifugation at 4000 rpm for 20 minutes. Part of the separated sera was directed to the enzyme activity determination, while the other part was stored at (-18 to -20°C) until assay.

Analytical Procedures:

Feedstuffs and Feces Samples: Samples of feeds were analyzed periodically. Feedstuffs and feces samples were analyzed for DM, CP, CF, EE and ash according to the A.O.A.C. [18] and NFE was calculated by difference.

Aflatoxin: The parent compound of extracted AFB_1 from the feedstuffs (CFM and CH) and feces were spotted in duplicate on thin layer plates having silica gel of 0.25 mm thick [March, DC-Kieselgel 60 (Dramstadlt, GFR)] were used and quantitatively determined using TLC scanner 3-CAMAG. Assay of aflatoxin B_1 was done according to Shanon *et al.* [19] method.

Blood Biochemistry: Serum total protein (TP) was determined according to Doumas *et al.* [20], serum albumin, Hill and Wells [21], urea -N, Patton and Grouch [22], creatinine, Ullmann [23], glucose Siest *et al.* [24], total lipids [25], cholesterol [26], Bilirubin, Doumas [27], Transaminase enzymes (AST and ALT) were determined according to Rietman and Frankel [28] and alkaline phosphatase [29].

Hematological Blood Parameters: Hemoglobin, hematocrite and differential leukocyte count were determined according to Linne and Ringsrud [30], red blood cells, Miller and Weller [31]. Mean cell volume and mean cell hemoglobin concentration, Schalm *et al.* [32], Leukocyte count, Coles [33].

Statistical Analysis: The data of all traits were statistically analyzed according to Snedecor and Cochran [34] in one way analysis of variance design by computer program of SAS [35] using the model:

$$Y_{ij} = \mu + A_i + e_{ij}.$$

Where:

Y_{ij} = Represents observation,
μ = Overall mean,
A_i = Effect of treatments (rations)
e_{ij} = Experimental error (common error). Duncen multiple range test, [36] was applied whenever possible.

RESULTS AND DISCUSSION

Digestibility Coefficients: Apparent digestibility coefficients and nutritive values of tested rations (Table 2) showed that control ration (R1) recorded significant lower ($P<0.05$) digestibility coefficients of all items of nutrients compared with rations supplemented with the feed additives. The digestibility of CP, CF, EE, NFE and feeding values of (R3, R4 and R5) diets were more than Hydrated sodium calcium alumino-silicate (HSCA) or control diets (R2 & R1). On the other hand, contaminated-diet plus 1% clay (Hydrated sodium calcium alumino-silicate + 0.5% gentian violet + 1% propionic acid) recorded higher digestibility coefficients values for all nutrients especially CP, EE and NFE than the other diets. In this respect, heifer fed high concentrate diets; supplementing the diet with 2% Bentonite increased digestibility coefficients of DM, CP, CF, EE and NFE [37, 38]. Also, Saleh *et al.* [39] showed that the digestibility of CP and NFE were increased significantly when bentonite was added at rate of 6% of concentrate rations for lambs, while using 3% Bentonite did not significantly affect compared with the control. Bentonite addition to diets of calves at levels 1 or 3% of DM increased reactive surface areas of nutrients by promoting the action of digestive enzymes and the area of contact with the mucous membrane of the digestive tract [40]. Also, bentonite addition to diets of sheep at 0.5% of DM increased significantly the digestibility coefficients of all nutrients except NFE digestibility [41].

Table 2: Digestibility coefficients and nutritive values of the experimental rations (on DM basis)

	Experimental rations					
Item	R1	R2	R3	R4	R5	± SE
Digestibility coefficients %						
DM	67.03^{b}	70.34^{ab}	71.15^{ab}	71.48^{ba}	72.02^{a}	0.54*
OM	70.10^{c}	72.75^{b}	76.32^{a}	76.21^{a}	76.29^{a}	1.26*
CP	58.17^{c}	71.03^{b}	74.22^{a}	74.50^{a}	75.65^{a}	1.52*
CF	52.86^{c}	66.54^{b}	68.37^{a}	68.43^{a}	68.88^{a}	1.44*
EE	63.21^{d}	71.63^{c}	73.43^{b}	73.50^{b}	74.16^{a}	1.12*
NFE	61.30^{c}	67.82^{b}	68.48^{b}	68.86^{b}	70.05^{a}	1.07*
Feeding values %						
TDN	57.05^{b}	64.05^{a}	65.35^{a}	65.62^{a}	66.56^{a}	1.15*
DCP	8.68^{b}	10.49^{a}	10.96^{a}	11.01^{a}	11.18^{a}	0.82*

* Each value is the mean of 3 calves

Dissimilar superscripts (a, b and c) at the same row are significantly differ (P<0.05)

Table 3: Performance of Zaraibi male kids fed the experimental rations

	Experimental rations					
Item	R1	R2	R3	R4	R5	± SE
No. of animals	7	7	7	7	7	--
Duration of trail, d	120	120	120	120	120	--
Av. Initial LBW, kg	14.18	14.55	14.19	14.51	14.61	2.45ns
Av. final LBW, kg	23.12^{b}	27.24^{a}	27.30^{a}	27.62^{a}	28.22^{a}	2.74*
Total gain, kg	8.94^{c}	12.79^{b}	13.21^{a}	13.11^{a}	13.61^{a}	0.73*
Daily wt. gain, kg	74.50^{d}	106.58^{c}	110.08^{b}	109.25^{b}	113.42^{a}	2.56*
Daily intake, g/h/d:						
CFM	315.5^{b}	329^{a}	331^{a}	332^{a}	339^{a}	2.74*
Berseem hay	154.5^{b}	219^{a}	222^{a}	219^{a}	226^{a}	1.86*
Total DM intake	470.0^{b}	558^{a}	553^{a}	551^{a}	565^{a}	3.02*
DM intake, g/kg BW	20.32	20.12	20.26	19.95	20.02	0.50 ns
TDN intake, g	268.13^{d}	347.79^{c}	361.38^{b}	361.56^{b}	376.00^{a}	2.34*
DCP intake, g	40.80^{d}	56.96^{c}	60.61^{b}	60.66^{b}	63.16^{a}	1.25*
Water consumption:						
ml/h/d	1550^{a}	1230^{d}	1365^{c}	1340^{c}	1450^{b}	4.54*
ml/g DM intake,	3.30^{a}	2.22^{d}	2.47^{c}	2.43^{c}	2.57^{ab}	0.12ns
Feed Efficiency:						
DM intake/kg gain	0.30^{a}	5.14^{b}	5.06^{b}	5.04^{b}	4.98^{b}	0.11*
TDN intake/kg gain	3.60^{a}	3.28^{b}	3.30^{b}	3.31^{b}	3.31^{b}	0.70*
DCP intake/kg gain	0.55^{a}	0.53^{a}	0.55^{a}	0.55^{a}	0.55^{a}	0.60ns

Dissimilar superscripts (a, b, c and d) at the same row are significantly differ (P<0.05)

Results in Table 2 showed that total digestible nutrients (TDN) and digestible crude protein (DCP) of R2, R3, R4 and R5 rations, were higher (P<0.05) compared to R1 (control ration). In this respect, TDN and DCP% increased significantly by the addition of Bentonite at levels 2.5 to 10% of the concentrate rations [39, 41] by addition of 0.5% Bentonite. They reported that the improve in TDN and DCP values might be due to the increasing of digestibility coefficient of the most nutrients when Bentonite was added to the rations. Recently Proctor *et al.* [42] reported that the pharmacology of ginseng indicate its effect on metabolism. On the other side Abou-Akkada *et al.* [43] reported that, toxin decrease the bacterial population of the rumen.

Feed Intake: Data presented in Table 3 illustrated that, average DM intake expressed as daily DM intake or TDN and DCP% was significantly higher (P<0.05) with kids fed diet supplemented with HCAS + 0.5% GV+ PA (R5), followed by HCAS (R2), HCAS + PA (R3) and HCAS+ GV (R4) than those fed the control diet (R1). Total DMI was adversely affected with the contamination of AFB_1. It was decreased by about 10.62, 8.78 and 8.82% for R2, R3 and R4, respectively, than control. In this respect, Lynch *et al.* [44] postulated that voluntary intake of hay and grain by calves was decreased dramatically after daily oral doses (80 μg /kg BW) of crude AF for 1 week. Garrett *et al.* [45] mentioned that the aflatoxin contaminated feeds are consumed by livestock at relatively higher levels, adverse effects, such as decrease feed intake. Also, Nowar *et al.* [46] with rabbits and Soliman and Saleh [47] with lambs found that the intake expressed as TDN and DCP values were reduced by feeding lambs AF-diet.

Body Weight Gain and Daily Gain: Performance of the growing lambs is presented in Table 3. These results indicated that, the average daily gain (ADG) was significantly ($P<0.05$) increased in Zaraibi kids treated rations (R2, R3, R4 and R5) than those fed the control ration (R1). In addition, using HSCA alone either with propionic acid or gentian violet improved ADG by about 43.06, 47.75, 46.64 and 52.24%, respectively. Whereas, lowest ($P<0.05$) weight gains were observed in kids in R1 (containing AFB_1, 15.98 μg/kg DM in concentrate feed mixture (CFM) and 103.27 μg AFB_1/kg DM in clover hay (CH). The decrease in ADG of contaminated diet (R1) which can depress appetite and may be due to the effect of AF on digestibility of nutrients and consequently reduce growth rate performance. In this respect, Nowar *et al.* [46] with growing rabbits and Soliman and Saleh [47] with growing lambs. They reported that, gentian violet if supplemented with HSCA (diet 4 and 5) will act as anti fungal agent against mycotoxicosis whereas addition of PA (diet 3 and 5) may decrease pH and favor the acidic condition, thus favor the beneficial bacterial population in rumen and will further improve the performance of kids. But the results of the present study did not support this assumption and the result clearly showed that the presence of aflatoxin in the feed depressed ($P<0.05$) the weight gain of kids of control group. The kids performance was only improved when the diet was supplemented with HSCA at 0.1% level. These results are in agreement with the findings of Ghosh *et al.* [48] and Giroir *et al.* [49] who reported that aflatoxin in broiler diets significantly reduced their body weight. However, use of aflatoxin binder has shown to improve the weight gain. Similarly, Santurio *et al.* [50] reported that the chicken diet treated with aflatoxin and without bentonite were adversely affected. Na Bentonite treated at 5.0g/kg increased feed intake by 23.8%.

Water Intake: The data in Table 3 showed that daily water intake expressed as ml/ head or ml/g DM intake was tended to increase with control (contaminated diet) compared with other treated diets. This may be due to the negative effect of aflatoxin-naturally contaminated diets on animal metabolism especially fore-stomach. In the contrary, the daily water consumption expressed as ml/ head or ml/g DM intake were decreased with additives supplemented diets (R2, R3, R4 and R5). In this respect, drinking water increased by Bentonite addition to AF-contaminated diet of lambs [51]. Also, these results are accordance with those of Abd El-Hamid *et al.* [52] who indicated that the water consumption was lower with addition of natural clays to small ruminant rations (sheep and goats) and this decrease may be attributed to controlling effects of clays on thirst and urine excretion.

Feed Efficiency: Feed efficiency of the experimental diets is shown in Table 3. Feed efficiency expressed as DMI and/ kg gain, was better ($P<0.05$) in kids received treated diets with HSCA + GV. + propionic acid (R5), followed by HSCA + PA (R3), HSCA + GV. (R4) and R2 (HSCA), respectively, than R. Also, feed efficiency expressed as TDNI/ kg gain, was better ($P<0.05$) in kids received treated diets R2 followed by R3 and R4 and R5, than R1. No significant difference among all treatments in feed efficiency expressed as DCP/kg gain. The obtained results are in agreement with those found in several studies which indicated that aflatoxicosis in ruminants species induced a lake of appetite [53] and a reduction in daily gain [46,54]. The superiority of feed conversion values of R2, R3, R4 and R5 might be due to the higher efficiency of TDN and DCP utilization. Addition of these supplements to toxic-diets significantly ($P<0.05$) decreased the deleterious effects of AFB_1 on lambs performance, such as lowering averages of feed intake, body weight gain and feed efficiency. The basic mechanism of clay (binding agents) in preventing the toxicity appears to involve sequestration of AFB_1 in the gastrointestinal tract and chemisorptions to the absorbent, which reduce the bioavailability of toxins [55]. Huntington *et al.* [51] and Moate *et al.* [56] reported that feed efficiency increased by contaminated dietary addition of natural clays in dairy cows diets. Soliman *et al.* [41] mentioned that, feed conversion efficiency of growing lambs fed diets supplemented with 2 gm/h/d clay were better than control group. On the contrary McCollum and Golyean [57] detected no differences in feed intake and feed efficiency among treatments when using toxificated diets supplemented with or without natural clay.

Clinical Chemistry: The effects of the different tested rations on some blood serum parameter are illustrated in Table 4. Serum total protein (STP), albumin and globulin of R2, R3, R5 and R5 had a significant ($P<0.05$) higher

Table 4: Biochemical blood parameters of the growing Zaraibi goats fed on different experimental diets

	Experimental rations					
Item	R1	R2	R3	R4	R5	±SE
Total protein, g/dl	6.73^{c}	7.07^{bc}	7.10^{bc}	$7..23^{b}$	$7..93^{a}$	0.09*
Albumin, g/dl	2.87^{c}	3.00^{a}	2.97^{ab}	3.03^{a}	2.98^{ab}	0.06*
Globulin, g/dl	3.87^{c}	4.07^{ab}	4.13^{b}	4.20^{b}	4.95^{a}	0.05*
Urea - N, mg/dl	13.87^{a}	12.20^{b}	11.83^{c}	12.07^{b}	11.67^{c}	0.17*
Creatinine, g/dl	1.03^{a}	0.87^{b}	0.93^{b}	0.90^{b}	0.80^{b}	0.05*
Glucose, mg/dl	66.63^{c}	71.00^{a}	71.00^{a}	69.00^{b}	70.00^{b}	1.02*
Total lipids, mg/dl	371.00^{a}	365.33^{b}	362.00^{c}	365.67^{b}	354.00^{d}	1.75*
Cholesterol, mg/dl	80.33^{a}	77.33^{c}	77.00^{c}	79.67^{b}	77.00^{c}	1.13*
Total bilirubin, mg/dl	0.67^{a}	0.30^{c}	0.27^{d}	0.33^{b}	0.27^{d}	0.08*
Ast, IU/l	58.67^{a}	55.00^{c}	54.33^{d}	57.00^{b}	54.00^{d}	1.17*
ALT, IU/l	17.00^{a}	15.67^{c}	15.00^{c}	16.67^{b}	15.00^{c}	0.59*
ALP, IU/l	131^{a}	123^{b}	119^{c}	130^{a}	117^{c}	1.30*

* Each value is the mean of 3 calves

Dissimilar superscripts (a, b, c and d) at the same row are significantly differ (P<0.05)

Table 5: Hematological blood parameters of the growing Zaraibi goats fed on different experimental diets

	Experimental rations					
Item	R1	R2	R3	R4	R5	±SE
Hemoglobin, g/dl	10.73	11.23	11.43	11.27	11.70	0.11 ns
Hematocrite, %	35.66	33.33	34.33	34.66	34.66	0.52 ns
Red blood cellsx10^{6}/ul	12.20	12.60	12.66	12.76	13.06	0.11 ns
Mean cell volume, fi	18.10	18.53	18.47	19.00	19.00	0.22 NS
Mean cell hemoglobin, pg	5.40	5.76^{a}	5.83	6.0^{a}	6.16	0.15 NS
Mean cell hemo. concent., %	30.16	33.86^{a}	32.60	32.76	33.05	0.56 NS
White blood cellsx10^{3}/ul	10.03	9.73	9.53	9.63	9.33	0.11 NS
Neutrophils, %	35.33^{a}	33.00^{b}	32.67^{b}	33.00^{b}	31.66^{b}	0.96*
Lymphocytes, %	56.66^{b}	60.66^{a}	61.33^{a}	60.00^{a}	63.00^{a}	1.25*
Monocytes, %	5.0^{a}	4.0^{b}	4.3^{b}	4.6^{b}	3.6^{c}	0.37*
Eosinophils, %	2.3^{a}	2.0^{b}	1.6^{c}	2.0^{b}	1.6^{c}	0.07*
Stap cells, %	17.00^{a}	15.67^{b}	15.00^{b}	16.67^{b}	15.00^{b}	0.59*

* Each value is the mean of 3 calves

Dissimilar superscripts (a, b and c) at the same row are significantly differ (P<0.05)

values than control diet. This finding is in agreement with the findings of Soliman *et al.* [41], Southern and Clawson [58] and Hassan *et al.* [59]. This significant reduction in the values of STP and albumin, than control, might explain by the reported harmful effect of Aflatoxin on liver where it interferes with protein synthesis and RNA production or deficient synthesis of albumin that occurs commonly in association with chronic hepatic disease [33]. Bingol *et al.* [60] mentioned that, there were no correlations between glucose, ALP, AST and ALT and negative correlation significant between feed AF and TP levels of serum dairy goats fed doses of ranged between 82 to 540 μg AFB_1/kg DM concentrate and forages. In the contrary, addition of clay or clay (R2) or with GV plus propionic acid (R5) had increased total protein and globulin.

Data recorded showed significant increase (P<0.05) in the mean values of serum transaminases activities (ALT & AST), urea-N, creatinine and Cholesterol concentrations, for growing Zaribi kids fed the contaminated diet (R1) compared to kids fed contaminated diets plus HSCA (R2) or HSCA plus PA (R3), HSCA + gention viloet (R4) or diet with HSCA + GV.+ OA (R5). This finding reflected well sings and the biochemical alterations associated with Aflatoxicosis as described by many investigators [61, 62]. Al-Jabouri *et al.* [63] found that treating rats orally for 10 days with aqueous extract of chamomile significantly reduced serum cholesterol in hyperlipemic rats comparable with control. All previous investigators concluded a specific pattern of change in different blood parameter during aflatoxicosis in different animal species. The recorded variation was mainly dependant upon species, dose, age, diet and amino acid content of the diet. Sometimes, these variations may recorded in the same species. Harvey *et al.* [54] reported that, the addition of HSCA diminished aflatoxin toxicity on major blood parameters of growing lambs. Hassan *et al.*

[59] studied the effect of 3 graded doses of AF (50, 100 and 200 μg/kg BW/d and reported that, AF impaired serum protein synthesis as reflection by the significant reduction in serum total protein and albumin concentration. Similar results were observed in blood picture measurements in mature NZW rabbits orally treated with AFB_1 (15 or 3098 μg/kg BW).

Hematological Parameters: Data in Table 5 showed hematological parameters. The results indicated that the values of hemoglobin (Hb), red blood cells (RBC's), MCH, MCHC and lumphocytes cells were reduced with contaminated diet (R1) than in the other treatment groups and the differences were significant in Hb, RBC's and lymphocytes as shown in Table 5. On the other hand, data in Table 5 showed significant decrease in hematocrit and hemoglobin contents of control (R1) diet. This result is in agreement with Harvey *et al.* [54] who recorded that addition of clay diminished AF toxicity on blood parameters of growing lambs. Also, data in Table 5 showed significant decrease in hematocrit and hemoglobin contents of control (R1) diet. This result is in agreement with Harvey *et al.* [54] who recorded that addition of clay diminished AF toxicity on blood parameters of growing lambs. These results were in line with the findings of Harvey *et al.* [54] and Abdel-Hamid *et al.* [52] who recorded decrease in most hematological parameters a result to aflatoxicosis. On the other hand, addition of bentonite to contaminated diet had increased Hb, RBC's, MCV, MCH, MCHC and lymphocytes cells. Similar results were observed by Harvey *et al.* [54] with hydrated sodium calcium aluminosilicate. Aflatoxin induced immunosupperession and increased WBC's [54], but adding clays overcome this effect on immunity of aflatoxin since they increased lymphocytes percentage. Hassan *et al.* [59] studied the effect of 3 graded doses of AF (50, 100 and 200 μg/kg BW/d and mentioned that, decrease in red blood cell count, HB, MCH and MCHC together with increase in packed-cell volume and mean corpuscular volume indicated anaemic response to AF administration.

Clinical Symptoms: Kids of R2, R3, R4 and R5 showed few discontinues clinical sings during the experiment while kids of R1 showed describable aflatoxicosis clinical symptoms, such as loss of appetite, increase water intake, dry nuzzles, rough hair coat, diarrhea, increase in rate of respiration, polydispesea, polyuria and decrease in body weight especially at last month of the experiment. Garrett *et al.* [45] who mentioned that the aflatoxin contaminated feeds are consumed by livestock at relatively higher levels, adverse effects, such as decrease feed intake and a subsequent in feed efficiency are observed. These symptoms are in agreement with that recorded by Aydin *et al.* [64] who reported that aflatoxins exert acute and chronic effects in animals. Several investigators recorded the clinical signs of aflatoxicosis in farm animals such as, lack of appetite [65] and weight loss [66], as well as a decline production [67, 68].

Accordingly, It is concluded that adding 1% Hydrated sodium calcium alumino-silicate (HSCA), 1% Propionic acid (PA) and 0.5% gentian violet (GV), was superior in detoxification than adding additives to the contaminated rations growing male Zaraibi kids. All could improve digestibility coefficients, average daily gain and both feed efficiencies. It could also increased excretion of AFB_1 and OA in feces.

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