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EVALUATION OF MYCOFIX TO AMELIORATE THE TOXIC EFFECT OF T-2 TOXIN ON PERFORMANCE OF BROILER CHICKENS

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ABSTRACT

The possible protective effect of Mycofix against the toxic effect of T-2 toxin in growing broiler chickens was investigated in two age stages; the first and second ages, ranged from 1-21 and 22-42 days, respectively. The experiment was consisted of 4 dietary treatments: treatment 1: control; treatment 2: 2.5g Mycofix/kg feed; treatment 3: 8 ppm T-2 toxin alone; treatment 4: 8 ppm T-2 toxin plus Mycofix 2.5g Mycofix /kg feed. T-2 toxin alone significantly ($p<0.05$) decreased body weight gain, feed consumption and increased feed: gain ratio. Broiler chick performance was more sensitive to T-2 toxin during the first three weeks of age (initial stage of the experiment) than the other 3 weeks of age. When 2.5g Mycofix /kg were added to the diet, it protects broiler chicks against the adverse effect of T-2 toxin on BW gain, feed consumption, and feed: gain ratio. The oral lesion induced by T-2 toxin alone in the first three weeks and the more severe lesions in the following 4-6 weeks were counteracted by Mycofix at both stages of experiment. A significant (($p<0.05$) increase in the relative weight of gizzard, pancreas in the initial experimental stage was noticed while a significant increase was reported in the relative weights of bursa, thymus, and spleen in the final stage of the experiment. Mycofix was found to be effective in ameliorating the negative effect of T-2 toxin on these organs.

The results of the present trail indicate that Mycofix is capable of counteracting the adverse effects of T-2 toxin on performance, oral lesions, and relative weight of internal organs based on the enzymatic inactivation of the 12, 13-epoxide ring of T-2 toxin.

تقييم المايكوفكس في تخفيف تاثير سم T-2 على اداء وانتاجية فروج اللحم

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الخلاصة

تم دراسة التأثير الواقي للمايكوفكس ضد الفعل السلبي لسم T-2 في الأفراخ النامية في تجربة أنجزت على مرحلتين: المرحلة الأولى من 1−21 يوما" والمرحلة الثانية من 22−42 يوما" و بشكل عشوائي تام. تألفت التجربة من 4 معاملات غذائية: مجموعه سيطرة؛ مجموعة أضيف اليها2.5 غم/كغم مايكوفكس؛ مجموعة أضيف إليها 8 جزء بالمليون سمT-2، مجموعة أضيف اليها8 جزء بالمليون سم T-2 مع 2.5غم/ كغم مايكوفكس. أدى إضافة سم T-2 لوحده إلى خفض معدل الزيـــــادة الوزنية، استهلاك

العليقة، ومعامل التحويل الغذائي وبصورة معنوية، أما عند إضافة المايكوفكس بنسبة2.5 غم/ كغم فقد أدى إلى تخفيض تأثير سم T-2 على إنتاجية فروج اللحم. كان تأثير السم أعلى في المرحلة الأولى من التجربة عند مقارنته بالمرحلة الثانية. كان للمايكوفكس تأثير ايجابي في تعديل صورة آفات الفم المسببة عن استهلاك السم وفي مرحلتي التجربة كما سجلت زيادة معنوية في أوزان القانصة والبنكرياس في المرحلة الأولى من التجربة وازداد على ذلك أوزان كل من جراب فابر يشيا التوثة والطحال في المرحلة الثانية. إضافة المايكوفكس عدل من تأثير السم على هذه الاعضاء الداخلية.

أوضحت التجربة فعالية المايكوفكس في تخفيف التأثير السلبي لسم T-2 على انتاجية افراح فروج اللحم الافات الفموية وأوزان الأعضاء الداخلية من خلال التثبيط الإنزيمي ل 12- 13 حلقة الأبوكسيد لسم T-2.

INTRODUCTION

Many mycotoxins (< 300 mycotoins), which produced by toxigenic fungi, especiaaly Aspergillus, Penicillium and Fusarium species, could induce signs of toxicity in avian species (1, 2) and this number is increasing. It has been estimated that 25% of the world's crop production is contaminated with mycotoxin (1). Of these toxigenic fungi, Fusarium spp., are considered as one of the main producing trichothecenes (3). Type A trichothecenes, including T-2 toxin, have a tetra cyclic sesquiterpene nucleus with characteristic epoxide ring (4, 5). T-2 toxin, reported to be produced by *Fusarium tricictum* has been identified in feedstuffs worldwide, including corn, wheat, barley, oats, rice, rye, sorghum, safflower seed, mixed feed (2). The adverse effects of dietary T-2 toxin exposure to avian species, , at levels ranging from 1 to 16 ppm, include an inflammatory response in the mouth, decreased growth rate, feed consumption, conversion, and negative effects on relative weight of internal organs, (6, 7, 8). Detoxification of T-2 toxin was tried physically (9); chemically (10); by administration of specific T-2 specific antibodies (11), and by using adsorbent materials (12). Recently, biological inactivation of T-2 toxin by the enzymes produced by Eubacterium spp. was investigated. The enzymes contained in Mycofix® plus 3.0(de-epoxydases and esterase) are the fermentation or the products of BBSH 797 microbes (BBSH 797 originally isolated from bovine rumen contents) are able to biotransformation T-2 toxin, resulting in the non toxic metabolite, de-epoxy –HT-2 toxin (13).

The aim of the present study was to investigate the possible effectiveness of mycofix (a new biomin product, which contain this bacteria), in an attempt to ameliorate the negative effect of T-2 toxin on performance of growing broiler chickens.

MATERIALS AND METHODS

A total of 80, 1-day-old male broiler chickens of the Ross line were used. The experimental design consisted of a complete randomized trial with 1 positive control, 1 negative control, and mycofix feed additive test groups of two experimental dietary treatments. The experimental diets were fed for 42 days (1 to 42 days of age). Each dietary treatment was replicated 2 times; with 6 chicks per replicate pen from d 1 to 21 and 8 birds per replicate pen from day 22 to 42 (4 birds were removed at random from each replicate pen at day 22 to be able to conduct the experiment until day 42 of age). The experimental treatments consisted of the same commercial mash, based on corn and soybean meal,

according to the recommendations of the NRC (1994) (14), with T-2 toxin or mycofix additive as follows:
Group 1: control
Group 2: 2.5 kg Mycofix® plus 3.0/t
Group 3: 8 ppm T-2 toxin
Group 4: 8 ppm T-2 toxin +2.5kg mycofix ® plus 3/t
The experimental treatments are summarized in table 1.

Table 1: Summary of experimental layout and dietary treatments.

Group No. of replicate Pens	Chicks per replicate pen	Dietary modifications Feed additive
1-21 days		
1 2	6	none none
2 2	6	mycofix® plus 3.0 none
3 2	6	none 8ppm
4 2	6	mycofix® plus 3.0 8ppm
22- 42 days		
1 2	4	none none
2 2	4	mycofix® plus 3.0 none
3 2	4	none 8ppm
4 2	4	mycofix® plus 3.0 8ppm

The experimental ration was checked to contain no detectable levels of aflatoxins, ochratoxins, zearalenone, and T-2 toxin by the method reported by Coker et al (1984) (15). Purified crystalline T-2 toxin was produced by *Fusarium tricinctum* NRRL 3299 and determined by the metode of thin layer chromatography according to the method reported by Burmeister et al.(1971) (16). The crystalline toxin was dissolved in acetone, added to experimental diets, and mixed to homogeneity by means of a twin- shell blender.. The level of mycofix inclusion was selected according to the manufactures recommendations for a level of contamination of 8 ppm T-2 toxin. Mycofix (Mycofix® Plus, Biomin GmbH, Herzogenburg, Austria) was obtained from a local distributor. Chickens were kept in batteries in thermoregulated room with continuous light; feed and water were provided *ad libitum*. Response variables measured during the experiment included body weight, body weight gain, feed intake, and feed efficiency. On 21 and 42 days of experiment, eight birds from each group, were killed by cervical dislocation and the liver, heart, spleen, thymus, bursa of Fabricius, kidney, proventriculus, gizzard, pancreas were dissected and individually weighed. Heads were removed from all chicks and visually scored for oral lesions (using a four –point scoring system ranging from 1 to 4) by the same individual without knowledge as to treatment groups. A lesion score of 1 indicated no visible lesions; a score of 2 was seen as one or two mouth lesions clearly visible on either the lower or upper mandible; a lesion score of 4 was seen as large lesions occurring at several sites within the mouth, principally on the

upper and lower mandibles, the corners of the mouth, and the back of the tongue; lesions scored as 3 were intermediate in appearance to lesions scored 2 to 4. Histopathological study of oral lesions was performed by fixing affected portions in 10% neutral buffered formalin. Fixed tissues were trimmed, embedded in paraffin, sectioned at 4 µm, and stained with hematoxylin and eosin. Tissue samples from treatments show oral lesions were examined microscopically. The statistical analysis used a completely random experimental design in a factorial (2x2) arrangement. Data were subjected to analysis of variance when significant differences were obtained. Tukeys test was used. (17).

RESULTS

The 1-21 days; 22-42 days; and the entire period of the trail 1-42 days performances of the four experimental groups are summarized in Tables 2, 3 and 4. Body weight gain was significantly ($p<0.05$) lower in the groups fed T-2 toxin alone (group 3). Ameliorative effect to the effect of T-2 toxin was noticed when T-2 toxin was amended with mycofix® plus 3.0., (group 4), comparing with group fed T-2 toxin alone. Although body weight gain did not reach control group level but was not differ from broilers fed mycofix® plus 3.0. Alone (group 2), Feed intake was significantly lower in group 3. Addition of Mycofix® plus 3.0 to the feed containing T-2 toxin, was effective in alleviating this negative effect compared with group 3. Feed conversion ratio was significantly higher in group 3. No significant differences in the FCR were observed between the control group and the group 4, and the group 2.

The reduction in body weight gain of chicks fed T-2 toxin during the initial stage of the experiment (1-3)weeks was higher than that noticed in the final stage (3-6) weeks and were 60.8% (-39.2%) and 78.9% (-21.1%) respectively, compared to control group. The overall (1-42 days) reduction in body weight gain was 74.3% (-25.7%). When Mycofix® plus 3.0 was amended the T-2 toxin contaminated diet, it was effective in eliminating 27.1% reduction in BWgain during the first three weeks, and 13.1% in the second stage, and overall 14.6 % during the entire period (1-42) days of age (Figure 1).

The reduction in feed consumption of chicks fed T-2 toxin during the initial stage of the experiment (1-3) weeks was higher than that noticed in the final stage (3-6) weeks and were 86.1% (-13.9%) and 93.2% (-6.8%), respectively compared with the control group. The overall (1-42 days) reduction in feed consumption was 92.3% (-7.7%). When Mycofix® plus 3.0 was amended the T-2 toxin contaminated diet, it was effective in eliminating 6.9% reduction in feed consumption during the first three weeks, and 4% in the second stage, and overall 1.2 % during the entire period (1-42) days of age (Figure 2). The increase in feed conversion of chicks fed T-2 toxin during the initial stage of the experiment (1-3) weeks was also higher than that noticed in the final stage (3-6) weeks and were 41.6 and 18.1 respectively compared with the control group. The overall (1-42 days) increase in feed consumption was 24.3%. When Mycofix® plus 3.0 was amended to the T-2 toxin contaminated diet, it was effective in eliminating 35.7% increase in feed consumption during the first three weeks, and 12.5% in the second stage, and overall 21.5 % during the entire period (1-42) days of age (Figure 3).

Table 2: Effect of T-2 toxin and mycofix on broiler performance at initial stage of experiment (1-21 days).

Treatments	Mycofix (%)	T-2toxin (ppm)	BW gain (g)	Feed intake (g)	Feed: gain (g/g)
Control (-)	0.00	0	513	688	1.341
Mycofix	0.25	0	505	678	1.342
T-2toxin	0.00	8	312	593	1.900
T-2 +Mycofix	0.25	8	451	640	1.419
C.V. (%)			20.887	6.635	17.916
		----------Principle effects ---------			
T-2 toxin (+)			363.5	616.5	1.659
T-2 toxin (-)			509	683	1.341
Mycofix (+)			478	659	1.380
Mycofix (-)			412.5	640.5	1.625
		----------Probability----------			
T-2 toxin (T)			0.001	0.001	0.024
Mycofix (M)			0.991	0.218	0.119
T x M			0.037	0.041	0.015

Table 3: Effect of T-2 toxin and mycofix on broiler performance at final stage of experiment (22-42 days).

Treatments	Mycofix (%)	T-2toxin (ppm)	BW gain (g)	Feed intake (g)	Feed: gain (g/g)
Control (-)	0.00	0	1492	4972	3.332
Mycofix	0.25	0	1486	4896	3.294
T-2toxin	0.00	8	1178	4636	3.936
T-2 +Mycofix	0.25	8	1373	4835	3.521
C.V. %			11.445	2.975	8.352
----------Principle effects ----------					
T-2 toxin (+)			1275	4735.5	3.728
T-2 toxin (-)			1489	4934	3.312
Mycofix (+)			1429.5	4865	3.407
Mycofix (-)			1335	4804	3.634
----------Probability----------					
T-2 toxin (T)			0.009	0.021	0.033
Mycofix (M)			0.660	0.710	0.900
T x M			0.033	0.038	0.058

Table 4: Effect of T-2 toxin and mycofix on broiler performance at all stage of experiment (1-42 days).

Treatments	Mycofix (%)	T-2toxin (ppm)	BW gain (g)	Feed intake (g)	Feed: gain (g/g)
Control (-)	0.00	0	2005	5660	2.822
Mycofix	0.25	0	1991	5617	2.821
T-2toxin	0.00	8	1490	5229	3.509
T-2 +Mycofix	0.25	8	1824	5295	2.902
C.V. %			13.108		4.031
11.034					
----------Principle effects ----------					
T-2 toxin (+)			1572.5	5262	3.205
T-2 toxin (-)			1998	5638.5	2.821
Mycofix (+)			1907.5	5456	2.861
Mycofix (-)			1633	5444.5	3.165
----------Probability----------					
T-2 toxin (T)			0.054	0.040	0.032
Mycofix (M)			0.155	0.189	0.119
T x M			0.046	0.024	0.053

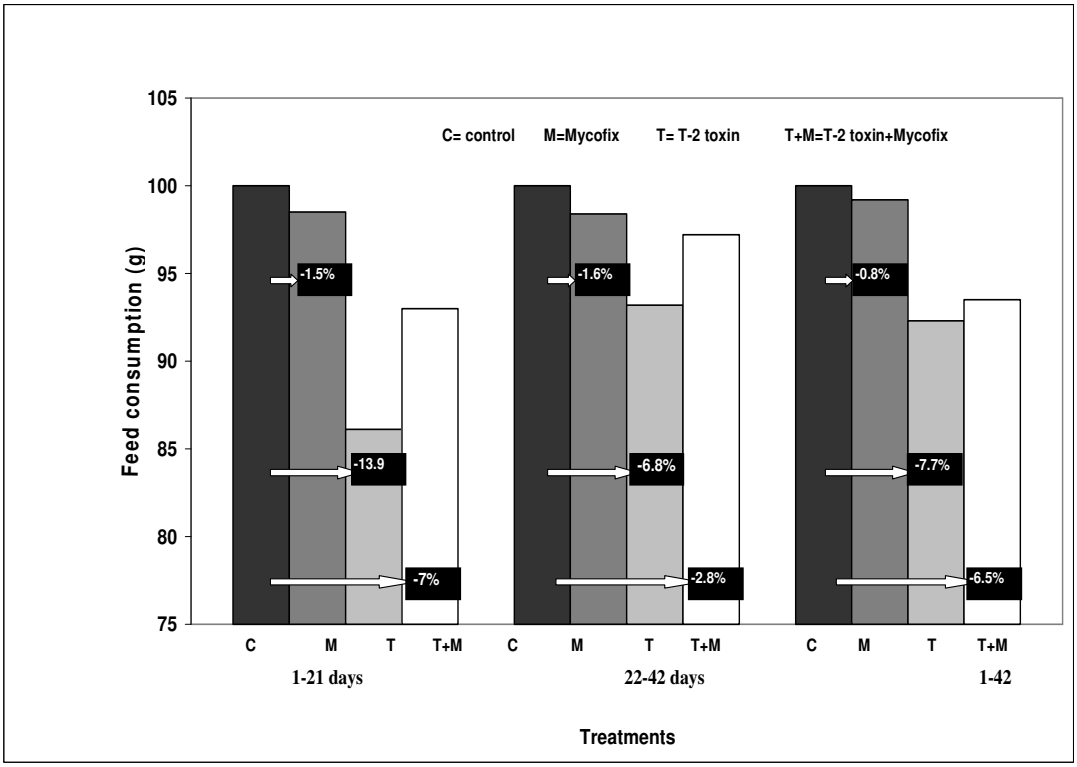

Figure1: Affect of T-2 toxin and mycofix plus 3.0 0n the percentage of body weight gain of broiler during the first stage of the experiment.

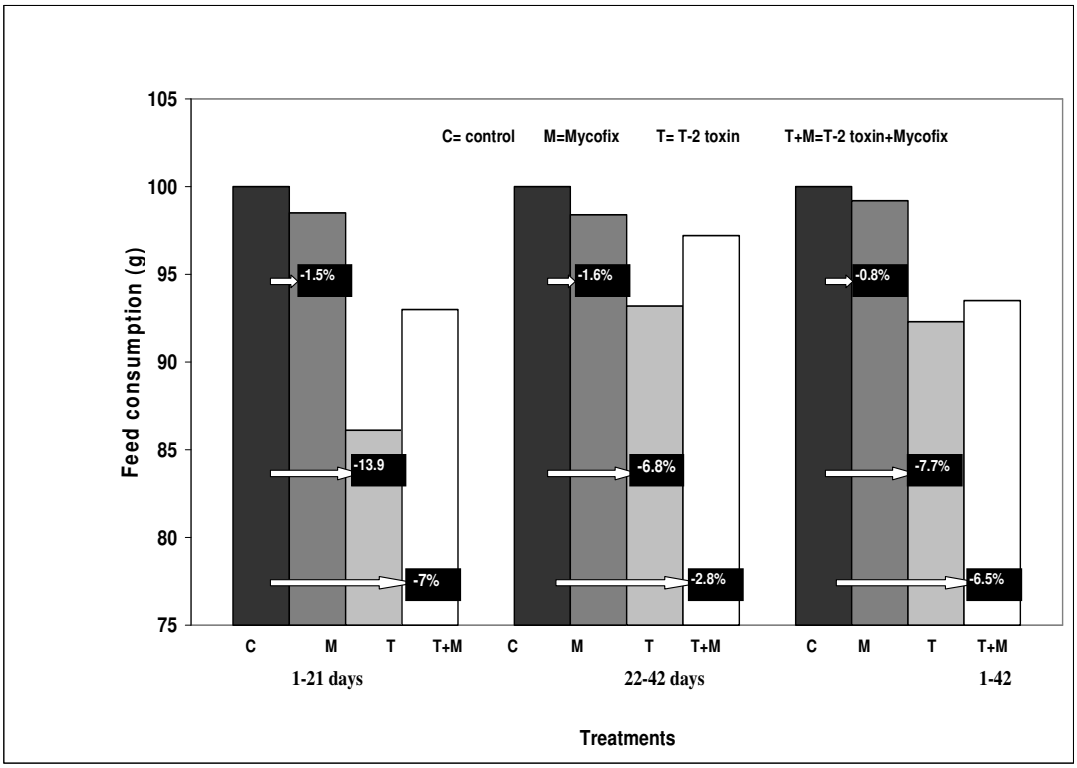

Figure 2: Effect of T-2 toxin and mycofix plus 3.0 0n the feed consumption of broiler chicks during the first 3 weeks of age (initial stage of the experiment).

The score of oral lesions in broilers fed T-2 toxin alone at the two stages of experiment show significant difference ($p<0.05$) compared with that of groups fed diet with no toxin (group 1 and 2). Addition of 2.5g mycofix plus 3.0 /kg to the contaminated diet (group 4), was effective in amelioration the toxic effect on oral lesions induced by T-2 toxin (Table 5 and 6). The oral lesions seen here were characteristic of T-2 toxicosis which first appeared when the chicks were about 1 week old, as raised ceasous yellow-white plaques. By 2-weeks, the lesions increased in size and invaded the lingual papillae at the root of the tongue, margin of the beak, mucosa of the hard palate and angle of the mouth. By three weeks, the size of the lesions increased to more extent than that of the 2nd week. Microscopically the ulcers had a base of granulation tissue and inflammatory cells, (Figure, 4, 5). The severity of these lesions in the following three weeks, up to 6 weeks, were increased and characterized by the presence of crusts of exudates with bacterial colonies (Figure 6). Few birds had necrotic lesions on the mucosal lining of the crop (Figure7).

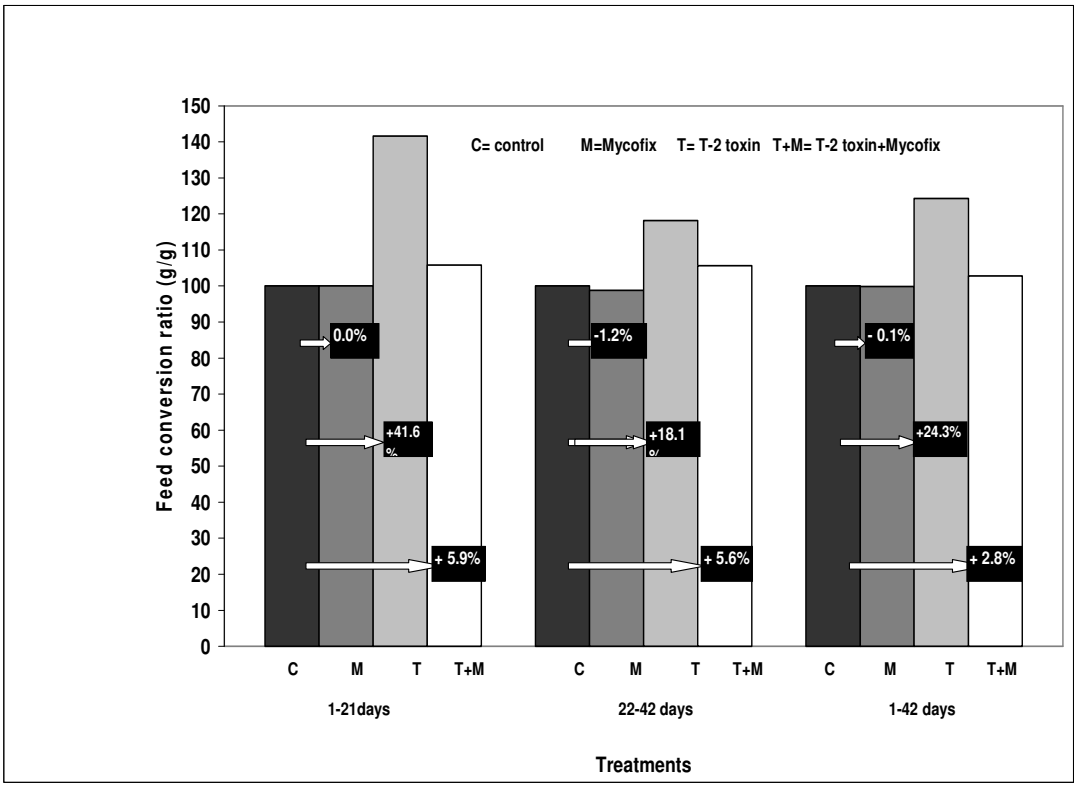

Figure 3: Effect of T-2 toxin and mycofix plus 3.0 0n the feed conversion ratio of broiler chicks during the first 3 weeks of age (initial stage of the experiment).

Table 5: Effect of T-2 toxin and mycofix on broiler oral lesions at initial stage of experiment (1-21 days).

Treatments	Mycofix (%)	T-2toxin (ppm)	Oral lesion score
Contrl(-)	0.00	0	0.0
Mycofix	0.25	0	0.0
T-2toxin	0.00	8	2.3
T-2 +Mycofix	0.25	8	1.1
C.V. (%)			129.005
		----------Principle effects ---------	
T-2 toxin (+)			1.7
T-2 toxin (-)			0.0
Mycofix (+)			0.55
Mycofix(-)			1.15
		----------Probability----------	
T-2 toxin (T)			0.003
Mycofix (M)			0.547
T x M			0.053

Table 6: Effect of T-2 toxin and mycofix on broiler oral lesions at final stages of experiment (22-42 days).

Treatments	Mycofix (%)	T-2toxin (ppm)	Oral lesion score
Control(-)	0.00	0	0.0
Mycofix	0.25	0	0.0
T-2toxin	0.00	8	3.7
T-2 +Mycofix	0.25	8	2.7
C.V. %			118.225
	----------Principle effects ----------		
T-2 toxin (+)			3.2
T-2 toxin (-)			0.0
Mycofix (+)			1.35
Mycofix (-)			1.85
	----------Probability----------		
T-2 toxin (T)			0.003
Mycofix (M)			0.415
T x M			0.042

*Means with different subscripts are significantly ($p<0.05$) different.

Figure 4: Beak and palate ulceration and crusting in a broiler chicken following 21 days consumption of 8 ppm T-2 toxin.

Figure 5: Microscopic oral lesion in broiler chicken after 3 weeks of feeding 8 ppm T-2. Oral mucous membrane show intense inflammation and localized necrosis, sloughing of upper fibrous material which contained bacterial aggregations, while underlying tissue was heavily infiltrated with granular leukocytes and hyperplasic epithelial layer. H&E stain. X 220.

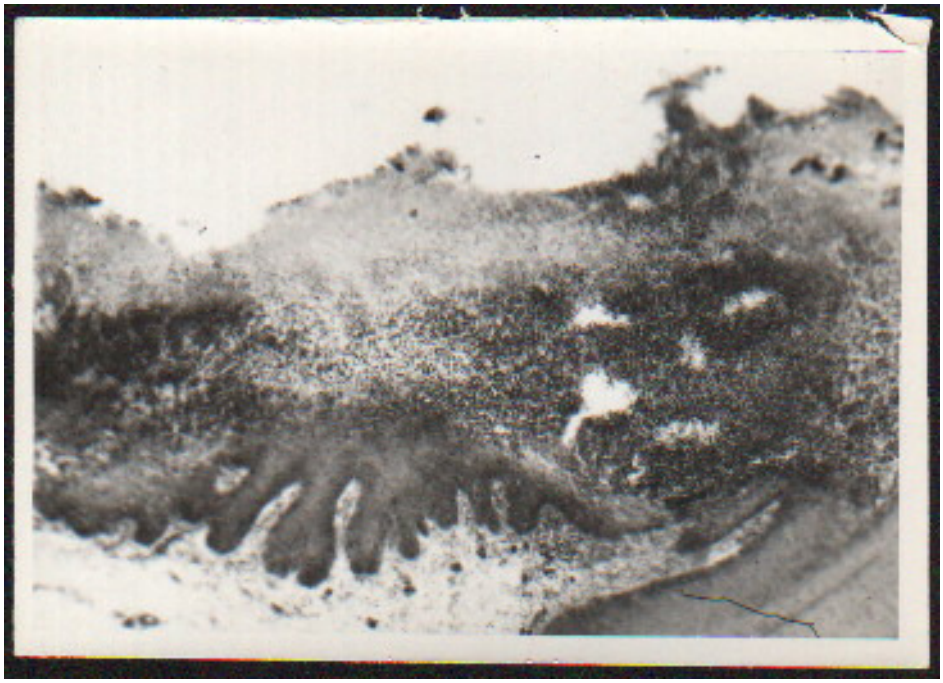

Figure 6: Microscopic oral lesion in broiler chicken after 6 weeks of feeding 8 ppm T-2 toxin, characterized by ulceration and crusting, submucosal granulation tissue and inflammatory cells, bacterial colonies and feed components. H&E stain. X 220.

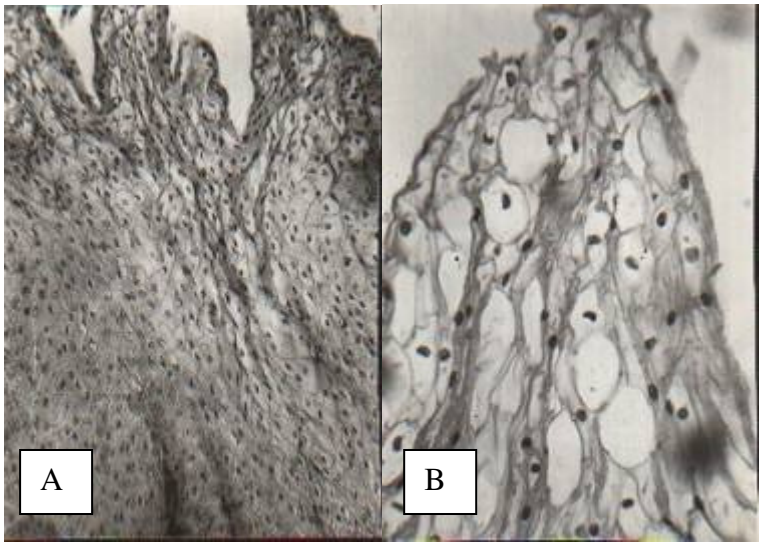

Figure 7: (A): Ballooning degeneration (swelling of the cytoplasm), pyknosis, and desquamation of crop epithelium in broiler chickens 42- days of age fed 8 ppm T-2 toxin. H &E. X450. B: Higher magnification of (A).H&E.X1000.

The relative weights of liver, spleen, heart, proventriculus, gizzard, pancreas, bursa, thymus, and spleen of broiler chicks at 21 days of age, are summarized in table 5. No significant differences in the relative weights of liver, heart, proventriculus, and kidney were observed in the four experimental groups. Significant differences were noticed in the relative weight of gizzard, pancreas, in group of broilers fed 8 ppm t-2 toxin alone (group 3) when compared with control groups (group 1 and 2). The adverse effects of 8 ppm T-2 toxin on these internal body organs were significantly decreased by Mycofix® plus 3.0 additions at a rate of 2.5 kg/t of feed (group 4). The levels of ameliorations were almost reached those of control levels (groups 1 and 2)(Table 7). At 42 days of age, the relative weights of the gizzard, pancreas, thymus and spleen were differ significantly in group fed T-2 toxin alone, compared with control groups. Mycofix® plus 3.0, after its addition, show a positive effect in counteracting T-2 toxin effect on these organs to levels similar to that of control group (Table 8).

Table 7: Effect of T-2 toxin and Mycofix on relative body weight organs in broiler chickens at 21 days of age.

Treatments	Mycofix (%)	T-2 toxin (ppm)	Liver (g/100 g bw)	Heart (g/100 g bw)	Kidney (g/100 g bw)
Control (-)	0.00	0	3.17	0.79	0.43
Mycofix	0.25	0	3.18	0.71	0.40
T-2toxin	0.00	8	3.29	0.83	0.57
T-2 +Mycofix	0.25	8	3.24	0.76	0.53
C.V. %			18.571	65.475	16.698
		----------Principle effects ----------			
T-2 toxin (+)			3.265	0.795	0.600
T-2 toxin (-)			3.175	0.750	0.415
Mycofix (+)			3.210	0.735	0.465
Mycofix (-)			3.230	0.810	0.550
		----------Probability----------			
T-2 toxin (T)			0.066	0.071	0.090
Mycofix (M)			0.155	0.189	0.119
T x M			0.092	0.072	0.066

			Proventriculus (g/100 g bw)	Gizzard (g/100 g bw)	Pancreas (g/100 g bw)
Contrl (-)	0.00	0	0.74	3.70	0.44
Mycofix	0.25	0	0.71	3.91	0.31
T-2toxin	0.00	8	0.93	4.87	1.71
T-2 +Mycofix	0.25	8	0.83	3.80	0.42
C.V. %			12.351	13.272	92.009
		----------Principle effects ----------			
T-2 toxin (+)			0.88	4.335	1.065
T-2 toxin (-)			0.725	3.805	0.375
Mycofix (+)			0.77	3.855	0.365
Mycofix (-)			0.835	4.285	1.075
		----------Probability----------			
T-2 toxin (T)			0.042	0.018	0.042
Mycofix (M)			0.279	0.415	0.520
T x M			0.078	0.032	0.012

			Bursa (g/100 g bw)	Thymus (g/100 g bw)	Spleen (g/100 g bw)
Contrl(-)	0.00	0	0.46	0.084	0.040
Mycofix	0.25	0	0.39	0.086	0.044
T-2toxin	0.00	8	0.14	0.025	0.011
T-2 +Mycofix	0.25	8	0.31	0.068	0.033
C.V. %			42.375	43.069	46.00
			----------Principle effects ----------		
T-2 toxin (+)			0.225	0.04	0.170
T-2 toxin (-)			0.425	0.085	0.042
Mycofix (+)			0.350	0.077	0.093
Mycofix (-)			0.300	0.054	0.025
			----------Probability----------		
T-2 toxin (T)			0.049	0.050	0.024
Mycofix (M)			0.598	0.953	0.923
T x M			0.660	0.722	0.608

Table 8: Effect of T-2 toxin and Mycofix on relative body weight organs in broiler chickens at 42days of age.

Treatments	Mycofix (%)	T-2toxin (ppm)	Liver (g/100g bw)	Heart (g/100g bw)	Kidney (g/100g bw)
Control (-)	0.00	0	2.56	0.50	0.65
Mycofix	0.25	0	2.57	0.50	0.57
T-2toxin	0.00	8	2.51	0.53	0.73
T-2 +Mycofix	0.25	8	2.52	0.53	0.69
C.V. %			1.159	3.363	10.350
		----------Principle effects ----------			
T-2 toxin (+)			2.515	0.53	0.71
T-2 toxin (-)			2.565	0.50	0.244
Mycofix (+)			2.545	0.515	0.65
Mycofix (-)			2.535	0.515	0.69
		----------Probability----------			
T-2 toxin (T)			0.830	0.504	0.943
Mycofix (M)			0.320	0.408	0.922
T x M			0.854	0.598	0.932

			Proventriculus (g/100g bw)	Gizzard (g/100g bw)	Pancreas (g/100g bw)
Contrl(-)	0.00	0	0.53	1.78	0.25
Mycofix	0.25	0	0.57	1.79	0.23
T-2toxin	0.00	8	0.63	1.94	0.30
T-2 +Mycofix	0.25	8	0.53	1.80	0.27
C.V. %			8.364	5.916	11.375
			----------Principle effects ----------		
T-2 toxin (+)			0.63	1.87	0.285
T-2 toxin (-)			0.55	1.78	0.240
Mycofix (+)			0.55	1.795	0.250
Mycofix (-)			0.63	1.860	0.275
			----------Probability----------		
T-2 toxin (T)			0.287	0.045	0.021
Mycofix (M)			0.780	0.919	0.416
T x M			0.184	0.011	0.021

			Bursa (g/100g bw)	Thymus (g/100g bw)	Spleen (g/100g bw)
Contrl(-)	0.00	0	0.80	0.37	0.22
Mycofix	0.25	0	0.80	0.35	0.21
T-2toxin	0.00	8	0.40	0.27	0.09
T-2 +Mycofix	0.25	8	0.48	0.33	0.23
C.V. %			33.935	13.090	51.00
		----------Principle effects ----------			
T-2 toxin (+)			0.44	0.30	0.16
T-2 toxin (-)			0.80	0.36	0.215
Mycofix (+)			0.64	0.34	0.22
Mycofix (-)			0.60	0.32	0.155
		----------Probability----------			
T-2 toxin (T)			0.045	0.021	0.012
Mycofix (M)			0.930	0.802	0.329
T x M			0.319	0.032	0.024

DISCUSSION

Results of the current study indicate that chicks fed diet containing T-2 toxin at a rate of 8 mg/kg had decreased BW gain, feed intake and feed conversion ratio. The overall reduction in BWgain and feed consumption reported here during the two stages of experiment were (-25.7% and -7.7%) respectively, and there was an increase in feed conversion ratio by +24.3%. The level of T-2 toxin used in this experiment was also reported to cause reduction in the above mentioned parameters (7, 8, 18, 19, 20, 21, and 22). In our experiment the percentages of this reduction showed that, they were higher during the first three weeks of experiment (initial stage), in which, chicks were most sensitive to dietary T-2 toxin than that of the following three weeks (final stage) (4-6) weeks of age. These results were in consistent with (23), who fed one day old broiler chickens with dietary T-2 toxin for 3,6, and 9 weeks, and show that chicks were most sensitive to dietary T-2 toxin during the first three weeks of age.T-2 toxin is extremely caustic (24), The reduction in the above mentioned parameters could be attributed to the T-2 toxic effects which have been described as radiomimetic; inhibitor to protein synthesis through the inactivation of initiation and termination, possibly through its binding to ribosome (25), so the toxic effect of T-2 toxin can be functionally divided into two broad groups of inhibition: initiation inhibition and elongation/termination inhibition; however, its inhibitory effects depend on the concentration of the toxin and other environmental factors (26).

The oral lesions seen here were characteristic of T-2 toxicosis which was also reported in broilers by other investigators, who fed T-2 toxin up to 8ppm (7, 8, and 27). The most prominent effect of T-2 toxin on the relative weights of internal organs was reported in the gizzard, pancreas and lymphatic organs (Bursa, thymus and spleen). T-2 toxin is extremely caustic and has dermatitic and inflammatory effect to the digestive tract, beginning from the mouth, through the crop, proventriculus, gizzard and intestinal tract (24). This effect of T-2 toxin was result in the development of oral lesions and an increase in the relative weights of gizzard (23) .T-2 toxin has been shown to cause necrosis and lymphoid depletion in the thymus, spleen, and lymph nodes of laboratory animals. (25). Atrophy of the lymphatic organs was also reported by other investigators, when chicks fed 8 ppm T-2 toxin /kg feed (7, 18, 21 and 24).

The ameliorative effect of Mycofix® plus 3.0 to the performance parameters, oral lesions and relative weight of internal organs could be attributed to the chemical composition of the product. The explanation of the positive Mycofix effect in detoxifying T-2 toxin was obtained from the report on Mycofix® plus 3.0 (13). Mycofix® plus 3.0 has been complemented with certain biological components (microbes and / or enzymes capable of degrading these toxic substances by breaking the particular functional group). T-2 toxin has a toxic specific group on position 12, 13 responsible for the molecules negative impact on performance and health of animals. Enzymes contained in Mycofix® plus 3.0(de-epoxydases and esterase) are either the products of Saccharomyces cervisiae fermentation or the products of BBSH 797 microbes (BBSH 797 originally isolated from bovine rumen contents) are able to biotransformation T-2 toxin, resulting in the non toxic metabolite, de-epoxy –HT-2 toxin (Figure 8).

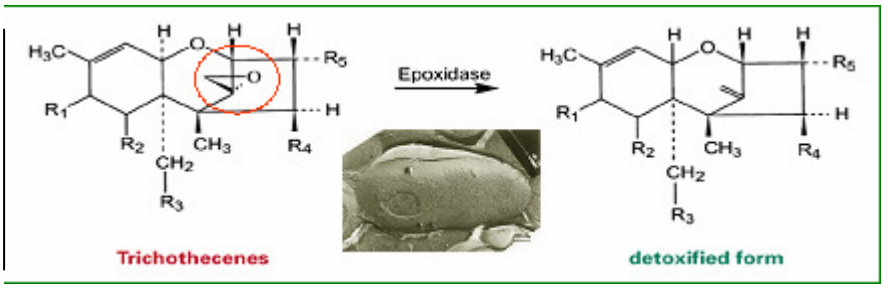

Figure 8: Detoxification of trichothecenes by epoxidase to detoxified form. Obtained from report on Mycofix® plus 3.0 (13).

Phytogenic substances contained in Mycofix® plus 3.0 are flavolignans, terpenoid complexes and saponins. Flavolignans have antihepatotoxic activity, protecting liver from damage by making liver cells less permeable to toxins. Terpenoides reduce inflammations while saponins inhibit cancer cell growth. The phycophytic constituents in Mycofix® plus 3.0 contains over 60 minerals and elements, more than 12 vitamins, valuable carbohydrates like aiginic acid, laminarin, as well as full range of amino acids. These constituents of mycofix play an important role in amelioration the toxic effect of 8 mg T-2 toxin/ kg feed, confirming other studies, used this product in counteracting the negative effect of T-2 toxin in broiler chickens (8).

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