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EFFECT OF MYCOFIX $^{+3}$ IN TOXICITY REDUCTION OF T-2 TOXIN IN QUAILS

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ABSTRACT

Sixty newly hatched unsexed brown local quail chicks were fed diets containing 4 ppm T-2 toxin singly or in combination with the mycofix$^{+3.0}$ adsorbent at a rate of (0.25%) for a period of 42 days, to investigate their effects on performance and blood profile. Birds were randomly allotted to three groups of 20 each (with two replicates), i.e., control, T-2, and T-2 +Mycofix^{+3}. Significant ($P\leq0.05$) reduction in quail performance was observed from the first week onwards in the toxin fed birds compared to other groups. Mortality reaches 25% in toxin fed group. Significant ($P\leq0.05$) reduction in the relative weight of lymphoid organs and pancreas were noted , while there was an increase in the weight of liver, proventriculus and gizzard compared with control group. Significant ($P \leq 0.05$) reduction in blood picture, differential lymphocytes count, triglycerides and alkaline phosphatase (ALP), and a significant ($P\leq0.05$) increase in heterophils, glucose, serum enzymes Aspartate aminotrasferase (AST), Alanine aminotrasferase (ALT), and stress factor between control and toxin treated group was observed. Addition of mycofix$^{+3.0}$ at a rate of (0.25%) was significantly ($p\leq0.05$) improved performance, restored internal organ weights, and blood parameters to that of control. In conclusion, it was clear that the addition of mycofix is effective in averting the toxicity of T-2 toxin in quails.

Key words Japanese quail - T2 toxin -mycofix^{+3}–performance- blood parameters

INTRODUCTION

Over 180 trichothecenes produced by number of fungal genera including Fusarium,Trichoderma,Myrothecium,Stachybotrys, Trichothecium (Bhunia,2008).The most common trichothecenes are; DON(deoxynivalinol), 3-acetyl DON, and T-2 (Trichothecene-2) toxin (Haschek,et al., 2010). Of these T-2 toxin is the most potent mycotoxin of the trichothecenes group and has been involved in mass poisoning in animals (An ,2005). T-2 toxin is produced by Fusarium poae, F.sporotrichoides, and F. tricinctum (Burmeister,1971). It is sever dermatoxin, immunotoxin,

immunosuppressive agent and inhibits protein synthesis through disruption of DNA and RNA (Ueno, 1984). Poultry are quite sensitive to T-2 toxin, causing severe necrosis of oral tissue; sever oedema of the body cavity, haemorrhage of the large intestine, necrotic effects of lymphoid tissues, and death. (Heredia, et al.,2009). T-2 toxin have a negative impact on the viability of wild quail populations (Grizzle, et al., 2004). Anyhow, bobwhite quails were reported to be more resistant to the effect of T-2 toxin than broilers, and only higher T-2 toxin levels (8 and 16 ppm) could induce oral lesions, reduction in body weight gain and feed conversion ratio (Ruff, et al., 1992). On the other hand Japanese quails were

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reported to be more susceptible to the effect of T-2 toxin than bobwhite quails, since 4 ppm of the toxin was sufficient to induce reduction in haematological parameters body weight gain and feed consumption, but not feed conversion (Madheswaran, et al., 2005a); increase in relative organs weight; oral lesions; histological changes; depletion in lymphoid organs, necrosis in the testis (Madheswaran, et al., 2005b) and changes in certain serum biochemical parameters (Madheswaran, et al., 2004). The toxic effects of mycotoxins may be limited by natural or synthetic agents such as antioxidants, e.g., selenium, vitamins and provitamins, food components, e.g., phenolic compounds, coumarin, chlorophyll and its derivatives, fructose and aspartame, medicinal herbs and plant extracts, mineral and biological binding agents, e.g., hydrated sodium calcium aluminosilicate, bentonites, zeolites, activated carbons, bacteria, and yeasts (Farombi, 2006). The Mycofix® product line from BIOMIN is a range of specially developed feed additives that protect animal health by deactivating mycotoxins found in contaminated feed. Its modular system consists of three strategies: Adsorption – Elimination of toxins, Biotransformation – Elimination of toxicity and Bioprotection – Elimination of toxic effects. Mycofix , is one of the new promising mycotoxins adsorbent that was successfully alleviate the negative effects of T-2 toxins in broilers (Aziz,2005; Omar,2010). The aim of this study was to elucidate the ameliorative effect of mycofix+3on the performance and hematobiochemical alteration of quails during T-2 toxicosis.

MATERIALS AND METHODS

Animal care and experimental design: The study was carried out on growing brown local quail, during 2010 year, at a private poultry farm in Al- Hamdania / Mosul governorate, Iraq,. Birds were reared for 5 weeks and fed T-2 toxin alone or with Mycofix $^{+3}$ adsorbent. A total number of 60 unsexed brown local one day old quail chicks procured from commercial hatchery were randomly distributed into 3 experimental groups containing 20 birds each (in two replicates, 10 birds each). Deep litter rearing system was used. Birds were housed in pens measuring (102×93×81) cm, in which the temperature degree and humidity percentages were daily measured and recorded approximately 35 ± 2.0 C^o and 65 ±3.0% respectively as averages at the first week, then the temperature degree was gradually decreased with age until quail chicks were acclimatized to the environmental condition. Pens were equipped with waterers and feeders.. Average initial weight of brown Japanese quail chicks at the experimental start ranged between 9.97 and 10.12 ±0.1 g with insignificant differences among the experimental groups indicating the random distribution of individuals among the dietary experimental groups. The diets were formulated to provide the nutrient requirements according to (Leeson and Summers, 1997) and presented in table (1). The ration based on yellow corn soybean contained 28% crude protein and 3015 Kcal metabolizable energy.

Feeds and water were offered *ad libitum* for chicks along the experimental period. Continuous lighting program (24hr) was used during the whole experimental period. Purified crystalline T-2 toxin was produced by culturing *Fusarium tricinctum* 3299 according to the method reported by (Burmeister,1971).

The amount of toxin was calculated using Neogen ELISA kit (Neogen Corporation) with XL_{800} reader. The toxin was dissolved in acetone, added to experimental diets, and mixed to homogeneity by means of a twin –shell blender.

Table (1): Gross composition of the experimental diets (kg/ton) for Growing Japanese quail fed T-2 toxin alone or with mycofix+3*

Ingredients	Quail starter
Corn	370
Soybean meal (48%)	515
Limestone	17.5
Dicalcium phosphate(20%P)	22.5
Fat	60
Salt	3.5
DL-methionine	1.5
Vitamin-Mineral Premix	10
Calculated analysis	
Crude protein (%)	28
Crude fat (%)	7.7
Crude fiber (%)	2.5
Metabolizable energy(kcal/kg)	3015
Calcium (%)	1.2
Available phosphorous(%)	0.6
Sodium (%)	0.18
Methionine(%)	0.58
Methionine+cystine(%)	1.03
Lysin(%)	1.72

*Leeson and summers(1997)

The experimental ration was checked to contain no detectable levels of aflatoxins, Ochratoxins, Zearalenone, and T-2 toxin (obtained from santa cruz biotechnology,inc.california,USA) by the method reported by (Coker *et al.*,1984). Mycofix $^{+3}$ adsorbent (BIOMIN, AUSTRIA) was used. The experimental treatments consisted of three groups: Group 1: no toxin or mycofix^{+3} (negative control) Group 2 : 4 ppm T-2 toxin (positive control) Group 3 : 4 ppm T-2 toxin + 0.25% mycofix^{+3}. Birds were vaccinated against Newcastle disease and Infectious bronchitis by spray method at day of age, Newcastle disease at 8 days and Infectious bursal disease at 14 days of age. Nutrient utilization was calculated at the end of experimental period. Individual body weight was recorded at 1st, 2nd, 3rd, 4th, and 5th weeks of age. Blood samples were collected from the right jugular vein using EDTA containing tubes at the end of the experiment. Total leukocyte and erythrocyte counts, packed cell volume and haemoglobin, differential leukocyte counts was performed (Campbell, 1995). Blood Glucose, Triglycerides, AST, ALT and ALP were calculated using kits supplied by Biomeurix company Birds were scarified, defeathered weight, dressed, shank weight, and the relative weight

(percent of the body weight) of bursa of Fabricius, spleen, thymus, gizzard, proventriculus, and pancreas were calculated. The statistical analysis of obtained data were performed by William E. W. (2009), using SPSS method. Anova was performed to test the significant differences among means at ($P \leq 0.05$) level of significance .

RESULTS AND DISCUSSION

Body weight: The effect of T-2 toxin and mycofix+3 on the weekly body weight is presented in Figure 1. Body weight gain was affected by treatment with 4 ppm T-2 toxin ($p \leq 0.05$) in the 1st, 2nd, 3rd, 4th, and 5th,weeks. There were 20.03,23.29,19.91,18.27,and 20.60 % reduction respectively as compared with the control group. Amending T-2 contaminated diet with mycofix+3, significantly ($p \leq 0.05$) improve body weight gain by 33.26,28.66,17.62,15.37, and 18.65 % through these weeks respectively compared with the T-2 toxin fed group. No significant differences were present between control group and the T-2 toxin contaminated diet group amended with mycofix+3 (Table2) . In the light of introducing quail production recently in Mosul governorate as a partial substitution of the high losses in broiler production, many critical issues should be considered if this process want to be to successes. Of these, is their balanced nutrition and the controlling of the the suppressing deleterious pugs like moulds and their mycotoxins, which may have a negative impact on the viability of quail populations.

Feed consumption : Total feed consumption was significantly ($p \leq 0.05$) 15.91% reduced in T-2 toxin fed group (table2), compared with control group. The addition of mycofix+3 to the T-2 contaminated diet was effective in 12.21% increase of total feed consumption, compared with T-2 toxin fed group, and effective ($p \leq 0.05$) in restoring feed consumption with that of the control one**.**

Feed conversion ratio: Feed contaminated with T-2 toxin had a negative statistical ($p \leq 0.05$) effect on the feed conversion ratio by 7.71% increase (14 points)(table2), compared with control group. Amending T-2 toxin contaminated diet with mycofix+3 was responsible for counteracting the negative toxin effect by 6.59 % improvement (12 points), compared with T-2 toxin fed group, which by this not differ significantly from T-2 toxin fed group. No differences in the rate of mortality was recorded between control group and the T-2 toxin contaminated group after addition of mycofix+3, which was 5%, while there was a significantly ($p \leq 0.05$) 25% higher mortality in the group fed T-2 toxin alone compared with other groups (Table 2). In this study, quails consumed 4 mg/kg T-2-containing diet showed a poor body weight gain, FC and FCR values ($P \leq 0.05$). These results agreed with other reports on T-2 toxin who referred to the toxic effects on almost all cellular processes in the digestive system and a small dose of the toxin can damage the mucosa of the digestive tract impairing resorption of nutrients (Coffin and Comb,1981;Ruff e al.,1992; Natraja *et al*.,2004;).

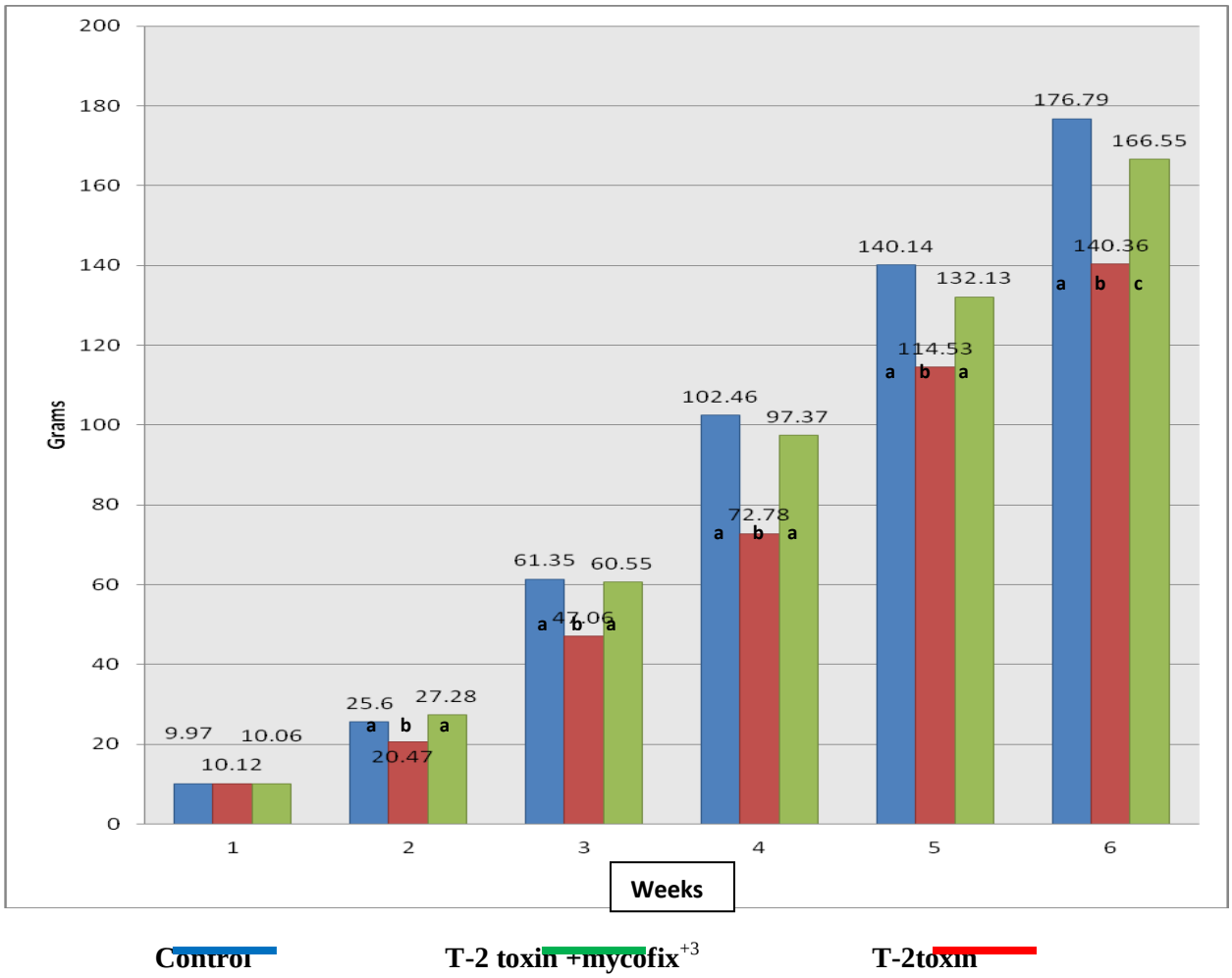

Figure 1: Live body weight of growing brown Japanese quail chicks fed T-2 toxin alone or with mycofix^{+3}

The lower FCR seems to have been mediated through decreased nutrient utilization through erosion and irritation of alimentary tract resulting into decrease in feed consumption, utilization and consequently reduction in body weight and FCR of toxicated quails. T-2 toxin was reported to Impaired liver functions and carbohydrate utilisation, so these mechanisms may have affect the growth performance and general health of the birds (Leeson *et al.*,1995).Furthermore, T-2 toxin is one of the most potent small molecule inhibitors of eukaryotic protein synthesis known, blocking, initiation and translation processes in protein synthesis (Madheswaran *et al.*,2005a) Mortality rate of 25% in brown Japanese quail fed 4 ppm T-2 toxin during the second week in our study is more than that reported by (Ruff *et al.*, 1992) of (20%) when they gave 8ppm or (22.5%) at 16 ppm in more resistant bobwhite quails (Madheswaran *et al.*,2005b).

Relative organs weight: The effect of T-2 toxin and mycofix^{+3} on the carcass composition and the relative weights of internal organs are presented in table 3. There were a significant ($p \leq 0.05$)

Table (2): Live body weight gain , feed consumption, feed conversion ratio, and mortality of growing brown Japanese quail chicks fed T-2 toxin alone or with mycofix^{+3}

Age	Treatments		
	Control	T-2 toxin (4ppm)	T-2 toxin(4ppm)+ 0.25%mycofix^{+3}
Body weight gain (g)			
7 days	15.69±0.247*	10.35±0.721	17.22 ±0.217
14 days	35.69 ±0.721** a	26.59 ±0.837 b	33.27 ±1.587 a
21 days	41.11 ±2.038 a	35.72 ±2.423 b	36.62 ±1.797 a
28 days	37.68 ±2.391 a	31.74 ±2.927 b	34.96 ±2.193 a
35 days	36.65 ±2.124 a	25.83 ±2.658 C	34.41 ±3.242 b
Average Daily weight gain (gm/day/bird)	4.76±0.08 a	3.86±0.12 b	4.46±0.09 a
Feed consumption and feed conversion ratio			
Total feed consumption (g)	638.18±8.55 a	536.63±12.63 b	602±10.58 a
Average Daily feed intake (gm/day/bird)	18.23±0.37 a	15.33±0.72 b	17.20±0.58 a
Total feed conversion (g/g)	3.82±0.04 b	3.96±0.12 a	3.84±0.08 b
Mortality%			
Mortality %	5	25	5

*S.E: Meaning standard error

**a, b, c Means in the same rows have the different superscript are significantly different at($P \leq 0.05$).

20% reduction in the defeathered, dressed and shank weights in T-2 fed group compared with control one, but with a significant ($p \leq 0.05$) ameliorative effect of 15% increase in body composition parameters after mycofix^{+3} was added to T-2 toxin fed group, compared with T-2 toxin alone. T-2 toxin inclusion in the diet had a statistical significant ($p \leq 0.05$) reduction effect on the relative weights of the lymphoid organs, (thymus, bursa of fabricius and spleen) and pancreas with a reduction of 25, 15, 33.33 and 20.85 % respectively, compared with control group. Addition of mycofix^{+3} to the T-2 contaminated diet , gave a total protection against the negative T-2 toxin effect on these organs, by 10.86, 5.85, 43.75 and 29.03 % increase in the relative weights respectively when compared with T-2 toxin fed group. On the other side, T-2 toxin, had a significant ($p \leq 0.05$) effect on the relative weights of the liver, gizzard and proventriculus, by 36.87, 34.90 and 39.67 % increase respectively, compared with control group. Amending the T-2 toxin contaminated diet with mycofix^{+3} was responsible for counteracting the negative effect, by 19.66, 12.93 and 10.84 % reduction in the relative weights of these organs, compared with T-2 toxin fed group. Our results on the relative organ

weights of liver, proventriculus, and gizzard were increased , while those of the pancreas, spleen and bursa were significantly (P≤0.05) decreased by feeding 4ppm T-2 toxin.

Table (3): Carcass composition, relative weight (g/100g) of internal organs of growing brown Japanese fed T-2 toxin alone or with mycofix^{+3} .

Parameters	Treatments		
	Control	T-2 toxin (4ppm)	T-2 toxin(4ppm)+ 0.25%mycofix^{+3}
Relative weight (g/100g) body weight			
Live weight	176.79±3.35* a	140.36±2.65** b	166.55±2.85 a
Defeathered weight	87.89±1.58 a	69.78±2.50 b	82.80±1.98 a
Dressed	71.45±1.21 a	56.73±1.87 b	67.31±1.43 ab
Shank	2.14±0.05 a	1.70±0.10 b	2.02±0.08 a
Bursa of Fabricious	0.184±0.005 a	0.138±0.013 b	0.153±0.003 a
Thymus	0.283±0.005 a	0.239±0.085 b	0.253±0.008 a
Spleen	0.048±0.007 a	0.032±0.050 b	0.046±0.008 a
Liver	1.402±0.052 c	3.321±0.165 a	2.668±0.203 b
Provenrticulus	0.361±0.011 b	0.487±0.037 a	0.424±0.020 a
Gizzard	1.545±0.043 c	2.158±0.074 a	1.924±0.086 b
Pancreas	0.235±0.013 a	0.186±0.009 b	0.240±0.013 a

*S.E: Meaning standard error

**a, b, c Means in the same rows have the different superscript are significantly different at (P≤0.05).

These results were in line with other trails (Hoerr *et al.*,1982;Ueno, 1977). Liver is reported to be a target organ for T-2 toxin (Speijers and Speijers,2004), and the increase in the relative weight of gizzard may be due to the results of severe inflammation and thickening of mucosal layer. Regression in lymphoid tissues relative weight reported here, might have been due to necrosis and these results were in line with other trails (Hoerr et al.,1982;Ueno, 1977). Liver is reported to be a target organ for T-2 toxin (Speijers and Speijers,2004), and the increase in the relative weight of gizzard may be due to the results of severe inflammation and thickening of mucosal layer. Regression in lymphoid tissues relative weight reported here, might have been due to necrosis and cellular depletion and lymphocytolysis by the mycotoxins (Kamalavenkatesh,2003; Kamalavenkatesh et al.,2005), due to the toxin affect on the actively dividing lymphoid cells (Pestka et al.,2004), and other cells having liver, kidney and pancreas cells, which characterized by the presence of numerous cytoplasmic free polysomes and so inhibition of protein synthesis(Larsen et al., 2004). Recently T-2 toxin was reported to cause apoptosis in thymic and splenic lymphocytes (Li et al.,1997; Shinozuka et al., 1997). Hemodilution as expressed by a significant (P≤0.05) reduction in packed cell volume, haemoglobin and total erythrocyte counts were observed in the toxin fed groups., which were in agreement with (Kubena et al., 1989).

Blood parameters : The effect of T-2 toxin and mycofix^{+3} on the blood profile is presented in table 4. Contamination of the diet with T-2 toxin had a statistical significant ($p \leq 0.05$) detrimental effect on the blood picture of red blood cells, , haemoglobin and packed cell volume, through23.52, 11.01, 15.94 % reduction respectively, compared with control group. Using mycofix^{+3} in the T-2 toxin contaminated diet was effective in mitigating the reduction effect of T-2. toxin on the blood parameters by 23.07, 9.24, 13.05% increase respectively, compared with T-2 toxin fed group. White blood cells, differential heterophils and lymphocytes were significantly ($p \leq 0.05$) affected by T-2 toxin. White blood cells were decreased by 18.75%, heterophils were increased by 155.17%, lymphocytes were decreased by 70.58% comparing with control group.

Table (4): Blood picture of growing brown Japanese quails fed T-2 toxin and mycofix^{+3}.

Parameters	Treatments		
	Control	T-2 toxin (4ppm)	T-2 toxin(4ppm)+ 0.25%mycofix^{+3}
RBCs $\times 10^6$	5.4±0.087 * a	4.6±0.099** b	5.2±0.073 a
Hemoglobin(gm)	13.620±0.287 a	12.120±0.196 b	13.240±0.428 a
Packed cell volume(%)	48.300±1.325 a	40.600±1.550 b	45.900±1.159 a
WBCs$\times 10^3$	16±2.84 a	13±4.93 b	15±2.58 a
Heterophils %	29±0.28 c	74±2.88 a	49±1.59 b
Lymphocytes %	68 ±1.68 a	20±0.88 b	51.±0.33 a
Stress factor H/L ratio	0.426 b	3.7 a	0.960 b

*S.E: Meaning standard error

**a, b, c Means in the same rows have the different superscript are significantly different at ($P \leq 0.05$).

Counteracting T-2 toxin effect on WBCs and differential counts was attained by Mycofix^{+3}, through elevating WBCs percentage to 15.38, lowering heterophils to 33.78%, and increasing lymphocytes to 155% compared with T-2 toxin fed group. Stress factor (H/L ratio), was significantly ($p \leq 0.05$) increased to 768.54% in T-2 toxin fed group, but numerically lowered by 74.05% after mycofix^{+3} addition compared to T-2 toxin fed group. The reduction in Hb in this study may be due to decreased protein synthesis in toxicated quails. It is documented that T-2 toxin causes erythropenia (resembling that induced by free radicals), leukopenia, lymphopenia, hypoplastic lymphoid tissues, bone marrow and splenic red pulp resulting in anaemia in laboratory animals, (Karppanen *et al*., 1989;WHO,2002). T-2 toxin is extremely toxic to and Lymphocytes(Larsen *et al*., 2004), which impose a stress condition in these birds , resembling that reported in broilers (Aziz ,2005). Stress conditions induced by T-2 toxin may increase free radicals which may reflected by the reduction in feed consumption and body composition parameters. Blood biochemicals glucose and triglycerides were also affected by T-2 toxin , triglycerides was significantly ($p \leq 0.05$) lowered by 28.127% compared with control

group. Addition of mycofix^{+3} lowered the effect of T-2 toxin by increasing triglycerides parameter to 21.48% compared with T-2 toxin fed group. Glucose was significantly ($p \leq 0.05$) increased by 27.92% compared with control group. Addition of mycofix^{+3} numerically lowered the effect of T-2 toxin by lowering glucose parameter to 5.26% compared with T-2 toxin fed group. Liver enzymes, AST,ALT were elevated and ALP reduced in a significantly , with a percentage of 23.23, 18.15 and 40.07 respectively compared with control group (table 5).

Table (5): Effects of T-2 toxin and mycofix^{+3} on some serum biochemical parameters of brown quail .

Parameters	Treatments		
	Control	T-2 toxin (4ppm)	T-2 toxin(4ppm)+ 0.25%mycofix^{+3}
Glucose mg/dl	* 202.00±31.529 b	258.40±8.812** a	244.800±5.895 ab
Triglycerides mg/dl	446.90±106.895 a	321.20±92.401 c	390.200±94.294 b
ALP u/l	38.100±2.689 a	22.830±1.282 c	30.400±1.423 b
AST u/l	15.280±0.905 b	18.830±1.202 a	16.240±0.732 b
ALT u/l	18.560±0.817 b	21.930±0.736 a	18.910±0.609 b

*S.E: Meaning standard error **a, b, c Means in the same rows have the different superscript are significantly different at ($P \leq 0.05$).

Mitigating T-2 toxin negative effect was achieved by addition of mycofix^{+3}, by reduction of 13.75 and 13.77% for AST and ALT , and an increase of 33.15% for ALP compared with T-2 toxin fed group. The effect of feeding T-2 toxin on blood chemistry showed numerical reduction in plasma triglyceride and increase in glucose levels which may be affected by the effect of T-2 toxin on liver (Trinder, 1969). Other changes included an increase in the levels of serum alanine aminotransferase (ALT), serum aspartate aminotransferase (AST) with concomitant reduction in the activities of serum alkaline phosphatase(ALP). The effect of feeding T-2 toxin on blood chemistry showed numerical reduction in plasma triglyceride and increase in glucose levels which may be affected by the effect of T-2 toxin on liver (Trinder, 1969). Other changes included an increase in the levels of serum alanine aminotransferase (ALT), serum aspartate aminotransferase (AST) with concomitant reduction in the activities of serum alkaline phosphatase(ALP).
Producers and scientists aim at developing effective decontamination technology dealing with this feed-borne toxin. Decontamination procedures have focused on degrading, destroying, inactivating or removing T-2 by physical, chemical and biological methods. Recently, researchers have directed efforts toward finding effective means of the biological degradation of T-2. In this context mycofix+3 was used in controlling the severity of T-2 and provided significant improvements (Aziz,2005; Omar,2010). As seen in Tables 1, the addition of mycofix+3 (0.25%) to an T-2-containing diet significantly ameliorated the adverse effects of T-2 on performance parameters (FC, BWG and FCR) in quails ($P \leq 0.05$). It was interesting

to note that no distinct oral lesions were observed in all groups. It is difficult to give a clear explanation for this result, anyhow , others reported that the effect of T-2 toxin on growth are not caused by the oral lesions but by the systemic adsorption of the mycotoxin (Diaz *et al.*, 1994). Previous studies (Omar,2010) reported similar improvements by mycofix+3, in trails of broilers T-2 toxicosis. The basic mechanism for protection against T-2 toxicity appears to involve sequestration of T-2, preventing its absorption from gastrointestinal tract. The counteracting of mycofix+3 on internal organs relative weight was also reported by (Aziz,2005; Omar,2010; Shareef and Aziz,2012). These mycofix+3 positive effects are largely attributed to its chemical composition. The ability of mycofix+3 in detoxifing T-2 toxin is by breaking of its 12,13 epoxide, by microbes-BBSH797- and enzymes-de-epoxidase and esterase, transferring it to non-toxic metabolite, de-epoxy-HT-2 toxin (Mycofix ® plus 3.0,2000). In addition, the bird itself may participate in the process of T-2 toxin detoxification through the effect of its anaerobic gastrointestinal tract microflora, (Leeson,1995). Phytogenic substances contained in mycofix+3 like flavolignans, terpenoid complexes and saponins have also been reported in having protecting antihepatotoxic activity against T-2 toxic damage to liver cells and their membranes, restoring by this many liver functions, and making liver less permeable to introducing of toxin or to releasing of its own enzymes to the blood stream , and in reducing inflammations. Ameliorative effect of Mycofix+3 also could be related to its minerals cocktail (of more than 60), vitamins (more than 12) and full range of amino acid present in this product. So, the addition of mycofix+3 to the diet may scavenge the free radicals generated by T-2 toxin , leading to improved feed consumption, BWG, FCR, and body composition parameters. The overall beneficial effects of Mycofix+3 could be attributed to the three main strategies; the first one is related to its adsorption effect ,i.e., elimination of T-2 toxin by Mycofix+3 through selectively binding and immobilizing T-2 toxin in the gastrointestinal tract of broilers, so the toxin bioavailability is greatly reduced. The second strategy is the biotransformation (elimination of toxicity), by changing their toxic structures, leading to non-toxic, environmentally safe metabolites. The third strategy of Mycofix+3 is related to the bioprotection (elimination of the toxic effects)and that is because Mycofix^{+3} consists of a blend of scientifically based, carefully selected plant and algae extracts that may assist in reducing toxin related effects on the immune system, inflammation and liver. Finally it could be said that the addition of Mycofix^{+3} to broiler feed significantly reduces the negative effects of T-2 toxin on performance parameters and serum biochemistry parameters.

تاثير MYCOFIX $^{+3}$ في خفض سمية سم T-2 في السمان

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الخلاصة

تم تغذية ٦٠ من أفراخ السمان الفاقسة حديثا غير المجنسة على علائق خالية أو حاوية على سم T-2 (٤جزء بالمليون /كغم عليقة) و مايكوفكس +٣ عند مستوى (0.25% / كغم عليقة) لمدة ٤٢ يوما لمعرفة

تأثيرها في الأداء الإنتاجي والوزن النسبي للأعضاء الداخلية وكذلك صورة الدم . وزعت الأفراخ على ثلاث مجاميع في كل مجموعة 20 فرخا وبمكررين وكالاتي : مجموعة سيطرة, مجموعة مستهلكة لسم T-2 بمفرده, مجموعة مستهلكة لسم T-2 مع الممتز مايكوفكس +٣. أوضحت النتائج أن كل من الزيادة الوزنية واستهلاك العليقة ومعامل التحويل الغذائي كانت اقل معنويا ($P\leq0.05$) في المجموعة المستهلكة لسم T-2 بمفرده ,ومن الأسبوع الأول مقارنة مع المجاميع الأخرى . وصلت نسبة الهلاكات إلى ٢٥% في الافراخ المستهلكة لسم الافلا مقارنة ب ٥ % في المجاميع الأخرى . وأوضحت النتائج أيضا أن الوزن النسبي لكل من البنكرياس وغدة فابريشيا وغدة التوثة والطحال قد انخفض بصورة معنوية ($P\leq0.05$) مقارنة مع المجاميع الأخرى بينما ازداد وزن الكبد والمعدة الغدية والقانصة معن ويا($P\leq0.05$) في الأفراخ المستهلكة لسم T-2 بمفرده مقارنة مع المجاميع الأخرى . كما وسجل انخفاض معنوي ($P\leq0.05$) في أعداد كريات الدم الحمراء والبيض وهيموكلوبين الدم وحجم الخلايا المرصوصة و الخلايا اللمفية والكليسيريدات الثلاثية وإنزيم ALP بصورة معنوية ($P\leq0.05$) في الأفراخ المستهلكة لسم T-2 بمفرده مقارنة مع المجاميع الأخرى. الا انه سجل ارتفاع معنوي ($P\leq0.05$) في مستوى الكلوكوز والخلايا العدلة ومؤشر الكرب وكل من إنزيم AST و ALT .في مقابل ذلك كله فان إضافة مايكوفكس +٣ إلى العليقة الملوثة بسمT-2 قد أدى وبصورة معنوية ($P<0.05$) تعديل المعايير المتاثرة سلبا بسم T-2 وإعادة قيمها ومستوياتها الى تلك في مجموعة السيطرة لكل من الزيادة الوزنية واستهلاك العليقة ومعامل التحويل الغذائي والوزن النسبي لكل من البنكرياس وغدة فابريشيا وغدة التوثة والطحال واوزان الكبد والمعدة الغدية وال قانصة و أعداد كريات الدم الحمراء والبيض وهيموكلوبين الدم وحجم الخلايا المرصوصة و الخلايا اللمفية والكليسيريدات الثلاثية وإنزيم ALP ومستوى الكلوكوز الخلايا العدلة ومؤشر الكرب وكل من إنزيم AST وALT .يتضح من النتائج ان مايكوفكس+٣ كان كفيلا بازالة التأثيرات السلبية التي سببها استهلاك سم T-2 في أفراخ السمان مما يعطيه دورا واعدا في علاج حالات التسمم الفطري بسم T-2 في السمان.

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