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AMELIORATIVE EFFECT OF SYNER-TOX AND *NIGELLA SATIVA* ON GROWTH PERFORMANCE AND SOME SERUM BIOCHEMICAL PARAMETERS IN BROILER CHICKS FED DIETS CONTAMINATED WITH AFLATOXINS

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ABSTRACT

Background: *Nigella sativa* L. (NS) is a broadly used herb-drug for various diseases and has been used as preservative and food additive. Syner-Tox (ST) also has an effect as a binder to myctoxins. This study was conducted to evaluate the efficacy of mycotxin binder (SynerTox) and NS to ameliorate the effect of aflatoxin on broiler chicks. **Materials and methods**: One hundred and fifty, apparently healthy one day old (Ross 308) broiler chicks were obtained from Assiut for Investment and Development Company Assiut, Egypt. The chicks were evenly distributed into five groups (30 chicks for each). G1 administered ration free from aflatoxins without any treatment, G2 administered ration contaminated by aflatoxins (AF is 300 ppb), G3 administered ration contaminated aflatoxins (300 ppb) plus commercial ST in drinking water, G4 administered ration contains aflatoxins (300 ppb) plus NS (10 gm/kg feed) and G5 administered ration contaminated by aflatoxins (300 ppb) plus ST and NS. **Results**: (a) For performance, weight of the whole body, liver, heart and bursa showed a decrease in G2 (which fed aflatoxin-contaminated diet) in comparison with G1 (which fed diet free from aflatoxin) but the weight of these previously mentioned organs and whole body in G3, G4 and G5 return normal nearly as in G1. (b) For serum biochemical parameters, ALT, AST, urea, uric acid and creatinine showed some fluctuation either increase or decrease when compared with G1 and G2 or with each other's. **Conclusion**: In order to reduce any possible aflatoxin toxicity from contaminated diets, NS and ST can be added as a feed additive to chicken diets.

Keywords: Aflatoxins – Broiler chicks – ST – NS- ALT – Urea - growth performance.

INTRODUCTION

AFB1, AFB2, AFG1 and AFG2 are the four main kinds of aflatoxins (AF) that are produced by Aspergillus species. While some of different types of AF have been recognized and derived from nature other than their metabolites. AFM1, AFM2, AFP1, AFQ1 and AFB1-8,9-epoxide are the major metabolic products (Wu *et al.,* 2016; Dai *et al.,* 2016). According to studies conducted by Dai *et al.* (2016); Pickova *et al.* (2021), AF and its metabolites are recognized to be fundamental causes to immunosuppression,

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hepatotoxicity, mutagenicity, and carcinogenicity in both humans and animals Additionally, their biotransformation with physiological enzymes may increase pathogenicity. AFB1 a human carcinogen categorized as group 1 by International Agency for Research on Cancer (IARC) is one of the most dangerous and carcinogenic AF (Al-Zoreky and Saleh, 2017).

The black cumin (*Nigella sativa*) seed has been utilized in traditional medicine across various regions, including the Middle East, North Africa, the Far East, and Asia (El-Daly, 1998). Several studies demonstrate the antibacterial properties of these seeds, wih effects on both gram- positive and negative bacteria (Mouhajir *et al.*, 1999 Nair *er al.*, 2005) Moreover research has shown that black cumin seed extract can inhibit aflatoxin production (Nasir and Grashorn, 2006) and antiparasitic activity (Mahmoud *et al.*, 2002).

Therefore, this study was established to investigate the impact of Syner-tox and *Nigella sativa* seed powder on growth performance and some serum biochemical parameters in broiler chicks fed diets contaminated with aflatoxins.

MATERIALS AND METHODS

[I] Materials:

(1) Birds:

Experimental design: One hundred and fifty, apparently healthy one day old (Ross 308) broiler chicks were obtained from Assiut for Investment and Development Company Assiut, Egypt .Initially, the stoking density was 10birds/m^2. Throughout the trail, all experimental groups were exposed to constant light and a steady brooding temperature of (34-35°C) , which lowered gradually to the chicks comfortable range of (24-26 °C) on day 21.Regular checks of the temperature and relative humidity were conducted using a sensitive thermo-hygrometer. During the trail phase water and feed were available at all times. The experimental period was 42 days. Birds during the experiment were vaccinated against Infectious Bronchitis (IB), Newcastle Disease Virus (NDV), Gumboro Disease (IBD) and Avian Influenza (AI). Clinical signs, mortality, Body weight and feed intake were recorded periodically during the experiment.

Animal groups (30 chicks for each):
G1 (Negative control): Administered ration free from aflatoxin confirmed by TLC without any treatment. **G2** (Positive control): Administered ration contaminated by aflatoxin [AF is 0.3 mg/kg feed (300 ppb)]. **G3**: Administered ration contaminated by aflatoxin (300 ppb) plus commercial mycotoxin binder (Syner-Tox®) in drinking water. ST was manufactured by IFT Animal Health (Cairo, Egypt). Birds received ST at a dose of 0.5 ml/L in drinking water (Amer *et al.*, 2022). **G4**: Administered ration contaminated by aflatoxin (300 ppb) plus Nigella sativa (10 gm/kg feed). NS seeds were obtained from faculty of Agriculture, Assiut University. Seeds added to the diets in by 10 g/kg diet after milled in a heavy-duty grinder (Hassan, 2018 & Laudadio *et al.*, 2022). **G5**: Administered ration contaminated s by aflatoxin (300 ppb) plus commercial mycotoxin binder (Syner-Tox®) and 10 gm/kg feed *Nigilla sativa*.

Diets: Diets were created using NRC (1994) guidelines to contain 23% CP 2956 kcal ME/kg for starter diet and 21% CP and 3070 kcal ME/kg for grower 20% CP and 2,900 kcal ME /kg for finisher phases diet. All ingredients used were in crushed form, purchased from Wadi El Nile Company for Poultry Feed. Fresh feed were mixed weekly and not stored for more than one week without addition of any drugs.

Mycotoxin binder: Syner-Tox® is a highly concentrated supplement containing critical components and essential micronutrients (citric acid 8%, phosphoric acid 6.5%, aspartic acid 0.03%, lactic acid 0.02%,

calcium lactate 0.02% papain 0.01%, sodium, potassium tartarate 0.01%, dried *Bacillus subtilis* fermintation extract 0.03%, calcium pantothenate 0.02%, propylene glycol 10%, thiamin mononitrate 0.03%, riboflavin 0.03%, pyridoxine hydrochloride 0.2%, disodium EDTA 1.5%, distilled water) (Zaky *et al.*, 2000).

The Ethics statement for Animal care and maintenance were in correspondence with the guidelines of the Egyptian Research Ethics Committee and the guidelines for care and laboratory animals use by Assiut University (6/2024/0152).

(2) Samples collection: The samples (blood and tissues) were collected at three times all over the experiment. The samples were collected at the 14th day, 28th day and the end of experiment (42 days). At each time, 5 birds were picked from each group. Collection of blood samples: the biochemical parameters were assessed using serum samples. (ALT, AST, Urea, Uric acid and creatinine).

[II] Methods:

(1) Serum biochemical parameters: All biochemical parameters were measured colorimetrical by UV Spectrophotometer JASCO model V-630 (Japan) using commercial kits for each test. ALT and AST was determined according to the methods of Tietz (1976); creatinine and urea levels were was determined in serum according to the methods described by Young (2001), and serum uric acid was measured according to the procedures descripted by Vassault *et al.* (1986).

(2) The performance parameters: Mortality rate was recorded daily during the experiment. The performance parameters were measured weekly according to Shehab (2008) and Deka *et al.* (2019) that include (a) Growth Performance, (b) Body weight (BW) was determined individually at 14, 28 and at the end of the experiment at 42 days of age with calculation of daily gain. The live BW was determined by weighting chicks of groups every week. The BW was obtained by dividing the total weight of all chicks in each group by the number of those chicks.

(3) Statistical analysis: To statistically evaluate the data, SPSS for Windows, version 16.0, was utilized for determine the serum biochemical parameters as the mean ± SE. One-way analysis of variance (ANOVA) with the Tukey and Dunnett multiple comparison tests was used to statistically examine the data.

RESULTS

Results of this study were summarized in the following tales (1 & 2) and figures (1-9).

(A) Growth performance:

The results of the present study (table 1 and figure 1) showed a significant decrease in the whole BW in G2 (AF treated group) when compared with the control negative group in all slaughter times. In the G3 (treated with ST) whole body weight showed a significant decrease in the 2nd and 3rd laughter time in comparison with G1. In the 3rd slaughter time, the BW was significantly increased when compared with G2 (AF treated group).BW showed a significant reduction the 4th group (NS treated group) when compared with the values in the G1 in the 1st and 3rd slaughter times. As shown in table 1 and figure 1. In the 5th group (ST& NS treated group), BW showed a significant increase when compared with 3rd and 4th groups in the 2nd and 3rd slaughter times. In the 5th group (ST & NS treated group), BW showed a significant decrease when compared with the 4th groups in the 3rd slaughter time. The results showed that contamination of broiler feeds with AF affected musculature formation.

The current study's findings demonstrated that there are notable variations in the body weight of broiler chicks under various treatments after six weeks of

experimentation (Figure 1). BW was significantly lower in G2 than it was in G1. Throughout the first week and the next six weeks of raising chicks, the decline is evident. The body weight was successfully restored with the addition of NS in G4. in the first two weeks to that of G1. The total body weight gain through 42 days of experimental period are representing in Table 1. The rate of feed consumption showed the lowest readings were reported in G2. So, addition of ST in drinking water and NS to feed of broilers contaminated with AF was effective in counterbalancing the unpleasant effect of AF on growth performance these broilers.

In the present study, liver weight in 3rd (ST treated group) and 4th group (NS treated group) were significantly decreased in the 2nd slaughter time while no changes were observed in the 1st and 3rd slaughter times when compared with the 2nd group (AF treated group) . Liver weight in the 5th group (ST&NS treated group) showed no significant changes in all slaughter times when compared with the 1st group but showed an increase when compared with G2.

Our results in the present study revealed that the weight of the liver in the G2 (aflatoxin treated group) was significantly decreased in the 1st and 2nd slaughter time, and decreased in the 1st slaughter time when compared with G1 (table 1, fig. 2).

In the present study, heart weight in the 2nd group (AF treated group) was increased when compared with the G1. Heart weight in 3rd, 4th and 5th groups showed no changes when compared with the 1st or 2nd groups in the 1st and 2nd slaughter times. While in the 3rd and 4th groups in the 3rd slaughter time, heart weight showed a significant decrease (Table 1, fig 3).

In the present study, bursa weight in the 2nd group (AF treated group) was increased when compared with the G1 (control negative group). The weight of bursa in the G5 (ST & NS treated group) showed no changes when compared with G1 (Table 1, fig 4). This means that ST and NS when given in combination can counteract the adverse effects of the AF.

(B) Serum biochemical parameters:

The results in the present study revealed a significant increase in ALT levels in G2 in all slaughter times when compared with G1, while significant decrease were observed in G3,G4 and G5 when compare with G2 (Table 2 & fig. 5). Our results revealed a significant increase in AST levels in G2 in all slaughter times but only significant increase in AST levels in G3 in the 1st slaughter time when compared with G1, while significant decrease were observed in G3,G4 and G5 when compare with G2 (Table 2 & fig. 6). The recorded concentrations for urea in serum of investigated chicks in this study showed a significant increased levels in G2 in all slaughter times when compared with G1, while significant decrease were observed in G3,G4 and G5 when compare with G2 (table 2 & fig. 7). Uric acid concentration in this study showed significant increase in G2 in all slaughter times when compared with G1, while significant decrease were observed in G3,G4 and G5 when compare with G2 in the 2nd and 3rd slaughter times (Table 2 & fig. 8). Creatinine levels in this research showed a significant increase in G2 in all slaughter times when compared with G1 but only significant decrease recorded in G4 and in the NS and ST treated group (G5) in the 3rd slaughter time when compared with G1, while no significant changes were observed in other groups (table 2 & fig. 9).

In the present study, liver weight in G3 and G4 were significantly decreased in the 2nd slaughter time while no changes were observed in the 1st and 3rd slaughter times when compared with the G2 (AF treated group). Liver weight in the G5 showed no significant changes in all slaughter times

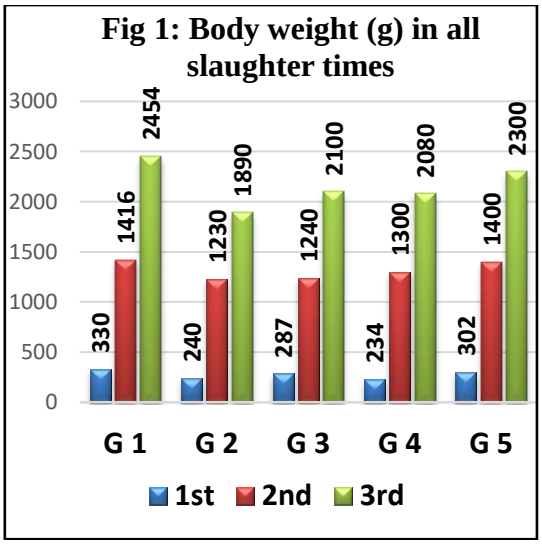
when compared with the G1 but showed an increase when compared with G2.

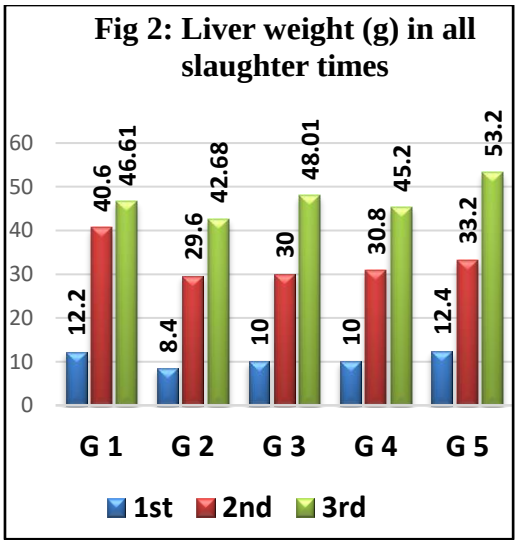
In the present study, heart weight in the 2nd group (AF treated group) was increased when compared with the G1. Heart weight in 3rd, 4th and 5th groups showed no changes when compared with the 1st or 2nd groups in the 1st and 2nd slaughter times. While in the 3rd and 4th groups in the 3rd slaughter time, heart weight showed a significant decrease (table 3, fig 3).

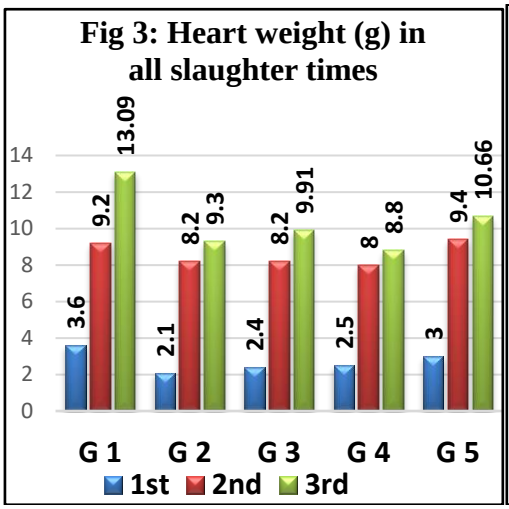
In the present study, bursa weight in the 2nd group (AF treated group) was increased when compared with the 1st group (control negative group). The weight of bursa in the 5th group (ST&NS treated group) showed no changes when compared with 1st group (negative control group) (table 4, figure 4). This means that ST and NS when administered in combination can counteract the adverse effects of the A

Table 1: Weight (g) of the whole body, liver, heart and bursa in all the slaughter time.

Slaughter Time	Organ	Groups of examined birds				
		1	2	3	4	5
1st Time	B.W.	330±22.135	240±18.225**a**	287±17.720	234±13.54**a**	302±12.409
	Liver	12.2±0.8	8.40±0.60**a**	10.00±0.707	10.00±1.00	12.40±1.123**b**
	Heart	3.6±0.40	2.10±0.292**a**	2.40±0.245	2.50±0.447	3.00±0.316
	Bursa	1.0±0.0	0.94±0.040	0.90±0.063	0.98±0.020	0.98±0.020
2nd Time	B.W.	1416±30.099	1230±33.91**a**	1240±43.012**a**	1300±22.360	1400±31.62**bc**
	Liver	40.6±2.977	29.6±2.4**a**	30±1.05**a**	30.8±2.33**a**	33.2±1.62
	Heart	9.20±0.374	8.20±0.374	8.20±0.735	8.00±0.837	9.4±0.245
	Bursa	4.0±0.316	1.8±0.374**a**	2.0±0.274**a**	2.1±0.245**a**	2.1±0.40a
3rd Time	B.W.	2454±36.96	1890±18.71**a**	2100±61.24**ab**	2080±71.76**a**	2300±22.36**bcd**
	Liver	46.61±2.94	42.68±3.01	48.01±2.22	45.20±2.13	53.20±2.33
	Heart	13.09±1.19	9.3±0.315a	9.91±0.244**a**	8.8±0.489**a**	10.66±0.535
	Bursa	3.84±0.512	2.93±0.401	3.00±0.318	1.41±0.192**a**	4.04±0.623**d**







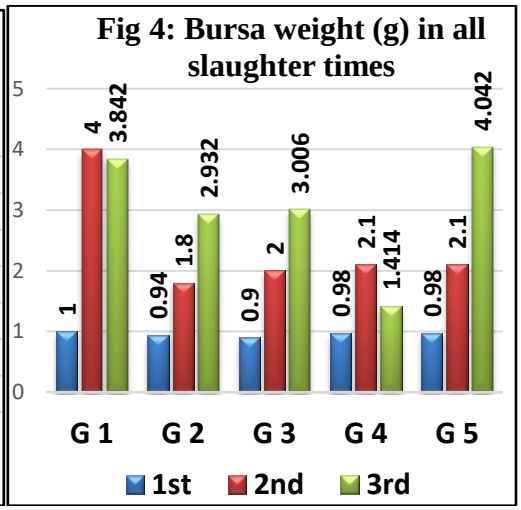


Table 2: Serum biochemical parameters in serum of chicks in all slaughter times.

Slaughter Time	Biochemical Parameters	Groups of investigated birds				
		1	2	3	4	5
1st (at 14th day)	ALT (U/l)	32.87 ± 1.767	54.38a ±1.331	39.49b ± 1.440	38.32b ± 1.412	37.52b ± 1.680
	AST (U/l)	70.22 ± 2.734	140.28a ± 4.733	88.42ab ±2.623	85.23b ± 4.930	83.46b ± 2.482
	Urea (mg/dl)	12.14 ± 2.889	16.25 a ± 5.308	14.18 ± 2.882	13.08 ± 3.988	12.43b ± 2.396
	Uric acid (mg/dl)	1.65 ± 0.411	4.21a ± 1.271	1.92 ± 1.109	1.96 ± 1.016	2.05 ± 1.200
	Creatinine (mg/dl)	0.55 ± 0.143	0.88a ± 0.372	0.63 ± 0.349	0.66 ± 0.301	0.61 ± 0.159
2nd (at 28th day)	ALT (U/l)	37.11 ±1.525	61.24a ±4.867	40.82b ±3.416	43.28b ±3.237	40.71b ±4.646
	AST (U/l)	88.32 ±2.740	220.45a ±6.521	92.22b ±6.993	98.56b ±4.444	90.57b ±3.517
	Urea (mg/dl)	13.19 ±1.883	21.42a ±1.875	14.82b ±1.708	14.67b ±1.542	14.48b ±1.198
	Uric acid (mg/dl)	1.77 ±0.168	3. 97a ±0.168	2.11b ±0.311	2.11b ±0.255	1.95b ±0.281
	Creatinine (mg/dl)	0.72 ±0.477	1.36a ±0.936	0.77b ±0.121	0.93 ±0.597	0.83 ±0.228
3rd (at 42th day)	ALT (U/l)	36.20 ±1.090	69.52a ±5.362	44.68b ±3.786	43.16b ±4.931	39.72b ±2.641
	AST (U/l)	90.06 ±2.390	210.14a ±6.2017	108.33b ±4.384	109.57b ±3.185	101.12b ±3.376
	Urea (mg/dl)	17.10 ±1.229	28.65a ±3.692	20.64b ±1.271	20.25b ±2.710	19.73b ±2.750
	Uric acid (mg/dl)	2.11 ±0.148	3.27a ±0.374	2.34b ±0.499	2.44b ±0.224	2.22b ±0.128
	Creatinine (mg/dl)	0.94 ±0.158	1.75a ±0.535	1.14 ±0.172	1.01b ±0.219	1.11b ±0.527

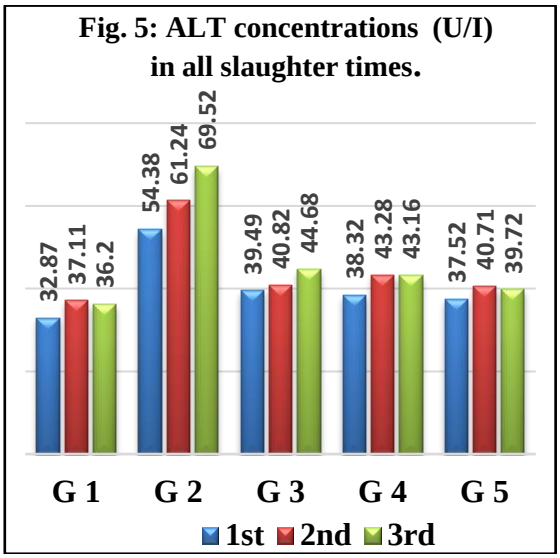


Fig. 5: ALT concentrations (U/I) in all slaughter times.

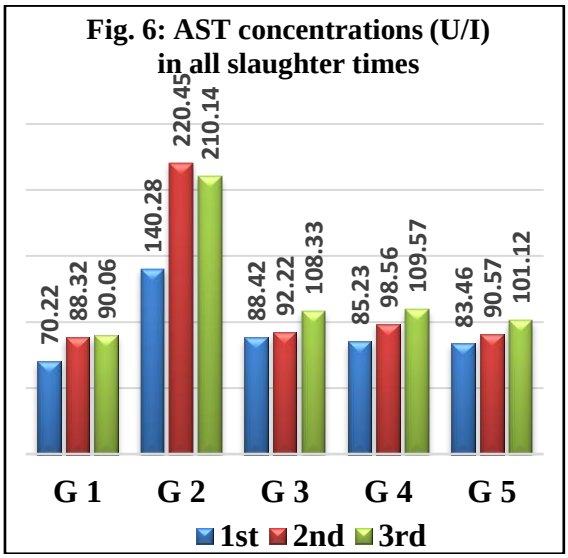


Fig. 6: AST concentrations (U/I) in all slaughter times

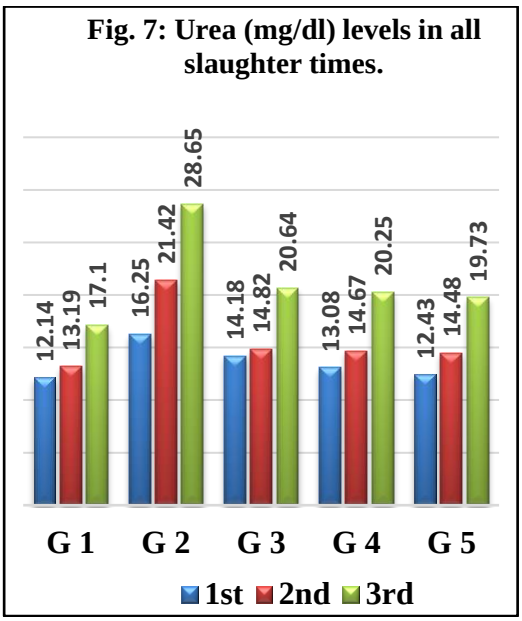


Fig. 7: Urea (mg/dl) levels in all slaughter times.

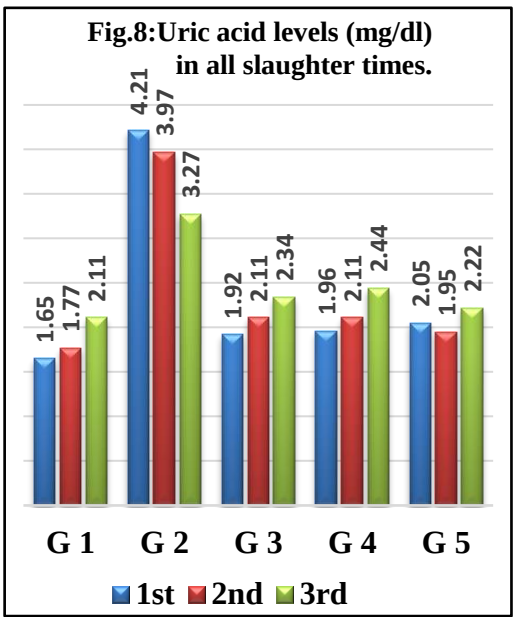


Fig.8:Uric acid levels (mg/dl) in all slaughter times.

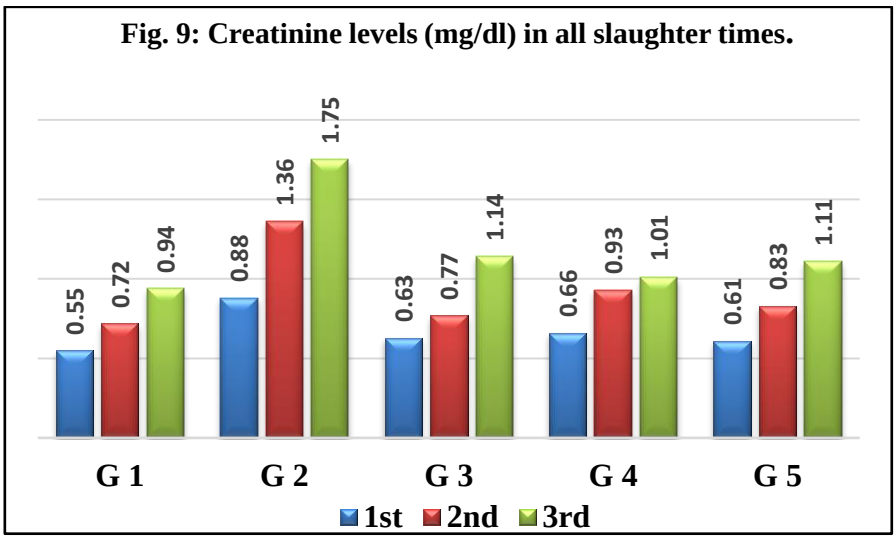


Fig. 9: Creatinine levels (mg/dl) in all slaughter times.

DISCUSSION

The presence of molds in feedstuffs can create flavors and odors of that reduce palatability and lowering feed consumption in animals and birds, additionally can decrease the nutritional value of feeds. Mycotoxins a type of fungal toxins can interfere with the digestion and metabolism of nutrients in animal production, leading to nutritional and physiological troubles and negatively impacting the immune system (Bunzen & Haese, 2006).

[A] Performance (BW, Liver & heart weight, Feed conversion rate):

Researches on the effects of dietary Nigella sativa meal on poultry performance revealed that it had a beneficial effect on the broiler body weight and feed consumption. (Guler *et al.,* 2006; Ziad *et al.,* 2008; AL-Beitawi *et al.,* 2009; Erener *et al.,* 2010; Toghyani *et al.,* 2010). Some studies revealed that diets contained 10% of NS had no effects on growth performance (Al-Homidan *et al.,* 2002). Conversely, incorporation of black seeds after grinding at levels < 0.25 up to 2% of the diet had great impact on performance and carcass characteristics (Abbas & Ahmed, 2010; Majeed *et al.,* 2010; Nasir & Grashorn, 2010).

Whole body weight:

AFB1, AFB2, AFG1 and AFG2 are main point of concern in poultry feeds among aflatoxins (Monbaliu *et al.,* 2010). AFB1 is the most potent and the more prevailing mycotoxins in feeds arranged according to toxicity as follow: AFB1> AFB2> AFG1 > AFG2 (Fandohan *et al.,* 2005). Many studies demonstrate that feeding broilers AFB1 impaired the growth rate and negatively affect feed conversion rate (Yarru *et al.,* 2009; Magnoli *et al.,* 2011).

Aflatoxicosis in poultry species is manifested by growth depression and inferior feed efficiency in broiler which may due to feed disgust and nutrient deficiency. AFB1 is the more potent and the most dangerous contaminant in poultry feed in tropical and subtropical areas. The results of our study (table 1 and fig 1) showed a significant decrease in the whole BW in G2 (AF treated group) in contrast to negative group in all slaughter times. This observation was in congruent with other studies as Tessari *et al.* (2006) that recorded BW gain was significantly decreased in broiler chickens fed diets contain AFB1 at 50 and 200 µg/kg of feed. Additionally, Denli *et al.* (2009) showed that BW gain was marked decreased when broiler fed rations contaminated with AFB1 (1 mg/kg feed). Moreover, BW gain was significantly dropped in broilers fed diet contaminated with 1 and 2 mg/kg AF (Yarru *et al.,* 2009). Bhatti *et al.* (2016) reported that a significant reduction in the whole BW gain had been observed in broiler fed diets contaminated with 0.2 and 0.6 mg/kg AFB1 as opposed to control group. Also, Nazarizadeh *et al.* (2019) recorded that the daily BW gain was severely impacted in broilers fed 0.5 mg/kg AFB1 in contrast to control diet. Furthermore, Nazarizadeh and Pourreza (2019) reported that BW gain was diminished in broilers fed diet polluted with 2 and 4 µg/g AFB1in compare to control group. Solis-Cruz *et al.* (2019) reported a decrease in the BW gain as chicks fed a diet that includes that includes 2 ppm of AFB1 during the first 3 weeks of the experiment in contrast to the control negative group. Likewise, Alam *et al.* (2020) found reduction in the BW gain in broilers fed diets contain 200 and 400 ng/g AFB1 in comparison to broiler that have not received any treatment . Rashidi *et al.* (2020) recorded that daily BW gain was severely impacted in broilers fed diet contain 0.5 mg/kg AFB1 in correlation to the control group. Additionally, Alharthi *et al.* (2022) reported that daily BW gain was markedly diminished in broilers eaten contaminated diet contain 0.25 mg/kg AFB1 when compare with control group.

As shown in table 1 and figure 1, the present study recorded the beneficial effects of NS

addition on the performance of broiler chickens that is in agreement with the results reported by Miraghaee *et al.* (2011), Ghasemi *et al.* (2014), Hossain *et al.* (2014), Ali *et al.* (2014) and Talebi *et al.* (2021) that reported 1% NS seeds in diet enhanced the performance of broiler chickens. Even though there are some differences between the present study with those mentioned by Durrani *et al.* (2007) that reported more substantial in weight gain using 40 g/kg (4%) of NS seeds in the diet, and by Shewita and Taha (2011) that recorded a more improvement in weight gain in chickens supplied with 2% NS seed when compared with the BW of those that fed diets supplemented by 10% of NS seeds.

In the 5th group (ST& NS treated group), whole body weight showed a significant increase when compared with G3 and G4 in the 2nd and 3rd slaughter times. In the 5th group (ST&NS treated group), whole body weight showed a significant decrease when compared with the G4 in the 3rd slaughter time. The results showed that contamination of the AF in the chicken's feed affected the muscle mass formation. The results in this study are in agreement other researches revealed that supplementation of feeds by of black cumin seeds severely affect the body weight gain of the birds (Akhtar *et al.,* 2003; Majeed *et al.,* 2010). The data recorded in this study concerning performance by chickens are in accordance with those reported by Majeed *et al.* (2010) and Nasir and Grashorn (2010).

In contrast to our study, El-Nattat and El-Kady (2007) revealed that addition of NS meal at the level of 17% into the ration lowering performance of broiler chicken. The same observation was reported by Abbas and Ahmed (2010) that added NS seeds at a level of 1% - 2%. Shewita and Taha (2011) mentioned that supplementation of feed to broiler chicken by NS enhance body weight and reduce FCR at a lower dose but in a higher addition rate showed no notable variations in comparison with the control group. Other researches revealed that NS increased the BW such as Al-Mufarrej (2014) who reported improvement in BW in all treated groups in comparison to the control group.

Rasouli-Hiq (2017) reported detrimental effect of AFB1 on growth performance was emerged at the beginning of trial, while the favorable outcomes due to NS were reported at end of the trial. Although NS increased feed consumption and as a result improved growth rate in the birds supplied diets contaminated with AFB1, but unable to enhance feed efficiency across the whole experiment.

Our study provided an illustration about the body weight gain of broiler chicks along the experiment that showed important variations between different treatments (table 1). There was a marked decrease in body weight in G2 in contrast to G1. The diminution was recorded from the beginning and persists through the entire of the trial. Addition of NS in G4 was effective in enhancing the body weight. In accordance, Shareef and Omar (2012) found a decrease in growth rate of broiler chicks. Pervious researches have postulated that the decreased feed consumption during aflatoxicosis may due to impaired liver function caused by the liver affection. Gabal and Azzam (1998) revealed that long term addition of low levels AF may lead to marked lesions in the liver.

Liver weight:

Our results showed that the liver weight of G2 was markedly decreased in the 1st and 2nd slaughter time, and decreased in the 1st slaughter time when compared with G1 (Table 1, fig 2). The results in the present study are similar to Nazarizadeh *et al.* (2019) who found that the liver weight of broilers fed diets contain 0.5g/kg of AFB1 was decreased in opposite to control diet.

In the present study, liver weight in G3 and G4 were significantly decreased in the 2nd slaughter time while no changes were

observed in the 1st and 3rd slaughter times when compared with the G2 (AF treated group). Liver weight in the G5 showed no significant changes in all slaughter times in contrast to the G1 even though showed an increase when compared with G2.

Heart weight: In the present study, heart weight in the 2nd group (AF treated group) was increased when compared with the 1st group (control negative group). Heart weight in 3rd, 4th and 5th groups showed no changes when compared with the 1st or 2nd groups in the 1st and 2nd slaughter times. While in the 3rd and 4th groups in the 3rd slaughter time, heart weight showed a significant decrease (Table 1, fig. 3). Our results are accordant with that observed by Tessari *et al.* (2006) who reported that relative heart weights were significantly higher in broiler chickens fed diet contaminated with AFB1 at 50 and 200 µg/kg of feed. Furthermore, feeding broiler diets contain AF at 3 mg/kg, showing no changes in the heart weight (Santurio, 1999).

Bursa weight: In the present study, bursa weight in the G2 (AF treated group) was increased when compared with the G1. The weight of bursa in the G5 (ST & NS treated group) showed no changes when compared with G1 (table 1, fig 4). This revealed the beneficial effect of ST and NS when supplied in combination to overcome the dangerous effects of AF.

[B] Serum (ALT, AST, Urea, Uric acid & Creatinine):

The findings in our study showed a significant increase in ALT and AST levels in G2 (control positive) in all slaughter times when compared with G1, while significant decrease were observed in G3,G4 and G5 when compare with G2. Aflatoxins produced variable changes in ALT and AST concentrations in examined broilers as reported by Andretta *et al.* (2012).

Our reported data are in accord with that reported by Elzoghby *et al.* (2022), that aflatoxin significantly caused elevation in the liver enzymes (AST and ALT). Likewise, these results Consistent with the ordinal adverse sequences of AFB1 on hepatic cells result in elevated levels ALT and AST in serum of broiler chicks after fed on diets contaminated by AFB1 (Gómez-Espinosa *et al.*, 2017; He *et al.*, 2013), which could lead to damage in hepatic cells conducted by AFB1 .

Research has shown that broilers fed an AFB1 contaminated feed had significantly higher blood levels of ALT than broilers on a non-contaminated diet (Bhatti *et al.*, 2016). In compliance with the previous findings, Santurio (1999) confirmed that serum level of ALT was significant elevated in broilers consumed contaminated feeds with AF in compare to the control group. Rashidi *et al.*, (2020) revealed that feeding birds AFB1 contaminated diet leading to a significant arises in serum ALT in comparison to control negative group .Cao & Wang (2014) reported no significant difference on the serum level of AST in broiler chicks fed diets contain 0.4 mg/kg AFB1, but a significant lowering in serum level of ALT was recorded by Tedesco *et al.* (2004). Moreover, Valdivia *et al.* (2001) showed marked reduction in serum level of ALT in broiler chicks fed contaminated diet with AFB1 plus treatment compared with groups not undergo any treatments .

The main purpose of estimation of serum enzymes such as (ALT and AST) and is to assess liver damage (Saleh *et al.*, 2018; Pourbakhsh *et al.*, 2014), Thymoquinone, one of the ingredients of N. sativa with strong antioxidant activity, may be helpful in protecting liver cells (Yildiz *et al.*, 2008; Shirzadegan *et al.*, 2015). The results observed in this study showed a decrease in ALT and AST serum levels in NS treated group and also in NS and ST treated group when they compared with the values in G2. These results are in agreement with prior studies such as Al-Kubaisy & Al-Noaemi (2006), Talebi *et al.* (2012), Saleh, 2014 and Shirzadegan *et al.* (2015) who found a

decrease in ALT and AST levels of broiler chickens fed with NS supplementation but in dissension with Shewita and Taha (2011) who observed that serum AST level was significantly elevated with NS supplementation.

In the present study, ALT levels in ST group, NS treated group and NS and ST treated group in all slaughter times are decreased in comparison with the control positive group. Our findings are the same as those recorded by Talebi *et al.* (2021) who reported significant decrease on levels of ALT in NS seeds treated group. In the present study, feeding of birds on AF-contaminated diet induced liver impairment as evidenced by an increase in ALT & AST. So, dietary NS and ST supplementation significantly improved liver function by counteracting the effects of aflatoxins.

In our study, ALT and AST showed moderate increase in all treated group when compared with that in negative control one (Table 2 & fig. 5,6). The enzymes activities in birds are variable and produced from various organs. In fowls, Campbell and Coles (1989 reported that AST and ALT are manufactured in skeletal and myocardium. In the current study ST and NS counteract the effect of AF in broiler chicks. These observations in accordance with Zaky *et al.* (2000) who found that ST and NS counteract the effect of AF. Since the liver is the prime organ affected by aflatoxin, Arshad *et al.* (1993) and Youssef and Ashry (1999) found elevation in AST and ALT levels. Panangala *et al.* (1986) interoperate the increase in the serum enzymes consider an indicator of injuries to the hepatocytes during aflatoxin metabolism. Youssef and Ashry (1999) reported that the significant rise in ALT and AST due to AFB_1 can be improved in rats pretreated with NS extract.

AboSaleh *et al.* (2019) recorded significant elevation in levels of liver enzymes in broiler fed diets contain AF which may be related to hepatocellular necrosis and cellular permeability of hepatic cells this aforementioned finding agree with our result and on the same line with those reported by (Ozer *et al.*, 2008; Ilhan *et al.*, 2005; Mohamed & Metwally, 2009).

The recorded concentrations for urea and uric acid in serum of chicks in the present research showed a significant increased level in G2 in all slaughter times when compared with G1, (Table 2 & fig. 7,8). Likewise, Elzoghby *et al.* (2022) reported higher level of urea in control positive group more than group fed diet free from AF. Abundant production of creatinine and urea and to some extend the drop of excretion by the kidney which negatively affected by AF explain the rise of urea and uric acid values. While significant decrease were observed in G3,G4 and G5 when compare with G2 which indicated restoring kidney function by feed additive as ST and NS as mentioned by Shareef and Omar (2012).

Thrall (2007) found changes in serum uric acid and creatinine of examined birds that fed AF via the diets. Sobrane Filho *et al.* (2016) found an increase uric acid level in AF treated group when compared negative control group. Batina *et al.* (2005) and Maciel *et al.* (2007) recorded no changes in uric acid level due to presence or absence of AF and on the other hand observed decline in concentration of uric acids in bird fed diets contaminated with 5 mg AF and treated by 0.25% of clinoptilolite and they interpreted this finding to benefical effect to clinoptilolite.

Rashidi *et al.* (2020) declared that diets contaminated with AFB1 fed to broiler lead to elevated level of serum uric acid in comparison to control group. Furthermore, Fani Makki *et al.* (2014) found that uric acid level was higher in broilers fed contaminated diet with aflatoxins than control negative group. Inversely, Mesgar *et al.* (2022) showed that fed broiler diets include AF 500 µg/kg have no impact on serum level of urea neither uric acid. Solis-Cruz *et al.* (2019)

revealed that feeding broilers diets that supplemented with 2 ppm of AFB1 for 21 days of age led to no affection in uric acid level.

Creatinine levels in this research showed a significant increase in G2 in all slaughter times when compared with G1 while significant decrease recorded in G4 and in the NS and ST treated group (G5) only in the 3rd slaughter time when compared with G1, while no significant changes were observed in other groups (table 2 & fig. 9). Sobrane Filho *et al.* (2016) found a reduction in creatinine concentration in broilers when given diets contaminated with aflatoxins. This reduction was also recorded by Batina *et al.* (2005) and Maciel *et al.* (2007), observed that a 30% decrease in creatinine levels recorded during feeding bird diet contain with 5 mg /kg aflatoxin. Creatinine level was generated from the destruction of muscle phosphocreatine. Muscle activity increase, leading to elevation of creatinine levels and further of kidney affection (Thrall, 2007). Elzoghby *et al.* (2022) showed significant elevation of creatinine concentration in the animal group that treated with AF when in comparison to negative control.

We have concluded that AFB1can negatively influences the broilers productive performances .The toxic effect of AF can be partially corrected by using NS and ST.

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التأثير التحسيني لـ السينرتوكس وحبة البركة على أداء النمو وبعض المعايير الكيموحيوية في مصل الدم في بدارى التسمين المغذاة على علائق ملوثة بالأفلاتوكسينات

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الخلفية: حبة البركة هي دواء عشبي يستخدم على نطاق واسع لعلاج أمراض مختلفة وقد تم استخدامه كمادة حافظة ومضافات غذائية. كما أن السينرتوكس له أيضًا تأثير كمواد ممسكة للسموم الفطرية. أجريت هذه الدراسة لتقييم فعالية السينرتوكس وحبة البركة لتحسين تأثير الأفلاتوكسين على بدارى التسمين. **المواد والطرق**: تم الحصول على مائة وخمسين فرخاً لاحم عمر يوم واحد (Ross 308) سليمة ظاهرياً من شركة الهواري، أسيوط، مصر. تم تقسيم هذه البدارى بالتساوي إلى خمس مجموعات (٣٠ كتكوت لكل مجموعة). المجموعة الاولى أعطيت أعلاف خالية من الأفلاتوكسين وأي علاج اخر، المجموعة الثانية أعطيت أعلاف تحتوي على الأفلاتوكسين (300 جزء في البليون)، المجموعة الثالثة أعطيت أعلاف تحتوي على الأفلاتوكسين بالإضافة إلى السينرتوكس في مياه الشرب، المجموعة الرابعة أعطيت أعلاف تحتوي على الأفلاتوكسين (300 جزء في البليون) بالإضافة إلى وحبة البركة ١٠ جم/كجم علف والمجموعة الخامسة أعطيت أعلاف تحتوي على الأفلاتوكسين بالإضافة إلى السينرتوكس في مياه الشرب وحبة البركة ١٠ جم/كجم علف.

النتائج: (أ) بالنسبة للأداء، أظهر وزن الجسم بأكمله والكبد والقلب والجراب انخفاضًا في المجموعة الثانية (الذي تغذى على نظام غذائي ملوث بالأفلاتوكسين) بالمقارنة مع المجموعة الاولى (الذي تغذى على نظام غذائي خالٍ من الأفلاتوكسين) ولكن وزن هذه العناصر سابقًا تعود الأعضاء المذكورة والجسم بالكامل في المجموعات الثالثة والرابعة و الخامسة إلى طبيعتها تقريبًا كما هو الحال في المجموعة الاولى. (ب) بالنسبة للمعايير الكيميائية الحيوية في الدم، أظهر ALT وAST واليوريا وحمض اليوريك والكرياتينين بعض التقلبات إما زيادة أو نقصان عند مقارنتها مع المجموعات الاولى والثانية أو مع بعضها البعض.

الاستنتاج: يمكن استخدام السينرتوكس وحبة البركة كإضافات غذائية إلى علائق الدواجن للتخفيف من أي سمية محتملة للأفلاتوكسين التى قد تكون موجودة فى هذه الأعلاف.