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Full length article

Protective effect of adsorbing and bio-transforming antimycotoxin agents on growth performance, carcass traits, blood parameters of broiler chickens exposed to mycotoxin- contaminated feed

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ABSTRACT

Mycotoxin contamination in feed a common problem in broiler chickens' industry worldwide. This experimental study was performed at the Faculty of Veterinary Medicine, Thamar University with the aim to assess the impact of adsorbing and bio-transforming antimycotoxin agents on reducing toxic of aflatoxin B1 (AFB1) in broilers feed by examining the growth performance, carcass trait, serum parameters. 126 one-day old broiler chicks (Ross) were purchased from market and randomly allocated into 6 treatments and control groups containing 3 replicates with 7 birds in each replicate. The experimental groups were as following: (1) basal diet (clean or positive control), (2) mycotoxin-contaminated basal diet (negative control), (3) mycotoxin- contaminated basal diet and biolan in drinking water at 1%, (4) mycotoxin-contaminated basal diet and 2% zeolite, (5) mycotoxin- contaminated basal diet and 2% enzymes; and (6) mycotoxin- contaminated basal diet and mycofix 1%. In the starter period (0-3weeks), the birds in negative control, biolan, zeolite and enzymes groups showed better feed intakes, but not significant (P<0.05) comparing to other groups. The best feed conversion ratio (FCR) was recorded in the positive control and mycofix groups, and the worst FCR was recorded in the negative control group. In the grower period (3-6 weeks), the birds in biolan group showed higher feed intake, but the best weight gains and FCR were showed by the zeolite, positive control, enzymes and mycofix groups compared to the other groups. In the period of 6-7 weeks, enzymes and mycofix groups showed the best FCR indices compared to the negative control. Considering the weights of carcass yields and internal organs in broilers, the results revealed that, there were significant differences (P<0.05) in the dressing percentages of carcass at the end of experiment and none in the relative weight of the heart, liver, gizzard. Biochemistry analysis of blood demonstrated that there were no significant differences(P<0.05) in total protein, Albumin, Globulin serum concentrations of treated and negative control groups with exception in enzyme and mycofix groups. There were no significant differences (P<0.05) among mean values of serum cholesterol and triglycerides in treated and control group, in spite, higher mean values concentration of cholesterol and triglycerides was recorded in treated groups. The results also displayed that, the serum urea and creatinine were lower in the negative control group compared to treated and the positive control groups. In conclusion, the present results showed that there is positive effect by adding the adsorbenting and biotransforming antimycotoxins agents to broiler diets in terms of growth performance, carcass traits and blood parameters. Further research work should be carried on other additives diet of broilers.

INTRODCTION

The poultry industry is one of the main sources of meat production worldwide. It is an important source of human proteins and of income for many breeders and workers in the poultry farming sector (Obaid et al., 2023). Poultry farming profitability significantly depends on feed costs, with them accounting for 60–70% of the total production cost (Makkar, 2018), for this reason, the efficient use of feed is extremely important in broiler production.

Mycotoxins are secondary metabolites of fungi mainly belonging to the genera Aspergillus, Alternaria, Fusarium, Cladosporium, Claviceps, and Penicillium (Peng et al., 2018). Feed ingredients have been shown to be prone to contaminated with mycotoxins, resulting in contamination of final poultry feed commodities (Njobeh et al. 2012; Akinmusire et al., 2018). The occurrence of mycotoxin contamination is global challenge, accompanied by rising animal and human health hazards and huge financial losses in the food and feed production industries (EFSA, 2011; Pinotti et al., 2016).

Feed additives are used in chicken nutrition to increase feed safety, improve growth and carcass quality, and raise immunity. The commonly used feed additives in poultry diets include antimycotoxins (Olivera et al., 2015). Antimycotoxins are feed additives that protect animal health by deactivating mycotoxins found in contaminated feed. These substances can bind to mycotoxins and prevent them from being absorbed through the gut and into the body. The addition of antimycotoxins to poultry diets has been considered the most promising dietary approach to reduce the effects of mycotoxins (Galvano et al., 2001).

Mycotoxin binders are nutritionally inert adsorbents that reduce mycotoxin absorption from the gastrointestinal tract by integrating them into contaminated feed, thereby preventing and decreasing mycotoxicosis and transportation of mycotoxins into animal products (Boudergue et al., 2009). Another way of reducing the negative effects of mycotoxins already ingested and present in the gastrointestinal tract of animals involves the use of mycotoxin modifiers such as enzymes, yeast, and bacteria, to degrade the mycotoxins into less toxic metabolites. Recently, the inclusion of *Lactobacillus spp*. in broiler chickens' diets was shown to alleviate the toxic effects of Aflatoxin B1(AFB1) and Zearalenone, ZEN, (Chang et al. 2020), as well as Deoxynivalenol, DON, (De Souza et al., 2020).

Depending on their mode action, antimycotoxins may act by reducing the bioavailability of the mycotoxins i.e., adsorbing agent or by degrading mycotoxins or transforming them into less toxic metabolites i.e., bio-transforming agents. A little data available on the effect of adsorbing and bio-transforming antimycotoxins agents in broiler diets. Therefore, the aim of this study was to investigate the effect of adsorbing and bio-transforming antimycotoxins agents on the performance, carcass traits and blood parameters of broilers exposed to mycotoxin- contaminated feed.

MATERIALS AND METHODS

Study area

The current experiment study was conducted during the year of 2023 in the Department of Veterinary Medicine, Faculty of Agriculture and Veterinary Medicine, Thamar University.

Chemical, biological materials and feed

The zeolite used in this experiment was obtained from Yemen zeolite company, Sana`a, Yemen. zeolite contains clinoptilolite as the active substance. The biolan was purchased from market and consist of a complex of non-starch polysaccharides obtained from yeast cell wall (YCW) purification. MP-zyme a commercial enzyme composed of: Amylase, cellulose, xylase, phytase, protease, β-glucans and pectinase. Mycofix plus 3.0 is the product of Biomin® GTI GmbH. Herzogenbeurg, Austria. Mycofix®Plus originally contained the components: Synergistic blend of minerals, biological constituent, BBSH 797, phytogenic substances, and Phycophytic constituents. Adsorbic antimycotoxin used was Zeolite, the biotransformic antimycotoxin was MP zyme and the combination formulated product was mycofix plus 3.0.

The basal diet was prepared for starter and growth periods. The composition of the diets prepared according to the requirements prescribed in Ross strain. Metabolizable energy (ME) and crude protein (CP) number of diets were 3200 kcal/kg and 23% respectively, and for the rest of the experimental period from 4 to 7 weeks of age, The grower–finisher experimental diets were contained 20% CP, and 3200 kcal/kg ME satisfying the needs recommended by NRC. (1994).

The concentration of aflatoxin B1 used in treated and negative groups was at dose of 0.1 mg/kg according to guidance keys given by Ramandani et al. (2020). The level of aflatoxin that is still safe in feed ingredients is no more than 50 pbb or 0.05 mg/kg (Jannah et al., 2024).

Birds and experimental design

A total of 126 one-day old broiler chicks (Ross) were purchase from market. The birds were randomly

allocated into six treatments and control groups containing 3 replicates with 7 birds in each replicate. The experimental bird groups were as the following: (1) basal diet (clean or positive control), (2) mycotoxin-contaminated basal diet (negative control), (3) mycotoxin-contaminated basal diet and biolan in drinking water at 1%, (4) mycotoxin-contaminated basal diet and 2% zeolite, (5) mycotoxin- contaminated basal diet and 2% enzymes; and (6) mycotoxin- contaminated basal diet and mycofix 1% as presented in Table 1. All bird groups were reared under standard managemental condition. The prophylactic measures were taken to control diseases and to increase the viability of the birds. The experimental room of the birds` was properly prepared, it was previously disinfected with 4% formalin and divided into separated compartments of equal size each of (1.5 x 2m) 3 m^2 floor area and bedded by a layer of chaffed sawdust. Experimental compartments were equipped with cylindrical hanging feeders, water founts and gas brooders, and maintained room temperature and air flow. Along the experimental period, all the bird groups were subjected to 24 hours lighting during the first three days and gradually decreased by 5 minutes daily till it reaches 23 hours which extended to the age of 7 weeks. Room temperature maintained by gas brooders at 34˚C during the first three days and gradually decreased by 0.5˚C daily till it reaches 25˚C at the end of the third week, then it maintained at 24˚C thereafter till the end of the experiment.

Table 1. Summarizes the experimental group design

Treatments	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
	Control (+ve)	Control (-Ve)	Biolan	Zeolite	Enzymes	Mycofix
Com. diet	+	+	+	+	+	+
Mycotoxins	-	+	+	+	+	+
Biolan	-	-	+	-	-	-
Zeolite	-	-	-	+	-	-
Enzymes	-	-	-	-	+	-
Mycofix	-	-	-	-	-	+

SAMPLING AND MEASUREMENTS

Growth performance and feed conversion

Birds were checked twice daily and the weight of birds was used to adjust the average feed consumption and body weights. The average initial body weight of the chicks at the beginning of the starter period was nearly same. Chicks were weighed weekly, live body weight (LBW) and feed consumption was recorded to calculate the body weight gain (BWG) and feed conversion ratio (FCR). The amount of feed consumed was weekly recorded in each of the different experimental groups. The average amount of feed intake (FI) by each bird was calculated by dividing the weekly consumed feed by its respective number of living birds in each group at this week. Regarding the development of the body weight and weight gain, the birds were individually weighed every week and the live weight changes were taken as the criteria of the effect of the different treatments, and as a measure for growth, the amount of feed consumed was divided by the body weight gain of the bird in order to calculate the rate of feed conversion.

Carcass traits and Blood biochemistry

At the end of the experimental period (49 day of age), five birds from each group were randomly selected and slaughtered for measurement of carcass traits and blood biochemistry, water was removed from the birds 12 hours before the expected time of slaughtering. The birds were dressed for calculation of dressing carcass percentage, after removal of feathers, head and feet. The relative weights of some internal organs of birds, including gizzard, liver and heart were recorded at the end of the experiment.

A blood specimen was collected from each of the slaughtered bird of all groups at the end of the experiment for biochemistry analysis. Blood specimens were gathered from the brachial vein in suitable vacuum tube. The blood samples were allotted to clot at ambient temperature, centrifuged for 10 minutes at 3000 rpm, and serum from each sample was extracted. The serum samples (1ml/vial) were kept at -20°C until used. Blood parameters investigated and determined were total serum protein and its fractions (albumin and globulin), total cholesterol, triglycerides, urea and creatinine using standard test kits supplied by SGM (Roma / Italia).

Statistical analysis

The crude data obtained from current experimental study were subjected to statistical analyses using the SPSS Version 20 (IBM Corp., NY, USA). The results were expressed as means and standard deviations. Differences between means were tested for significance by the two-way analysis of variance using the general linear model procedure and Ducan's test with a significance level *P* at 5%.

RESULTS AND DISCUSSION

Growth performance

The results effects of adsorbenting and biotransforming antimycotoxin agents on the performance of broiler chickens exposed to mycotoxin-contaminated feed are summarized in Table 2**.** As shown, in the starter period (0-3 weeks), the birds in negative control, biolan, zeolite and enzymes group

showed better feed intakes, but not significant (P<0.05) comparing to other groups. The weight gains of birds were significantly (P<0.05) better in the groups of zeolite and Enzymes followed by the positive control groups. The best FCR was observed in the positive control and mycofix groups whereas; the worst FCR in the negative control group. The reasons behind different results obtained on performance of birds may be due to the effects of the mycotoxins which reduce the effectiveness of digestive enzymes of protein, lipids and starch which leads to reduction in the weight gain of the chicks and dietary conversion efficiency.

In the grower period (3-6 weeks), the birds in groups of zeolites, biolan and enzymes showed better feed intakes, whereas; the best weight gains were observed in birds of zeolite, enzymes and positive control groups followed by the mycofix and biolan groups. FCR was the best in the zeolite and the positive control groups followed by the enzymes and mycofix groups, whereas; the worst FCR rate was observed in birds of the biolan and negative control groups.

In the period of 6-7 weeks, the birds in the biolan group recoded the higher feed intake values, however; the best values weight gains and FCR were recorded in the zeolite, positive control, enzymes and mycofix groups compared to the other groups. it`s confirmed that the adding antimycotoxins to diet of birds are reduced the effect of the mycotoxins and significantly increased the weight of birds.

The addition of biolan which contains yeast cell wall (YCW) to the chicken feed stimulated feed intake from one to 21 days of age (Dos Santos et al., 2021). The increase in feed intake with treatments groups with YCW may be related to the trophic effect caused by YCW polysaccharides on the digestive mucosa, which increases the villus height, especially during the first seven days of life in chickens (Santin et al., 2001).

Concerning the whole experimental period (0-7 weeks) feed intake was the highest in the biolan group followed by the zeolite groups compared to the other groups. the birds in zeolite and enzymes groups showed better values of weight gain followed by the positive control group compared to the other groups. Regarding to FCR, the best indices was observed in birds of the positive control, zeolite, enzymes and mycofix groups compared to the negative control and Biolan groups (Table 2). The results of present study are in agreement with findings of previous studies (Garcia et al. 2007, Levic et al. 2008, Abaş et al., 2011 and Suresh et al., 2018; Kolawole et al., 2020). The reasons could be attributed to that supplying the diet of birds with antimycotoxins agents possess chemical and bioactive ingredients act to reduce the toxic effects of mycotoxins and contamination of intestine or have high absorption capacity. Furthermore, zeolite contained minerals (macro- and microelements) in an ionic state which is beneficial for birds' growth and amelioration of the intestinal status (Amad & Al-ansi, 2018; VasiljevI et al., 2021).

Carcass traits

The results revealed that, there were significant differences (P<0.05) in the dressing percentages of carcass at the end of this experiment, the bird in mycofix group had the best carcass dressing percentage followed by the zeolite and the enzymes groups compared to negative group. An improvement quality of carcass by supply birds' diet with adsorbenting and biotransforming antimycotoxin agents may be due to decreased the carcass fat percentage. These results are in line with findings of El-Katcha et al. (2017) who reported that chemical or biological mycotoxin-binders supplementation significantly improved dressing percentage of broiler chicken.

The impact of dietary treatments on the relative weight of heart, liver, gizzard and kidney yield of birds(broilers) are summarized in Table 3. As shown, no significant differences (p>0.05) were detected in the relative weight of the heart, liver, gizzard among the treatment groups compared to the negative control group. These results are in parallel with findings obtained by Chen et al. (2019), and in contrast to findings reported previously by many workers (Tessari, et al, 2006, Shannon et al., 2017, Saminathan, et al., 2018 and Aikore, et al., 2019), who found that increase in weights of the liver, heart, and kidneys in broilers fed with contaminated diets treated with antimycotoxin agents.

Table 2. Effect of adsorbing and biotransforming antimycotoxins on feed intake, body weight gain and feed conversion ratio in broilers exposed to mycotoxin- contaminated feed

Trait		Treatments and control groups					
Feed intake	Period	Control +ve	Control -Ve	Biolan	Zeolite	Enzymes	Mycofix
	0-3w	793.63 ^{b}	805.89^{ab}	812.45 ^{ab}	821.03 ^{a}	820.63 ^{a}	788.67 ^{b}
	3-6 w	2482.59^{bc}	2419.31^{c}	2544.54^{ab}	2609.33 ^{a}	2508.97 ^{b}	2486.08 ^{bc}
	6-7 w	1405.2 ^{ab}	1417.9^{ab}	1486.3 ^{a}	1389.6 ^{b}	1400.6 ^{ab}	1412.7 ^{ab}
	0-7 w	4681.43^{bc}	4643.09^{c}	4843.25 ^{a}	4819.92 ^{a}	4730.17 ^{b}	4687.49 ^{bc}
Body weight gain	0-3 w	470.44 ^{a}	446.78 ^{b}	468.72 ^{ab}	476.45 ^{a}	474.72 ^{a}	467.75 ^{ab}
	3-6 w	1449.27 ^{ab}	1264.14^{b}	1404.4 ^{ab}	1511.58 ^{a}	1440.4 ^{ab}	1411 ^{ab}
	6-7w	888.59 ^{b}	892.08 ^{ab}	904.62 ^{a}	889.59 ^{b}	905.62 ^{a}	900.61 ^{ab}
	0-7	2808.3 ^{ab}	2603 ^{c}	2777.74^{b}	2877.62 ^{a}	2820.74 ^{ab}	2779.36 ^{b}
FCR	0-3 w	1.69 ^{b}	1.8 ^{a}	1.73 ^{ab}	1.72 ^{ab}	1.72 ^{ab}	1.69 ^{b}
	3-6 w	1.71 ^{c}	1.91 ^{a}	1.81 ^{b}	1.73 ^{bc}	1.74 ^{bc}	1.76 ^{bc}
	6-7 w	1.63 ^{ab}	1.63 ^{ab}	1.69 ^{a}	1.61 ^{ab}	1.59 ^{b}	1.61 ^{ab}
	0-7 w	1.67 ^{b}	1.78 ^{a}	1.74 ^{ab}	1.67 ^{b}	1.68 ^{ab}	1.69 ^{ab}

**Figures in the same row having the same superscripts are not significantly different (P< 0.05). W=week*

Table.3. Effect of adsorbing and bio-transforming antimycotoxin agents on relative weights (% of pre-slaughter weight) of carcass yields and internal organs of broilers exposed to mycotoxin- contaminated feed

Organs	Treatments and control groups					
	Control +ve	Control -ve	Biolan	Zeolite	Enzymes	Mycofix
Dressed Carcass	72.56± 1.02^{ab}	71.26± 0.93^{b}	72.27±0.91^{ab}	72.8±1.11^{a}	72.67± 0.91^{ab}	72.94±1.02^{a}
Heart	0.507± 0.04^{ab}	0.527± 0.04a	0.490±0.02^{b}	0.478±0.04^{c}	0.511± 0.04^{ab}	0.510± 0.04^{ab}
Liver	2.29± 0.08^{ab}	2.43± 0.09^{a}	2.32±0.06^{ab}	2.27±0.08^{b}	2.34± 0.06^{ab}	2.29± 0.07^{ab}
Spleen	0.166± 0.03^{ab}	0.158± 0.01b	0.168±0.03^{a}	0.173±0.01^{a}	0.168± 0.03^{a}	0.166± 0.03^{ab}
Gizzard	1.620± 0.04^{ab}	1.630± 0.05a	1.630±0.05^{a}	1.480± 0.05^{b}	1.490±0.08^{b}	1.620± 0.04^{ab}
kidney	0.421±0.02^{b}	0.606± 0.01^{a}	0.430±0.01^{ab}	0.420±0.01^{ab}	0.428± 0.01^{ab}	0.421± 0.02^{b}

**Figures in the same row having the same superscripts are not significantly different (P< 0.05).*

Table. 4. Effect of adsorbing and bio-transforming antimycotoxin agents to mycotoxin contaminated diets on blood serum parameters of broilers exposed to mycotoxin- contaminated feed

Parameter	Experimental treatments					
	Control +Ve	Control -Ve	Biolan	Zeolite	Enzymes	Mycofix
Total protein (g / dl)	4.57±0.17^{ab}	4.32±0.18^{b}	4.51±0.12^{ab}	4.55±0.15^{ab}	4.64± 0.19^{a}	4.64± 0.20^{a}
Albumin (g/ dl)	2.32± 0.07^{ab}	2.18± 0.07^{b}	2.30± 0.08^{ab}	2.32± 0.08^{ab}	2.38± 0.04^{a}	2.37± 0.08^{a}
Globulin (g / dl)	2.25± 0.10^{ab}	2.14± 0.11^{b}	2.21± 0.03^{ab}	2.23± 0.07^{ab}	2.26± 0.15^{a}	2.27± 0.12^{a}
Cholesterol (mg /dl)	114.13±0.69^{a}	101.13±0.74^{b}	108.24±0.62 ^{ab}	109.34±0.65^{ab}	107.06±0.92^{ab}	106.12± 0.68^{ab}
Triglycerides (mg /dl)	68.44±0.65^{a}	59.98±0.96^{b}	65.44±0.41^{ab}	64.44±0.41^{ab}	67.44±0.55^{a}	62.65± 0.18^{ab}
Urea (mg/dl)	2.14± 0.04^{a}	1.84± 0.04^{b}	1.92± 0.05^{ab}	1.92± 0.05^{ab}	1.98± 0.07^{ab}	1.97± 0.03^{ab}
Creatinine (mg/dl)	0.19± 0.02^{a}	0.14± 0.02^{b}	0.17± 0.04^{ab}	0.18± 0.06^{a}	0.17± 0.01^{ab}	0.19± 0.02^{a}

**Letters in the same row having the same superscripts are not significantly different (P< 0.05*).

Biochemistry analysis of blood

The results of biochemistry analysis of blood samples are presented in Table 4. The results revealed that, there was no significant differences($P<0.05$) in total protein, Albumin, Globulin serum concentrations of treated groups and negative control groups with exception of enzyme and mycofix groups which were have higher mean values concentrations. Putra et al. (2024) studied and reviewed the protective effects of various feed additives on broiler chickens exposed to mycotoxin-contaminated feed and reached to similar results. The blood parameter changes impaired protein synthesis and have been shown to be marked by decreased blood total protein, globulin, and albumin levels that have been linked to mycotoxicosis. The biochemical parameters change of blood observed in the different studies could be attributed to age, sex, metabolic state, breed, and levels of mycotoxins and duration of exposure. The toxicity of mycotoxins has been demonstrated to trigger the suppression of hepatic protein, carbohydrate, and lipid metabolism, and might therefore lead to liver dysfunction and serum biochemical changes (Aviagen, 2019; Zabiulla et al., 2021). In current study, there were no significant differences ($P<0.05$) among mean values of serum cholesterol and triglycerides in treated and control group, in spite, higher mean values concentration of cholesterol and triglycerides recorded in treated groups. Blood analysis also displayed that, the serum urea and creatinine were lower in the negative control group compared to treated and the positive control groups (Table 4). These results are agreed with findings of Tapia and Seawright (1985). The higher mean values of serum urea and creatinine in treated group compared to negative groups may be due damage caused in liver and kidney by mycotoxins.

The mortality rate was influenced by the mycotoxins contaminated groups, especially the negative control group which recorded the highest mortality rate (8%) than the other groups (which recorded mortality rate between 3 to 4%) which prove that there was favorable effect of the antimycotoxins on birds (broiler chickens) health. An immunosuppressive effect of mycotoxins has been shown to cause reduced disease resistance, reduced drug efficacy, and vaccine failures, making the animal more susceptible to diseases and increasing mortalities (Antonissen, et al 2014, Monson, et al, 2015, Murugesan, et al, 2015 and Kemboi, et al 2020).

CONCLUSION

The present results showed that there is a positive effect of supply broiler diets with adsorbenting and biotransforming antimycotoxins agents on birds (broiler chickens) in terms of growth performance, carcass traits and blood parameters. Further study should be carried with other additives to diet of birds (broiler chickens).

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CONTRIBUTION OF AUTHORS

SA author contributed to the study conception, design, written 1st draft and final version of the manuscript. Material preparation and data collection were performed by ASA, HG, AA authors, data analysis and visualization were performed by AA, FB and AA authors. All authors read and approved the final version of manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest. The funders had no role on conducting of the study.

ETHICS CONSIDERATIONS

Birds were handled humanely throughout the study, and the experimental design and protocol for the use of the birds for research were approved by the faculty board of the Faculty of Veterinary Medicine, Thamar University.

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الفعالية الوقائية لمضادات السموم الفطرية الرابطة والمحولة الحيوية على النمو، وصفات الذبيحة ومؤشرات الدم في الدجاج اللاحم التي غذيت على أعلاف ملوثة بالسموم الفطرية

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الملخص

يعد التلوث بالسموم الفطرية في الأعلاف مشكلة شائعة في قطاع تربية الدجاج اللاحم في جميع أنحاء العالم. أُجريت هذه الدراسة التجريبية في كلية الطب البيطري، جامعة ذمار، بهدف تقييم تأثير مضادات السموم الفطرية الرابطة والمحولة الحيوية على خفض سمية الأفلاتوكسين ب 1 (AFB1) في الدجاج اللاحم من خلال تقييم النمو، وسمات الذبيحة، والمعايير المصلية. تم شراء 126 كتكوتًا من دجاج اللاحم (روس) بعمر يوم واحد من السوق، ووُزّعت عشوائيًا على 6 مجموعات (مجموعات معاملات ومجموعات ضابطة)، تحتوي كل منها على 3 مكررات، بواقع 7 طيور في كل مكرر. قسمت المجموعات التجريبية على النحو التالي: (1) غذاء أساسي (مجموعة ضابطة النظيفة أو الموجبة)، (2) غذاء أساسي ملوث بالسموم الفطرية (مجموعة ضابطة سالبة)، (3) بيولان في ماء الشرب بنسبة 1% وغذاء أساسي ملوث بالسموم الفطرية (4) ٢% زيوليت وغذاء أساسي ملوث بالسموم الفطرية، (5) 2% إنزيمات MP وغذاء أساسي ملوث بالسموم الفطرية، (6) 1% مايكوفكس وغذاء أساسي ملوث بالسموم الفطرية. في فترة البدء (0-3 أسابيع)، أظهرت الطيور في المجموعة الضابطة السلبية، ومجموعات البيولان والزيوليت والإنزيمات، استهلاكًا أفضل للعلف، ولكن ليس ذو دلالة معنوية إحصائية ($P<0.05$) مقارنةً بالمجموعات الأخرى. سُجِّلت أفضل نسبة تحويل غذائي (FCR) في مجموعتي الضابطة الموجبة والمايكوفكس، بينما سُجِّلت أسوأ نسبة تحويل غذائي في المجموعة الضابط ة السالبة. في فترة النمو (3-6 أسابيع)، أظهرت طيور مجموعة البيولان استهلاكًا غذائيًا أعلى، ولكن الزيادة في الوزن وأ نسبة التحويل الغذائي كانت الافضل في مجموعات الزيوليت والضابطة الموجبة والإنزيمات والمايكوفكس مقارنةً بالمجموعات الأخرى. في فترة 6-7 أسابيع، أظهرت مجموعتا الإنزيمات والمايكوفكس أفضل مؤشرات التحويل الغذائي مقارنةً بالمجموعة الضابطة السالبة. وفيما يتعلق بالأوزان النسبية لتصافي الذبيحة والأعضاء الداخلية في دجاج اللحم، أظهرت النتائج وجود فروق معنوية إحصائية ($P<0.05$) في نسب التصافي للذبيحة في نهاية التجربة، وعدم وجود فروق معنوية في الاوزان النسبية للقلب والكبد والقوانص. أظهر التحليل الكيميائي الحيوي للدم عدم وجود فروق معنوية ($P<0.05$) في تركيزات البروتين الكلي، والألبومين، والغلوبيولين في مصل الدم بين المجموعات المعالجة والمجموعة الضابطة السلبية، باستثناء مجموعتي الإنزيم والمايكوفكس. كما لم يلاحظ أي فروق معنوية احصائية ($P<0.05$) بين متوسطات قيم الكوليسترول والدهون الثلاثية في مصل الدم بين المجموعات المعالجة والمجموعات الضابطة، على الرغم من تسجيل متوسطات أعلى لتركيز الكوليسترول والدهون الثلاثية في المجموعات المعالجة. كما أظهرت النتائج انخفاض في مستويات اليوريا والكرياتينين في مصل الذبيحة في المجموعة الضابطة السالبة مقارنةً بالمجموعات المعالجة والضابطة الموجبة. خلصت النتائج الحالية الى ان هناك تأثيرًا إيجابيًا لمضادات السموم الفطرية الرابطة والمحولة الحيوية المضافة إلى علائق دجاج اللاحم على النمو الطير، وصفات الذبيحة، ومعايير الدم. وينبغي إجراء المزيد من الأبحاث على مضادات السموم الفطرية الأخرى المضافة الى عليقة الدجاج اللاحم.

الكلمات المفتاحية: مضادات السموم الفطرية الرابطة والمحولة الحيوية، افلاتوكسين ب1، معايير الدم، دجاج اللحم، الأداء

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