Evaluation of using Polyfam on broiler performance during mycotoxicosis

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Abstract

The aim of this study was to evaluate the possible protective effect of (polyfam) 5g\kg of ration against the toxic effects of mixed mycotoxins in growing broiler chickens (ROSS-308).Total 100 chicks, one week age were divided into 5 equal treated groups. G1; fed a contaminated ration with mycotoxin and supplemented with polyfam 5g/kg of ration and vaccinated with Gumboro vaccine at 15 and 22 days of age. G2; was fed a ration contaminated with mycotoxin and vaccinated with Gumboro vaccine at 15 and 22 days of age and not supplemented with polyfam. G3; was fed intact ration and vaccinated with Gumboro vaccine at 15 and 22 days of age. G4; was only fed a contaminated ration with mycotoxins. G5; was fed intact broiler ration as a control group. The diet was naturally contaminated with many mycotoxins, the mycotoxins in feed was analyzed by ELISA and the level of mycotoxins were as follows: Aflatoxin B1 0.001 mg/kg, Dezoxivalenol 1.24 mg/kg, Zearalenon 0.068 mg/kg ,Ochratoxin 0.005 mg/kg ,T2 toxin 0.09 mg/kg, Fuminisen B1 0.2 mg/kg. Results showed that polyfam significantly ($P<0.05$) protect chicken body weight, severity of clinical signs, morbidity and mortality rate. It was concluded that this preparation is protect chicken bioavailability parameters in comparison with the other groups and was recommended to use it as antitoxic material.

Key words: Broiler, mycotoxins, adsorbents, polyfam, performance, body weight.

تقييم استخدام البوليفام على اداء فروج اللحم المغذى بعليقة تحتوي السموم الفطرية

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الخلاصة

كان الهدف من هذه الدراسة تقييم التأثير الوقائي المحتمل لاستخدام (البوليفام) وبجرعة 5 غم/ كغم علف ضد السموم الفطرية الملوثة لعلائق فروج اللحم. استخدم في هذه التجربة 100 فرخا بعمر اسبوع واحد قسمت الى خمسة مجاميع متساوية، المجموعة الاولى اعطيت العليقة الملوثة بالسموم الفطرية مع مادة البوليفام بجرعة 5 غم/كغم علف ولقحت بلفاح الكمبورو بعمر 15و22 يوما، تم تغذية المجموعة الثانية العليقة الملوثة بالسموم الفطرية ولقحت ايضا بعمر 15 و22 يوما، المجموعة الثالثة اعطيت العلف السليم الخالي من السموم الفطرية ولقحت ايضا بعمر 15و22 يوما، اما المجموعة الرابعة فقد اعطيت العلف الملوث ولم تلقح وقد تركت المجموعة الخامسة كمجموعة سيطرة. تم تحليل العلف الملوث طبيعيا بواسطة الاليزا وكانت نسب السموم الفطرية كالاتي: الافلاتوكسين 0.001 ملغم/كغم ،الديزوكسيفالينول 1.24 ملغم/ كغم ،الزيرالينون0.068 ملغم/ كغم ، الاوكراتوكسين 0.005 ملغم/ كغم ، T2 0.09 ملغم/ كغم والفومينيسين B1 0.2 ملغم/ كغم. اظهرت النتائج ان البوليفام يقلل وبصورة معنوية فقدان وزن الجسم وشدة العلامات السريرية ونسبة الاصابة ونسبة الهلاكات. تم الاستنتاج بان مادة البوليفام كانت فعالة في حماية الدجاج من فقدان الوزن وبعض الصفات الحيوية اعلاه وتقليل تأثير السموم الفطرية مقارنة بباقي المجاميع وقد تمت التوصية باستخدامها كمادة مضادة للسموم.

الكلمات المفتاحية: دجاج اللحم ، السموم الفطرية ، الممتزات ، البوليفام ، الأداء ، وزن الجسم.

Introduction

Mycotoxins are often found as natural contaminants in grains (1).They are chemical substances produced by several fungi, particularly by many species of *Aspergillus, Fusarium, Penicillium* and *Alternaria*. They comprise a group of several hundreds of chemically different toxic compounds. The most common mycotoxins are Aflatoxins, Ochratoxin A, Trichothecenes, Zearalenone and Fumonisins. (2,3). The FAO and other researchers has estimated that worldwide about 25% of crops are affected annually with mycotoxins and since it was estimated that 25 % of the feed production per year has been contaminated with mycotoxins (4). Surveys reveal high occurrences and concentrations of mycotoxins to suggest that they are a constant concern (5). Mycotoxins are unavoidable because they are naturally occurring compounds. They contaminate crops before harvest or invade feedstuffs of poultry during processing, transport or storage (6) chronic and low level mycotoxin contamination through naturally contaminated grains often causes reduced production efficiency and increases susceptibility to many immune related infectious diseases (7). The data on combined toxic effects of mycotoxins are generally limited, particularly with respect to trichothecenes, and it is known that the issue of combined toxicity is very complicated (8). It has been reported that feeding mycotoxins in combinations could result in pronounced adverse effects in avian (9). Considering the increasing food price indices (10) the inactivation of mycotoxins from contaminated feed becomes an important economic aspect to back up the use of new strategies for improving growth performance (11). In order to avoid mycotoxicosis, several strategies have been investigated (12,13) which can be divided into pre- and post-harvest technologies and into biological, chemical, and physical methods. The best procedure to prevent the effect of mycotoxins is the minimizing of the mycotoxin production itself (14) e.g. by harvesting the grain at maturity and low moisture and storing it at cool and dry conditions which is difficult to perform in countries with a warm and humid climate. Feed additives like antioxidants, sulphur-containing amino acids, vitamins and trace elements can be useful as detoxicants (15). Biological methods are not yet used in practice though the number of corresponding patents increases continuously (16). These methods include fermentation procedures with microorganisms. One example is the conversion of aflatoxin B1 (particularly by *Flavobacterium aurantiacum*) to harmless degradation products. The conversions, however, are generally slow and incomplete (17). Chemically, some mycotoxins can be destroyed with calcium hydroxide monoethylamine (12). Particularly the ammoniation is an approved procedure for the detoxification of aflatoxin-contaminated feed in some U.S. states as well as in Senegal, France, UK and the average ammoniation costs vary between 5 and 20% of the value of the commodity (18). Main drawbacks of this kind of chemical detoxification are the ineffectiveness against other mycotoxins and the possible deterioration of the animals health by excessive residual ammonia in the feed. The physical methods are focused on the removal of mycotoxins by different adsorbents added to mycotoxin-contaminated diets (19) with the hope of being effective in the gastro-intestinal tract more in a prophylactic rather than in a therapeutic manner. Certain bacteria, particularly strains of lactic acid bacteria, propionibacteria and bifidobacteria, appear to have the capacity to bind mycotoxins, including aflatoxin and some Fusarium produced mycotoxins (20,21). Activated charcoal may be important in binding zearalenone and/or deoxynivalenol (22,23). In an in vitro gastrointestinal model, activated carbon reduced availability of deoxynivalenol and nivalenol (24).The addition of mycotoxin binders to contaminated diets has been considered the most promising dietary approach to reduce effects of mycotoxins. The theory is that the binder decontaminates mycotoxins in the feed by binding them strongly enough to prevent toxic interactions with the consuming animal and to prevent mycotoxin absorption

across the digestive tract. Therefore, this approach is seen as prevention rather than therapy (25). Even though food is often contaminated with more than one mycotoxin, most studies are limited to the toxicology of a single mycotoxin. The aim of this search was studying the effect of mixed mycotoxin in chicken body weight and some bioavailability parameters and searching the effect of using polyfam in keeping chicken performance.

Materials and methods

This experiment was conducted to determine the effect of dietary supplementation of Polyfam (lignin derivative, synthesized in Republic of Belarus) on detoxification of mycotoxin in broilers ration. The chicks were reared from 7 to 42 days in the condition of epizootology department and pathanatomy and histology department, Vitebsk state Academy of Veterinary Medicine, Republic of Belarus. A total of (100) chicks, one week age were used. Birds were fed starter diet during the third week of age (beginning date of experiment; 22.6% crude protein and 2870.4 kcal/kg of diet) and finisher diet (20.5% crude protein and 2920 kcal/kg of diet) until the marketing age (42 days of age). Chicks were randomly divided into 5 treated groups, 20 birds for each. First group G1fed a contaminated ration with mycotoxin and supplemented with polyfam 5g/kg of diet and vaccinated with Gumboro vaccine at 15 and 22 days of age . Second group G2 was fed a ration contaminated with mycotoxin and vaccinated with Gumboro vaccine at 15 and 22 days of age without polyfam. Third group G3 was fed a commercial broiler ration and vaccinated with Gumboro vaccine at 15 and 22 days of age. Fourth group G4 was only fed a contaminated ration with mycotoxins. Fifth group G5 was fed intact clean ration as a control group. The strain of vaccine was interfield 2512 that produced in Russian Federation, the vaccine was supplemented manually intra crop for every chick with one dose. The mycotoxins analyzed in Central Research Laboratory of grain products by ELISA (ridaskrin fast) and the final level of mycotoxins were as follows: Aflatoxin B1 0.001 mg/kg, Dezoxivalenol 1.24 mg/kg, Zearalenon 0.068 mg/kg, Ochratoxin 0.005 mg/kg, T2 toxin 0.09 mg/kg, Fuminisen B10.2 mg/kg. Body weights, clinical signs, morbidity rate and mortality rate per group was recorded weekly. At the end of experiment, five birds per group were randomly selected for determination the changes in liver and kidney in all groups. All data are analyzed by statistical program for study variation statistics, based on the significance ($P<0.05$).(Microsoft Excel 2003)

Results

After seven days of the first IBD vaccine, dietary mycotoxins and Gumboro vaccine group G2 and G4 significantly ($P<0.01$) depressed body weight in comparison with control group, but the body weight of Polyfam group G1 is not affected in comparison with the control. The effect of mycotoxins with or without vaccine was very clear after 7 days of second IBD vaccine in G2 and G4 which recorded decrease in bodyweight ($P<0.05$) in comparison with control group. The weight of Polyfam group G1 is not affected in comparison with the control. After 14 days of the second IBD vaccine the weight of all groups were less than control group, but addition of Polyfam in G1, was very effective in protecting chicken from loss of body weight to that of control one (Table 1).

Chicken bioavailability

The effect of mycotoxins and Polyfam on liver and kidney lesion in broilers at 42 days of age are presented in table (2). It is evident that mycotoxicosis had a severe negative effect on the liver parenchyma of broiler chicks in G2, when compared with that of control group, by changing liver color from mahogany (Fig. 1), to that which character-ized by enlarged muddy or even to yellowish discoloration, with friable consistency and sub capsular hemorrhages (Fig. 2). The addition of Polyfam to the diet of broilers in G1 was effective to return the normal red brown liver color of chicks in control (Fig. 3). Kidneys were also affected severely by

feeding mycotoxins G2 and G4 when compared with all other groups (Fig. 4). They were enlarged, swollen and pale in color. The morbidity rate was very high in G2 and G4 with a 100% and less in G 1. On the other hand the mortality rate was very high in G2 with 25% and G4 20% , while G 1 not recorded any mortality (0%).

Table (1): The effect of Polyfam in protecting chickens body weight in comparison with the other groups that fed mycotoxins contaminated ration.

Age Groups	7 days after first IBD vaccine	7 days after second IBD vaccine	14 days after second IBD vaccine
Group 1	510,00 ± 53,37 P_{1-2}>0,05 P_{1-3}>0,05 P_{1-4}>0,05 P_{1-5}>0,05	750,00 ± 70,23 P_{1-2}>0,05 P_{1-3}>0,05 P_{1-4}>0,05 P_{1-5}>0,05	1145,00 ± 70.23 P_{1-2}<0,05 P_{1-3}>0,05 P_{1-4}>0,05 P_{1-5}>0,05
Group 2	480,00 ± 44,94 P_{2-3}>0,05 P_{2-4}>0,05 P_{2-5}<0,01	720,00 ± 19,66 P_{2-3}>0,05 P_{2-4}<0,05 P_{2-5}<0,05	947,05 ± 53,37 P_{2-3}<0,01 P_{2-4}>0,05 P_{2-5}<0,001
Group 3	527,50 ± 53,37 P_{3-4}>0,05 P_{3-5}>0,05	795,00 ± 70,23 P_{3-4}>0,05 P_{3-5}<0,05	1197,50 ± 50,56 P_{3-4}>0,05 P_{3-5}>0,05
Group 4	515,00 ± 42,14 P_{4-5}<0,05	775,00 ± 14,05 P_{4-5}<0,05	1007,50 ± 106,74 P_{4-5}<0,05
Group 5	635,00 ± 22,47	1000,00 ± 84,27	1295,00 ± 22,47

The values represent mean of body weight (grams) ± SE

Table (2): The effect of Polyfam in clinical signs, morbidity rate, mortality rate and post mortem findings of liver and kidney.

Groups	Birds number	Clinical signs	Morbidity Rate	Mortality Rate	Changes in liver and kidneys
G1	20	Reduction in appetite and growth	50 %	0%	Normal red brown liver and normal kidney
G2	20	Reductions in appetite and growth, poor feathering, ervousness, loss of oordination, inability to stand, and mortality	100%	25%	Changing liver color from mahogany to that which characterized by enlarged muddy or even to yellowish discoloration, with friable consistency and sub capsular hemorrhages, Kidney enlarged, swollen and pale in color.
G3	20	Reduction in appetite for some days	0 %	0 %	normal red brown liver and normal kidney
G4	20	Reductions in appetite and, reduction of growth, poor feathering, nervousness, loss of coordination, inability to stand, and mortality	100%	20 %	Changing liver color from mahogany to that which characterized by enlarged muddy or even to yellowish discoloration, with friable consistency and sub capsular hemorrhages, Kidney enlarged, swollen and pale in color.
G5	20	No clinical signs	0%	0%	Normal red brown liver and normal kidney

Discussion

Many researchers have demonstrated that the detoxifying agents and adsorbents reduce the impact of mycotoxins in poultry feed (26,27). Our study revealed that the influence of mycotoxins on body weight is very clear in G4 compared to the control. These results agreed with (28) who indicated that the mycotoxin cause reduction in body weight, malformed feathers and impaired performance of broilers. This could be attributed to reduced protein and energy utilization (29) which impaired nutrient

Fig. (1): Mahogany normal liver at 42 days of control group (G5).

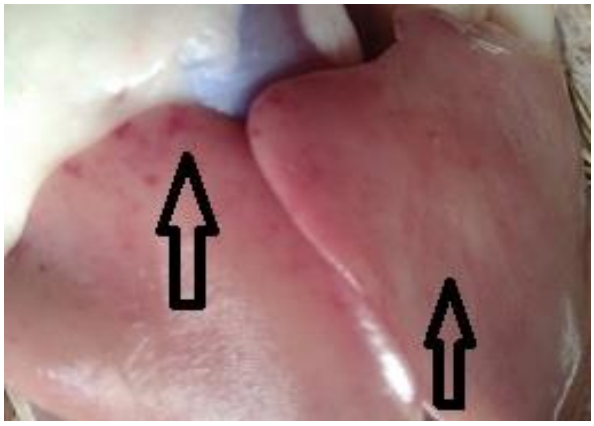

Fig. (2): Enlarged muddy yellowish discolorration with friable consistency and sub capsular hemorrhages at 42 days of age in G2.

Fig. (3): G1 Slight changes in liver at 42 days of age.

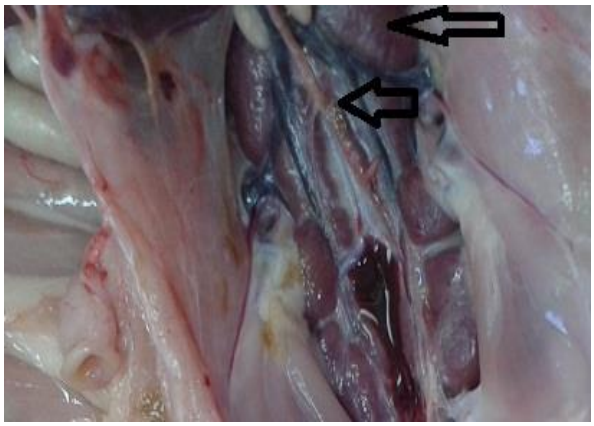

Fig. (4): G4 Swollen pale and enlarged kidneys filled with urate at 42 days of age.

absorption and reduced pancreatic digestive enzyme production (30) and consequently reduced appetite (31).The body weight of chickens did not differ significantly ($P<0.05$) between vaccinated group G3 and the control throughout the period of the experiment. The differences in body weight between the groups narrowed down and towards the end of the experiment, were not statistically significant ($P< 0.05$). These results agreed with (32) who refer that the body weight of vaccinated group with IBD vaccine was less than the control. On the other hand, the most decrease in body weight was in vaccinated group that fed a ration with mycotoxins G2 along the period of experiment in comparison with control group which recorded ($P<0.05$) in first week after first vaccination and ($p<0.05$) after second vaccination, that may be reveal the synergistic effect of both (vaccine and mycotoxin) which causes very clear effect in performance and weight gain, these results agreed with (33) who refers that the use of live vaccines can result in vaccination reactions and decrease body weight especially if the birds are stressed, furthermore, many researchers cleared that mycotoxins and stress factors result in decrease body weight (34).The effect of mycotoxins was very clear in G4 which revealed reductions in appetite and, reduction of growth, poor feathering, loss of coordination and inability to stand, these clinical signs agreed with(35). On the other hand, the high mortality rate was recorded in G2 and G4 because of the influence of mycotoxins , but G1 not recorded any mortality rate and that may be due to the supplementing of antitoxicant Polyfam in ration of this group which negated the effects of mycotoxins, these results agreed with (36,37). The post mortem finding referred

that the kidneys were enlarged, swollen and pale in color and the liver color changed from mahogany normal size to that which characterized by enlarged muddy or even to yellowish discoloration, with friable consistency and sub capsular hemorrhages in G4, that is may be due to that liver and kidney function is detoxification of mycotoxins, therefore it is may indicate less detoxifying capacity or damage of functions to some extent, these results agreed with (38). The results of this experiment clearly indicated that mycotoxicosis in broiler chickens can be influenced by supplementation the Polyfam to the contaminated diet. Supplementing of Polyfam with a dose 5g/kg ration essentially negated the effects of mycotoxins. In conclusion; The results of this experiment clearly demonstrated that mycotoxicosis cause loss of body weight in broiler chickens and decreasing the chicken performance. Furthermore, mycotoxicosis can be influenced by supplementation the Polyfam to the contaminated diet. Supplementing of Polyfam with a dose 5g/kg ration essentially negated the effects of mycotoxins.

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