DIETARY EFFECT OF VITAMIN A SUPPLEMENTATION ON GROWTH PERFORMANCE IN BROILER CHICKENS EXPOSED TO AFLATOXIN B1

Ojo, R.O.[2] & Alausa, O. J.[1],

Department of Animal Health and Production, Federal Polytechnic, Ilaro

Corresponding author: rosemary.ojo@federalpolyilaro.edu.ng 09077338645,
oluwadamilare.alausa@federalpolyilaro.edu.ng 08145920393

ABSTRACT

One hundred and ninety-two chicks were acclimatized for two weeks, after which the birds were randomly assigned to four treatments: T1 (basal diet + 35 µg aflatoxins + 10 g vitamin A/kg feed), T2 (basal diet + 35 µg aflatoxins + 15 g vitamin A/kg feed), T3 (basal diet + 35 µg aflatoxins without vitamin A), and T4 (basal diet without aflatoxins and vitamin A) the feeding trial lasted for three weeks. Each treatment consisted of three replicates with sixteen birds each. Growth performance parameters including initial weight, final weight, body weight gain (BWG), average daily gain (ADG), feed intake (FI), average daily feed intake (ADFI), and feed conversion ratio (FCR) were recorded. The results revealed significant differences ($p < 0.05$) in FI and ADFI, while other parameters showed no significant differences ($p > 0.05$) among treatments. T4 (positive control) and T1 (aflatoxin + 10 g vitamin A) recorded higher BWG (946.3 g and 918.9 g, respectively) compared to T2 and T3. Feed intake was higher ($p < 0.05$) in T1 and T2 compared to T3 and T4, whereas feed conversion ratio was more efficient in the positive control (T4; 2.03) and the vitamin A-supplemented aflatoxin diet (T1; 2.13). This finding suggests dietary vitamin A at 10 g/kg feed may have a potential mitigating effect against aflatoxin B1, although not statistically significant for growth parameters. Further studies with larger sample sizes, additional physiological parameters and longer feeding periods are recommended for a definitive conclusion.

Keywords: aflatoxin, vitamin A, broiler, growth performance

DESCRIPTION OF PROBLEM

Mycotoxins are toxic metabolites that threaten food and feed safety worldwide. Aflatoxins, in particular, have been identified as potent liver carcinogens (1, 2), and their presence in cereals is well documented (3, 4). Studies have shown that feed contaminated with aflatoxin can negatively affect poultry growth performance, with one study reporting a 23% reduction in broiler body weight when chicks were fed approximately 0.56 mg AFB1/kg diet (5). Vitamin A has been reported to enhance nutrient digestibility and crucial for supporting intestinal health (6). (7) also reported that Vitamin A had positive effects on the performance of Japanese quails. These findings suggest that Vitamin A supplementation may help mitigate the adverse effects of aflatoxin on poultry performance. However, the potential role of Vitamin A in alleviating the negative impact of aflatoxins on poultry growth and health remains underexplored, warranting further investigation.

MATERIALS AND METHOD

Experimental area

The experiment was conducted at the Poultry Unit, Department of Agricultural Technology Department, The Federal Polytechnic, Ilaro. It is located in Yewa South Local Government area of Ogun State, Nigeria. It has coordinates of Latitudes 6°37′46″N and 6°55′42″N and Longitudes 2°47′24″E and 3°6′48″E (Weather Spark, 2017).

Source of Vitamin A and Aflatoxin B1: Aflatoxin B1 was gotten from a reputable laboratory and Vitamin A was sourced from a reputable veterinary pharmacy in Ilaro metropolis.

Preparation of Experimental Diets

The basal diet was mixed with Aflatoxin B1. The appropriate quantity of Vitamin A designated for each treatment was thoroughly mixed with the aflatoxin-contaminated basal diet immediately before feeding.

Experimental animal and management

A trustworthy commercial hatchery supplied two hundred (200) day-old chicks of Arbor Acres strain, which were acclimated for fourteen (14) days in the brooding enclosure, after which the chicks were allotted to four (4) treatments. The treatments were replicated thrice with sixteen (16) birds per replicate. Standard routine and occasional (vaccinations and medication schedules) management practices for chickens was strictly followed. Throughout the five-week experiment, commercial feed and water were provided *ad libitum.*

Experimental design

The experiment was structured based on a completely randomized design (CRD). The test ingredient was administered as follows to each treatment:

Treatment 1: Basal diet + 35µi of Aflatoxins + 10g of Vitamin A per 1kg feed

Treatment 2: Basal diet + 35µi of Aflatoxins + 15g of Vitamin A per 1kg feed

Treatment 3: Basal diet + 35µi of Aflatoxins + 0g of Vitamin A per 1kg feed

Treatment 4: Basal diet + 0µi of Aflatoxins + 0g of Vitamin A per 1kg feed

Data collection

Daily feed intake (DFI)

This was calculated by deducting feed leftover from total feed supplied.

$$\text{DFI} = \frac{\text{Total feed supplied (g)} - \text{Total feed left over (g)}}{\text{Total number of days}}$$

Daily weight gain

Daily weight growth was calculated by dividing its weight gain by the number of days.

$$\text{DWG} = \frac{\text{Final weight (kg)} - \text{initial weight (kg)}}{\text{Total number of days}}$$

Feed conversion ratio

This was determined by calculating birds feed intake and divide it by weight gain of the birds.

$$\text{FCR} = \frac{\text{Total Feed Intake(g)}}{\text{Total weight gain (g)}}$$

Statistical Analysis

The Turkey test, a function of IBM SPSS 26, was utilized to distinguish the treatment means after the gathered data was subjected to an ANOVA analysis. According to (SPSS 2022), statistical significance was considered when $P < 0.05$.

RESULT AND DISCUSSION

Effect of Vitamin A Dietary Supplementation on Growth Performance of Broiler Chickens Fed Aflatoxin B1 Contaminated Feed

Feed intake (FI) and average daily feed intake (ADFI) differed significantly ($p < 0.05$) among treatments, while other parameters such as body weight gain (BWG), average daily gain (ADG), and feed conversion ratio (FCR) showed no significant differences ($p > 0.05$).

This study evaluated the effect of dietary vitamin A supplementation on the growth performance of broiler chickens exposed to aflatoxin B1-contaminated diets. Birds in T2 (aflatoxin + 15 g vitamin A) recorded the lowest BWG (798.0g), while T1 (aflatoxin + 10 g vitamin A) showed a higher BWG (946.3g) compared to compared to T2 (798.0 g) and T3 (862.2 g). Feed intake was significantly higher ($p < 0.05$) in T1 and T2 compared to T3 and T4, whereas feed conversion ratio appeared more favourable in the positive control (T4; 2.03) and the vitamin A-supplemented aflatoxin diet (T1; 2.13). This suggests that moderate Vitamin A

Parameters	T1	T2	T3	T4	SEM	P-Value
Initial Weight	399.9	408.3	385.1	385.0	5.99	0.403
Final Weight	1318.8	1206.3	1247.3	1331.3	22.9	0.159
BWG (g)	918.9	798.0	862.2	946.3	22.71	0.068
ADG (g/day)	43.8	38.0	41.1	45.1	1.08	0.068
FI (g)	1954.9[a]	1950.4[a]	1929.2[b]	1923.3[b]	4.52	0.003
ADFI (g)	93.09 [a]	92.88 [a]	91.87 [b]	91.58 [b]	0.22	0.003
FCR	2.13	2.45	2.26	2.03	0.06	0.059

Table 1. Effect of vitamin A dietary supplementation on growth performance of broilers fed aflatoxin b1 contaminated feed.

Standard mean of error, BWG = Body weight gain, ADG= Average daily gain, ADFI = Average daily feed intake, FI = Feed intake, FCR = Feed conversion ratio. [a,b] Means sharing different superscripts differ significantly ($p < 0.05$)

supplementation (10g/kg of feed) and the absence of aflatoxin contamination (basal diet) supported better growth performance compared to higher supplementation levels.

This agrees with the findings of (8, 9) who reported that supplementation of Vitamin A improved the productive performance of broilers. It underscores the role of vitamin A in improving nutrient digestibility and supporting gut health. However, excessive supplementation can impair Vitamin D3 and negatively affect bone formation, ultimately leading to reduced growth and performance (10), which could explain the lower weight gain observed in birds in T2 with the highest level of Vitamin A supplementation. The findings of this study align with several studies which showed that aflatoxin B1 reduces growth performance, while vitamin supplementation can mitigate its negative effects. (11) reported that aflatoxins, even at concentrations less than 1 ppm, can damage cells and depress growth rate, feed intake, and feed efficiency in poultry. Although, the observed differences in BWG and FCR were not statistically significant which may be due to the duration of the study, and the severity of aflatoxin contamination.

Conclusion and Application

Vitamin A supplementation influenced feed intake significantly, while other growth performance parameters showed only numerical improvements in broiler chickens fed Aflatoxin B1 contaminated diet. Further research with extended feeding durations with varying aflatoxin concentrations and additional physiological parameters should be carried out to establish definitive conclusions.

REFERENCES

1. IARC. (1987). Overall Evaluations of Carcinogenicity. IARC Monographs on the evaluation of carcinogenic risk of chemicals to humans, Supplement 7.
2. World Health Organization. (2011). *FAO/WHO guide for application of risk analysis principles and procedures during food safety emergencies* (pp. 53). World Health Organization.
3. Bryden, W. L. (2007). Mycotoxins in the food chain: Human health implications. *Asia Pacific Journal of Clinical Nutrition, 16*(Suppl 1), 95–101.
4. Ghaemmaghami, S. S., Rouhanipour, H., & Sharifi, S. D. (2024). Aflatoxin levels in poultry feed: A comparison of mash and pellet forms. *Poultry Science, 103*(1), 103254. https://doi.org/10.1016/j.psj.2023.103254
5. Al-Shawabkeh, K., Herzallah, S., Al Fataftah, A.-R., & Zakaria, H. (2009). Effect of aflatoxin B1 contaminated feed on broiler chickens' performance and meat content of

conjugated linoleic acid. *Jordan Journal of Agricultural Sciences*.

6. Khoramabadi, V., Akbari, M. R., Khajali, F., Noorani, H., & Rahmatnejad, E. (2014). Influence of xylanase and vitamin A in wheat-based diet on performance, nutrients digestibility, small intestinal morphology and digesta viscosity in broiler chickens. *Acta Scientiarum. Animal Sciences, 36*(4), 379–384. https://doi.org/10.4025/actascianimsci.v36i4.23910
7. Stanquevis, C. E., de Paula, V. R. C., Zancanela, V. T., Benites, M. I., Finco, E. M., de Aquino, D. R., Rodrigues, T. P. P. M., & Marcato, S. M. (2022). Levels of vitamin A supplementation for growing meat-type quails. *Emerging Animal Species, 4,* 100008. https://doi.org/10.1016/j.eas.2022.100008
8. Chibanga, J. F. (2014). *Effect of supplemental dietary vitamin A on aflatoxin B1 toxicosis in growing broilers* [Master's thesis, University of Zambia]. University of Zambia Institutional Repository. https://dspace.unza.zm/server/api/core/bitstreams/11ce6ecb-c4ac-45da-809c-3c1599b6cb0e/content
9. Irivboje, O. A., Okusanya, P. O., & Olufayo, O. O. (2025). Ameliorative effect of hog plum and vitamin A on growth performance of broiler chicken inoculated with aflatoxin B1. *Journal of Animal Science and Veterinary Medicine, 10*(2), 135–141. https://doi.org/10.31248/JASVM2025.545
10. Aburto, A., & Britton, W. M. (1998). Effects of different levels of vitamins A and E on the utilization of cholecalciferol by broiler chickens. *Poultry Science, 77*(4), 570–577. https://doi.org/10.1093/ps/77.4.570
11. Kana, J. R., Gnonlonfin, B., Harvey, J., Wainaina, J., Wanjuki, I., Skilton, R., & Teguia, A. (2013). Assessment of aflatoxin contamination of maize, peanut meal and poultry feed mixtures from different agroecological zones in Cameroon. *Toxins, 5*(5), 884–894. https://doi.org/10.3390/toxins5050884