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Performance of Cockerel Fed Hog Plum and Aflatoxin Contaminated Feed

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Abstract

A feeding trial of 42 days was carried out on cockerels to evaluate the curative and ameliorative effect of hog plum when they are fed aflatoxin B1 contaminated feed. One hundred and twenty day old chicks were purchased and randomly allotted into four treatments. At the first three weeks, each treatment received the extract of hog plum (EHP) and Aflatoxin (AF) as follows: Treatment (T) 1: 0 ml of EHP + 0 µi of AF, T2: 1ml EHP, T3: 35 µi of AF + 1ml of EHP, T4: 35 µi AF. At the last three weeks of chick phase, each treatment received: T1: 0 ml of EHP + 0 µi of AF, T2: 35 µi AF+: 0 ml of EHP, T3: 0 ml of EHP + 0 µi of AF, T4: 1ml EHP+ 0 µi of AF. EHP and AF were added per liter of water and kilogram of feed respectively. Data on feed intake, water intake, weight gained, feed conversion ratio and carcass yield were collected and analyzed using One Way Analysis of Variance (ANOVA). There was a significant difference (P<0.05) in parameters measured. T3 had the highest final weight values of 504.50g and the best FCR value of 2.87 at the first three weeks while T4 had the highest final weight during the last three weeks. It was concluded that extract of hog plum enhances growth of cockerel fed aflatoxin contaminated feed and it was recommended to be used a preventive and curative agent of aflatoxicosis in poultry.

Keywords: Aflatoxin; Cockerel; Feed; Hog plum

Description of problem

Cereal grains and their by-products are important ingredients in poultry diet. Global supplies of cereal grains intended for animal feed are frequently contaminated with mycotoxins (1). Among others mycotoxin, aflatoxins contamination of animal feeds is more common especially in countries with hot and humid environment (2). Aflatoxins are synthesized by *Aspergillus flavus*, *Aspergillus parasiticus*, and *Aspergillus nomiusin* (5) and causes aflatoxicosis (3) resulting in listlessness, anorexia, reduced growth rate, poor food utilization, decreased egg production and increased susceptibility to environmental and microbial stresses and increased mortality, severe cellular defects and carcinogenesis (4).

Pre and post-harvest contamination can be reduced by using appropriate agricultural

practices. However, the contamination is often unavoidable and still remains a serious problem which requires a suitable ameliorative or curative process in poultry birds to inactivate the toxin. Contemporary practices require the utilization of probiotics, antibiotics, phytobiotics, growth promoter, balanced diet and vitamins (6).

Phytobiotics, which are natural substances derived from plants and known for their positive effects on animal health and growth, are being explored as a natural approach to counteract the harmful effects of aflatoxins in animal feed. *Spondias mombin*, (Iyeye in Yoruba) is a plant species native to the tropical Americas, widespread throughout Africa and tropical Asia and found in all regions of Benin (7). Extracts of *Spondias mombin* acts as broad spectrum of beta-lactamase-producing enterobacteria (8), this research evaluated the ameliorative and curative effects of *Spondias mombin* on cockerel fed aflatoxin contaminated fed at chick phase.

Materials and method

Experimental Site

The experiment was conducted at the Training and Research Unit of the 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 (9).

Preparation of Experimental Extract

Fresh hog plum leaves (*Spondias mombin*) was harvested from the Polytechnic community, dried under room temperature, and then ground into powder using a blender (Pyramid® PM-B999) (10). Ten gramme of the hog plum blend was added to 100ml of ethanol in an air tight container and allowed to stay for 24 hours. The solution was filtered using muslin filter and extract of hog plum (EHP) was stored in a container and used for the experiment.

Experimental Animal and Management.

One hundred and twenty (120) day-old cockerel chicks were purchased from a reputable commercial hatchery, and kept in the brooding pen for two weeks acclimatization. After which the chicks were allotted to four (4) treatments. The treatments were replicated three times with ten (10) birds per replicate.

Standard routine and occasional (vaccinations and medication schedules) management practices for chickens was strictly adhered to. Commercial feed and water was given *ad libitum* throughout the experimental period. The experiment was divided into two phases; first three weeks of chick phase and last three weeks of chick phase. The experiment lasted for 6weeks.

Experimental design

The design of the experiment was Completely Randomized Design (CRD). At the first three weeks of chick phase, each treatment received the test ingredient as

follows:
Treatment (T) 1: 0 ml of EHP + 0 µi of Aflatoxins (control)
Treatment 2: 1ml EHP per liter of water
Treatment 3: 35 µi of Aflatoxins per kg of feed + 1ml of EHP per liter of water
Treatment 4: 35 µi Aflatoxins per kg of feed
At the last three weeks of chick phase, each treatment received the test ingredient as follows:
Treatment 1: 0 ml of EHP + 0 µi of Aflatoxins
Treatment 2: 35 µi Aflatoxins per kg of feed
Treatment 3: 0 ml of EHP + 0 µi of Aflatoxins
Treatment 4: 1ml EHP per liter of water

Data Collection

Feed intake

The feed intake was measured daily for birds in each treatment and quantity consumed per day were obtained by subtracting the quantity left over from the quantity fed. The average weekly body weight gain was gotten by measuring the initial body weight of the birds using a weighing balance (Camry® - 20 kg), then, subtracting it form the average weekly body weight. The feed conversion ratio was calculated by dividing the total feed consumed by the total body weight gained by the birds in their different treatments.

Statistical Analysis.

Data collected were subjected to analysis of variance (ANOVA) and the treatment means separated using Duncan′s Multiple Range Test. Statistical significance was assumed at $P < 0.05$ (IBM SPSS 26, 2022)

Result and discussion

Result

Growth Performance of Cockerel Chicks Fed Aflatoxin B1 Contaminated Feed and Ethanol Extract of Hog Plum at The First Three Weeks of Chick Phase

The result of effect of hog plum on growth performance of cockerels fed aflatoxin B1 contaminated feed at the first three weeks of chick phase is presented on Table 1. There was significant difference ($P<0.05$) in final weight, weight gain, daily weight gain and feed conversion ratio. T3 had the highest final weight, weight gain and daily weight gain values of 504.50, 324.00 and 15.42 g respectively while T4 had the least values for the parameters mentioned above. T3 had the best FCR value (2.87g)

Carcass Yield of Cockerel Chicks Fed Aflatoxin B1 Contaminated Feed and Ethanol Extract of Hog Plum at The First Three Weeks of Chick Phase

The result of effect of hog plum on carcass trait of cockerels fed aflatoxin B1 contaminated feed at the first three weeks of chick phase is presented on Table 2. There was significant difference ($P<0.05$) in dressing percentage, wings, and gizzard weight. T1 had the highest value of dressing (60.86) percentage while T4 had the lowest (54.96). T2 had the highest value of wings weight (11.39) while T4 had the least (7.54). T3 had the highest value for gizzard weight (4.16) while T1 had the lowest value (3.04).

Table 1. Growth Performance of Cockerel Chicks Fed Aflatoxin B1 Contaminated Feed and Ethanol Extract of Hog Plum a t The First Three Weeks of Chick Phase

Parameters	T1	T2	T3	T4	±SEM	P-values
Initial weight (g)	193.40	184.5	180.5	188.5	5.79	0.19
Final weight (g)	500.00^{b}	500.50^{b}	504.50^{a}	480.50^{c}	4.19	0.05
Weight gain (g)	306.60^{b}	316.00^{ab}	324.00^{a}	292.00^{c}	7.27	0.01
Daily weight gain (g/b/d)	14.60^{b}	15.04^{a}	15.42^{a}	13.90^{c}	0.26	0.05
Feed intake (g)	980.60	929.25	931.25	970.5	10.81	0.10
Daily feed intake (g/b/d)	46.69	44.25	44.34	46.21	3.32	0.10
FCR	3.19^{a}	2.94^{b}	2.87^{b}	3.32^{a}	0.70	0.01

T1: 0 ml of EHP + 0 µi of Aflatoxins (control), T2: 1ml EHP per liter of water
T3: 35 µi of Aflatoxins per kg of feed + 1ml of EHP per liter of water, T4: 35 µi Aflatoxins per kg of feed

Table 2. Carcass Trait of Cockerel Chicks Fed Aflatoxin B1 Contaminated Feed and Ethanol Extract of Hog Plum at The First Three Weeks o f Chick Phase

Parameters	1	2	3	4	±SEM	P-value
Final Weight	517.75^{a}	484^{b}	481.5^{b}	396^{c}	13.49	0.03
Dressing %	60.86^{a}	60.75^{a}	57.42^{a}	54.96^{b}	2.05	0.05
Head	6.33	6.61	6.22	6.06	0.17	0.58
Neck	2.96	3.12	4.35	3.28	0.18	0.24
Breast	12.04	11.93	13.51	13.19	0.42	0.83
Thighs	8.96	9.54	10.61	7.73	0.40	0.20
Back	11.93	13.25	9.23	11.20	0.94	0.89
Wings	8.68^{b}	11.39^{a}	9.33^{ab}	7.54^{c}	0.44	0.04
Drum Sticks	8.70	7.65	8.72	8.83	0.32	0.81
Proventriculus	0.53	0.51	0.52	0.64	0.03	0.84
Gizzard	3.04^{c}	3.24^{bc}	4.16^{a}	3.77^{b}	0.13	0.03
Lungs	0.52	0.71	0.41	0.76	0.04	0.17
Liver	2.56	2.68	2.49	2.82	0.09	0.93

T1: 0 ml of EHP + 0 µi of Aflatoxins (control), T2: 1ml EHP per liter of water
T3: 35 µi of Aflatoxins per kg of feed + 1ml of EHP per liter ofwater, T4: 35 µi Aflatoxins per kg of feed

Growth Performance of Cockerel Chicks Fed Aflatoxin B1 Contaminated Feed and Ethanol Extract of Hog Plum at The Last Three Weeks of Chick Phase

The result of effect of hog plum on growth performance of cockerels fed aflatoxin B1 contaminated feed at the last three weeks of chick phase is presented on Table 3. There was significant difference (P<0.05) in feed intake, daily feed intake, final weight, weight gain, and daily weight gain. T4 had the highest feed intake, daily feed intake, final weight, weight gain and daily weight gain values of 554.54, 26.40, 736.36, 190.90, 9.09g respectively. T1 had the least values for weight gained and daily weight gained while T2 had the least final weight.

Table 3. Growth Performance of Cockerel Chicks Fed Aflatoxin B1 Contaminated Feed and Ethanol Extract of Hog Plum at The Last Three Weeks of Chick Phase

Parameters	1	2	3	4	±SEM	P-value
Initial weight (g)	543.47	521.73	547.82	545.45	4.93	0.12
Final weight (g)	702.17^{b}	700.00^{b}	730.43^{a}	736.36^{a}	6.23	0.02
Weight gained (g)	158.69^{b}	178.26^{ab}	182.60^{ab}	190.90^{a}	3.62	0.01
Daily weight gain (g/b/d)	7.55^{bc}	8.48^{b}	8.69^{b}	9.09^{a}	0.22	0.01
Feed intake (g)	530.43^{b}	530.43^{b}	530.43^{b}	554.54^{a}	15.67	0.00
Daily Feed Intake (g/b/d)	25.25^{b}	25.25^{b}	25.25^{b}	26.40^{a}	2.12	0.00
FCR	3.34^{a}	2.97^{b}	2.90^{b}	2.90^{b}	0.12	0.00

Treatment 1: 0 ml of EHP + 0 µi of Aflatoxins , Treatment 2: 35 µi Aflatoxins per kg of feed, Treatment 3: 0 ml of EHP + 0 µi of Aflatoxins, Treatment 4: 1ml EHP per liter of water

Carcass Yield of Cockerel Chicks Fed Aflatoxin B1 Contaminated Feed and Ethanol Extract of Hog Plum at The Last Three Weeks of Chick Phase

The result of effect of hog plum on carcass trait of cockerels fed aflatoxin B1 contaminated feed at the last weeks of chick phase is presented on Table 4. There was significant difference (P<0.05) in dressed weight and dressing percentage only. T3 had the highest value for dressed weight (513.50) weight while T1 had the least value (386.75). T2 had the highest dressing percentage (64.83 %) while T1 had the least (49.90 %).

Discussion

The birds given ethanol extract of hog plum and aflatoxin contaminated fed concurrently had best final weight, weight gain, daily weight gain and feed conversion ratio followed by the birds fed EHP alone while the birds fed aflatoxin B1 (T4) contaminated feed without EHP had the lowest values for these parameters. This report shows that EHP has a positive effect on growth performance of cockerels as the group that received the extract had better performance when compared with other groups. This is in support with various findings by researchers

Table 4. Carcass Yield of Cockerel Chicks Fed Aflatoxin B1 Contaminated Feed and Ethanol Extract Hog Plum at The Last Three Weeks of Chick Phase

Parameters	1	2	3	4	SEM	P-value
Final Weight (g)	775.75^{b}	763.00^{b}	837.00^{a}	803.50^{ab}	28.28	0.04
Dressing (%)	49.90^{c}	64.83^{a}	61.35^{ab}	58.89^{b}	2.09	0.03
Head (%)	4.58	4.00	4.24	4.37	0.15	0.10
Neck (%)	4.30	4.26	4.18	3.63	0.17	0.86
Breast (%)	12.10	12.39	12.72	12.59	0.21	0.91
Thighs (%)	4.57	3.87	4.96	4.74	0.13	0.16
Back (%)	11.14	11.26	10.58	10.74	0.34	0.86
Wings (%)	4.20	4.33	4.36	4.39	0.09	0.09
Drum Sticks (%)	4.77	4.72	4.25	4.84	0.12	0.70
Proventriculus (%)	0.57	0.66	0.48	0.50	0.04	0.73
Gizzard (%)	2.99	3.41	3.52	3.82	0.12	0.20
Lungs (%)	0.52	0.40	0.48	0.50	0.03	0.81
Liver (%)	2.20	2.10	2.69	2.71	0.10	0.27

Treatment 1: 0 ml of EHP + 0 µi of Aflatoxins , Treatment 2: 35 µi Aflatoxins per kg of feed, Treatment 3: 0 ml of EHP + 0 µi of Aflatoxins, Treatment 4: 1ml EHP per liter of water

where herbal plants have been shown to act as growth enhancers or promoters. (11, 12). The performance of birds fed aflatoxin B1 and ethanol extract of hog plum concurrently implies that EHP has the ability to inactivate the aflatoxin and therefore counter the effects in the birds. Extract of Hog plum has been reported to be rich in different antioxidant vitamins and phytochemical compounds such as flavonoid, tannins, alkanoid and saponnins. (13). These constituents have been reported to have anti-inflammatory, free radicals scavenger and super antioxidant properties (14) which could be responsible for this result. These positive outcomes are likely attributed to the birds′ overall good health, possibly influenced by the addition and chemical composition of hog plum. The group fed aflatoxin alone had the lowest values in final weight, weight gain, daily weight gain and feed conversion ratio. This is in agreement with various studies which reported reduced weight and feed intake and low feed efficiency (14) in birds fed aflatoxin contaminated feed. Although, numerically, the group had higher feed intake than the birds given extract of hog plum but the feed efficiency was poor. This is in agreement with the work of (15) who reported high feed intake in birds on aflatoxin feed but with reduced weight gains. The reduced body weight could be due to poor feed conversion rate because of aflatoxin in the feed. Also, (16) stated in their report that aflatoxin reduces weight gain and feed intake.

The result at the last three weeks of the chick phase was significant different ($P<0.05$) in feed intake, daily feed intake, final weight, weight gain, and daily weight. T4 had the highest feed intake, daily feed intake, final

weight, weight gain and daily weight gain values while T1 had the least values for weight gained and daily weight gained. This results shows that the ethanol extract of hog plum has positive influence on growth of the birds. Flavonoid has been reported as flavouring ingredients of spices and vegetables which stimulate appetite in birds leading to increased feed intake, and weight. Also, they have been reported to have anti-inflammatory, antioxidant and super scavengers of free radicals. Alkaloids have been reported to have therapeutic significance due analgesic, antispasmodic and antibacterial potentials. Tannins are known to improve wound healing and inflamed mucus membrane (17, 18). These chemical constituents present in hog plum could be responsible for the reversal of the negative effects of aflatoxin B1 on this group of birds.

The carcass trait of the birds were significantly different ($P<0.05$) in dressing percentage, wings, and gizzard weight at the first three weeks of the chick phases while at the last three weeks of the chick phase only the dressed weight and dressing percentage were significantly different. The dressed weight, dressing percentage and wings is higher in the groups given EHP at different time than in the control corroborates the reports of (19, 20) who stated that supplementation of broiler chicken diets with phytochemicals improved carcass weight and dressing percentage. Gizzard weight is higher in the groups fed aflatoxin contaminated feed. This could be due to physiological activities caused by the aflatoxin in the feed. Report has it that decrease or increase in the relative weights of the internal organs could be a possible response of their internal organs to toxins in their diets (21*)*.

Conclusion and Applications

Conclusion

1. The results from this research work revealed that extract of hog plum enhances growth of cockerel fed aflatoxin contaminated feed.
2. Thus, it can be concluded that ethanol extract had both preventive and curative effects on aflatoxin B1 in cockerel at chick phase.

Recommendation

1. Hog plum is recommended to be used as a growth promoter, a preventive and curative agent in aflatoxicosis in poultry.

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