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Effect of Different Supplemental Vitamins on Growth Performance and Carcass Characteristics of Broiler Chickens

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Abstract

A total of 150 day-old broiler chicks was used to study the growth performance and carcass characteristics of broiler chickens. The chicks were divided into 5 treatment groups (control, vitamins A, C, E and A+C+E dietary supplementation) each of 3 replicates containing 10 birds per replicate. The dietary supplemental vitamins were administered from the brooding stage all through the period of the experiment which lasted for 8 weeks. At the end of the 8th week of the experiment, two birds of average weight were taken for carcass analysis. Data obtained on the growth performance and carcass analysis were subjected to Completely Randomised Design. The results showed no significant ($p>0.05$) differences in all the growth parameters considered. However, birds fed diet supplemented with vitamin A recorded a numerically higher feed intake of 196.94 g/bird/day than those of the control, vitamins C, E and A+C+E dietary supplemented groups. Significant ($p<0.05$) differences were obtained in the live weight, wings and heart of broiler chickens fed supplemental vitamins. The highest live weight (1950.00 g), wing (8.92%) and heart (0.43 %) were observed in birds fed diet supplemented with vitamin A. It was therefore recommended that for better carcass yield in terms of live weight, vitamin A supplementation at 0.45 mg/kg in the diets of broiler chickens will be appropriate and vitamin C should be supplemented at 50 mg/kg in broiler chicken's diets to reduce mortality.

Keywords: Supplemental vitamins, growth performance, broiler chickens, carcass yield

Introduction

The success of broiler chicken production depends on maximum weight gain within a minimum period which can be fulfilled by proper nutritional and management practices. In order to increase the growth performance of broiler chickens, various nutrients are incorporated in the diet. One of such nutritional manipulations is to fortify the broiler diets with micronutrients such as vitamins (Chew, 1996). Vitamins are organic compounds and are vital nutrients that an organism requires in limited amounts (Lieberman *et al.*, 1990). Thirteen vitamins are universally recognised at present: four fat soluble (A, D, E and K) and nine water soluble (eight "B" vitamins and vitamin C). Vitamin A is required for normal growth, reproduction and maintenance of the epithelial cells in good conditions (skin and the linings of the digestive, reproductive, and the respiratory tracts).

Vitamin C plays a major role in the reduction of corticosterone (Bain, 1996) which assist in reducing environmental stress. High ambient temperatures depressed feed intake, weight gain and increased mortality rates among broilers. A possible approach to counteracting the negative effects of heat stress and other stress in the environment among broiler chickens is the supplementation of birds' diets with Vitamin C. Vitamin E is a powerful antioxidant that is important for normal neurological function, growth and reproduction, maintenance of structural tissue integrity, development of the nervous system, contributes to diseases resistance and enhances the nutritional value of meat. Several studies have been conducted with various types of vitamins to examine the effect on the production performance of broiler chickens; there is however, inconsistency in reports on the effects of dietary vitamin supplementation on performance of broiler chickens.

This study therefore investigated the effect of vitamin A, C, E and combination of the three vitamins on growth performance and carcass yield of broiler chickens.

Materials and Methods

Site of experiment: The field experiment was carried out at the Poultry unit of Ogun-Osun River Basin Development Authority, while the laboratory work was carried out at the Animal Production and Processing laboratory of the Department of Animal Production and Health; Federal University of Agriculture, Abeokuta (FUNAAB), Ogun state, Nigeria. The Poultry unit of Ogun Osun River Basin Development Authority lies within latitude 7° 11' 59.66" and longitude 3° 26' 13.64" E (FUNAAB meteorological station)

Experimental birds and management: A total of one hundred and fifty, day-old broiler chickens were purchased from a reliable Hatchery in Abeokuta, Ogun state and used for the experiment which lasted for a period of 8 weeks. The chicks were managed intensively (deep litter system) all through the experiment. Before the arrival of chicks, the pens including feeders and drinkers were thoroughly washed and disinfected. Wood shaving was provided in the housing as litter material and charcoal pot was used as the source of heat during brooding which lasted for 2 weeks. Feed (finished feed) and water were provided *ad-libitum*.

Vitamins dietary supplemental level and treatment administration: The treatment levels considered are:

Control-No dietary supplementation of vitamins

Vitamin A- 0.45mg per kg of diet

Vitamin C -50mg per kg of diet

Vitamin E -9.1mg per kg of diet

Vitamins (A+ C+E) combination: one-third each of the above levels of inclusions.

Experimental procedure: From day-old, one hundred and fifty chicks were divided based on weight equalization into five treatment groups replicated three times with ten birds per replication. The birds were brooded separately in each experimental unit. All management practices necessary for broiler chickens were duly observed in the course of the experiment. Data were collected on growth performance indices on weekly basis and at 56th day, two birds of average weight were selected from each replicate and slaughtered for carcass yield evaluation.

Statistical analysis: The data obtained were subjected to Analysis of variance in a completely randomised design. Significantly ($p < 0.05$) different means among variables were separated using Duncan's Multiple Range Test as contained in Minitab® version 17.1.0 (Minitab, 2013).

Results and Discussion

Effect of dietary supplemental vitamins on growth performance of broiler: The effects of different supplemental vitamins on growth performance of broiler chickens were shown in Table 2. There were no significant ($p > 0.05$) differences in all the growth performance parameters considered. The observation in the growth performance parameters may be due to the quantity of vitamins used in this study. This observation is in agreement with the reports by Ogbamgba (2007) that vitamins A, C, E dietary supplementation did not significantly affect the growth performance of broiler chickens. On the contrary, Rajput *et al.* (2009) who fed broiler chickens diets supplemented with vitamin E at 300 mg/kg observed significantly higher body weight, lower average feed consumption, better feed efficiency than the control group. Also, Elagib *et al.* (2012) reported an increased body weight, improved feed intake and better feed conversion ratio of broiler chickens fed diets supplemented with 150 or 350 mg/kg vitamin C compared to those fed control diet. Mortality was numerically reduced (3.33%) in birds fed diet supplemented with vitamin C. This can be explained from the effect of vitamin C in reducing the level of environmentally imposed stress in animal.

Table 2: Effect of dietary supplemental vitamins on growth performance of broiler chickens

Parameter	Vitamins				
	Control	A	C	E	A+C+E
Initial weight (g)	57.41±2.41	66.44±4.29	57.78±2.84	62.25±5.82	62.25±2.77
Final weight (g)	1593.33±23.33	1830.82±106.12	1753.70±79.18	1688.20±99.66	1768.52±77.54
Weight gain (g/bird/day)	27.43±0.41	31.51±1.82	30.28±1.36	29.03±1.75	30.47±1.34
Feed intake (g/bird/day)	86.52±3.02	96.94±6.97	86.61±2.65	89.44±7.00	88.56±2.54
Feed conversion ratio	3.16±0.15	3.08±0.15	2.86±0.08	3.09±0.20	2.91±0.10
Mortality %	11.67±6.51	17.08±5.32	3.33±3.33	10.83±9.02	5.42±2.92

Effect of dietary supplemental vitamins on carcass characteristics of broiler: In Table 3, the effects of different dietary supplemental vitamins on carcass characteristics of broiler chickens are shown. Significant ($p < 0.05$) differences were observed in the live weight, wing and heart. The highest live weight (1950.00 g), wing (8.92%) and heart (0.43 %) were observed in birds fed diets supplemented with vitamin A. It implies that vitamin A supplementation promoted a better growth rate in the broiler chickens relative to the other treatment groups.

This is an indication that birds fed diet supplemented with vitamin A utilized the feed maximally to enhance the live weight thus confirming the reports of Joseph *et al.* (2014). A significant ($p<0.05$) lower live weight (1795.00 g) noted in birds fed diets containing the combined vitamins (A+C+E) is an indication that the combined effect of the three vitamins did not support a relatively better growth rate in broiler chicken production.

Table 3: Effect of dietary supplemental vitamin on carcass characteristics of broiler chickens

Parameter	Control	A	C	E	A+C+E
Live weight (g)	1765±35.00 ^b	1950±30.00 ^a	1900±10.00 ^{ab}	1840±50.00 ^{ab}	1795±45.00 ^b
Plucked weight(g)	1699±26.00	1820±49.00	1780±20.00	1775±175.00	1656±87.00
Dressing percentage	70.65±1.66	70.39±5.65	70.36±1.37	74.09±7.39	68.54±4.88
Cut-up parts ¹					
Head	2.61±0.05	2.59±0.29	2.66±0.01	2.72±0.07	2.89±0.32
Neck	6.3±0.57	6.45±0.95	6.05±0.28	5.07±0.52	6.17±0.57
Wings	9.19±0.47 ^a	8.92±0.17 ^a	8.58±0.05 ^{ab}	8.61±0.28 ^{ab}	7.91±0.14 ^b
Thigh	11.46±0.48	11.36±0.35	11.42±0.73	11.12±1.90	10.87±0.93
Drumstick	11.09±0.76	10.55±0.80	11.08±0.24	10.27±1.05	10.70±0.29
Back	14.45±1.33	14.09±1.11	14.05±0.08	16.56±2.59	12.89±0.32
Shank	4.58±0.25	4.53±0.31	4.95±0.08	4.12±0.38	4.58±0.47
Breast	20.39±2.50	18.55±2.18	18.55±0.88	19.31±1.49	17.84±0.53
Organs ²					
Heart	0.48±0.075 ^{ab}	0.43±0.07 ^{ab}	0.32±0.00 ^b	0.60±0.04 ^a	0.50±0.10 ^{ab}
Liver	2.37±0.29	2.66±0.52	2.63±0.33	2.70±0.32	2.48±0.15
Lungs	0.45±0.05	0.51±0.01	0.53±0.00	0.57±0.04	0.44±0.04
Spleen	0.09±0.03	0.08±0.03	0.11±0.00	0.11±0.00	0.07±0.04
Gizzard	2.21±0.01	2.51±0.17	2.11±0.04	2.73±0.45	2.36±0.25
Abdominal fat	1.28±0.17	2.04±0.58	1.47±0.30	2.62±1.67	2.04±0.58

^{a,b} Means within the same row with different superscripts differ significantly ($p<0.05$)

^{1,2}: percentages of the live weight

Conclusion

For better carcass characteristics in terms of live weight, vitamin A supplementation at 0.45mg/kg in the diets of broiler chickens is appropriate. Also, for reduced mortality rate, vitamin C should be supplemented at 50 mg/kg in broiler chicken's diets.

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