

EFFECTS OF ASCORBIC ACID ON WEIGHT GAIN AND HAEMATOLOGICAL PROFILE OF BROILER CHICKENS

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ABSTRACT

The experiment was conducted to determine the effects of feeding graded levels of ascorbic acid on growth performance and hematological parameters of broiler chickens. Five diets were formulated with ascorbic acid at 0.00, 0.07, 0.15, 0.22, and 0.30g/kg for diets 1, 2, 3, 4 and 5 respectively. Two hundred and twenty five (225) day old broiler chicks were randomly allocated to five dietary treatments with 45 birds per diet and 15 birds per replicate in a completely randomized design. The experiment lasted for a period of 8 weeks. (During the starterphase, result revealed that daily feed intake (47.74 to 55.22g), daily weight gain (11.23 to 14.30g), feed conversion ratio (3.54 to 4.42) and feed efficiency (0.23 to 0.28) were not affected by the dietary levels of ascorbic acid inclusion. The overall performance showed that daily feed intake (75.15 to 80.10g), daily weight gain (13.56 to 17.24g), feed conversion ratio (4.40 to 5.45) and feed efficiency (0.21 to 0.24) were not significantly affected by the inclusion of ascorbic acid in the diets. The result of hematological study shown that (7.75 μ L), red blood cell (3.80 to 4.87 μ L) and total protein 93.42 to 3.68g/L) were not significantly affected by the dietary treatments). It may be concluded that including ascorbic acid at up to 0.30% in the diets of broiler chickens did not affect feed intake, growth performance and hematological parameters.

Key words: Ascorbic acid, hematological, profile, broiler chicken.

INTRODUCTION

The significance of animal protein is considerable for human health with respect to human's physical and mental process. Broiler production plays a major role in food security due to their short production cycle, high feed efficiency and high biomass per unit of agricultural land. As compared to other domestic animals, broiler chickens are more susceptible to changes in environmental condition (Nolan *et al.*, 1999). A negative balance between the net amount of energy flowing from the animal to its surrounding environment and the amount of heat produced by the animal generate heat stress (Sahin *et al.*, 2003). Broiler production in

modern environment can experienced a variety of stress inform of environmental, pathological or nutritional. Environmental stress include extreme unusual climate, for instance Nigeria is characterized by ecological variation with such distinct seasonal changes, that is the hot season (March to June), cool wet season (Late to early October) and cool dry season (November to February).The global environmental industries of the world experienced huge losses every year because of the mortality and decrease production in relation to high stresswhich depressed feed intake reduced body weight again and breast yield in broiler chicken (Veldcamp *et al.*, 2000). The response of the body to this extraneous

stimulus disturbs the normal physiological equilibrium or homeostasis (Mistl and Palme, 2002).

Antioxidant supplementation may therefore provide beneficial effect against stress which induced tissue damage (Hesta *et al.*, 2009). Studies have shown that antioxidant nutrient supplementation especially ascorbic acid (Vitamin C) can be used to attenuate the negative effects of environmental stress (Sahin *et al.*, 2003). There has been a considerable interest in possible nutritional role for ascorbic acid on the basis that endogenous synthesis may be adequate to meet the full needs of poultry all time for requirement of ascorbic acid (Vitamin C). This may be increased under certain circumstances or stressful conditions (Whitehead and Keller., 2003). Ascorbic acid supplementation improves the performance of heat challenges of broiler chickens and lowered corticosterone level in the blood, the primary glucocorticoid hormone produced by the avian adrenal gland. Research reported by Farquharson and Jefferies (2000), McCorck *et al.* (2001), shows that ascorbic acid may influence bone development by mediating the biosynthesis of 1,25 dihydroxycholecalciferol and collagen. The research work was aimed to determine the weight gain of broiler chickens fed varying levels of ascorbic acid supplementation and its effect on hematological profiles.

MATERIAL AND METHODS

Experimental site

The experiment was conducted at the Poultry Research Farm of the National Animal Production Research Institute (NAPRI), Shika Ahmadu Bello University, and Zaria. Shika lies between latitude 110 and 120 N and between longitude 70 and 80 E at an altitude of 640m. The area falls within the savannah region of Northern Guinea Zone of Nigeria with an annual rainfall of 1092mm, with an average maximum temperature range of 27°C to 35°C depending on the season (Akpa *et al.*, 2000).

Experimental Design and Management of Birds

A total of two hundred and twenty five day old broiler chicks were used in the experiment in a complete randomized design. The layout consist of five treatments which were subdivided into three replicates of fifteen birds each. A commercial ascorbic acid was used at the rate of 0.0, 0.7, 0.15, 0.22, and 0.3mg/kg which were labelled T1, T2, T3, T4 and T5 respectively (Table 1 and 2). The T1 serve as the control.

The chicks were brooded in a deep litter floor house, mud pot were used as a source of heat during the brooding period and appropriate temperature (30-35°C), feed and water were supplied ad-libitum throughout the period of the experiment (8 weeks) and routine management such as sanitation, vaccination, feeding etc was dully observed as reported by Saha *et al* (2009).

Experimental Diets

Five experimental diets were formulated in which the source of energy were maize and wheat offal while the sources of protein were groundnut cake. The diet contain 24% crude protein and 2892.2 to 2897.2cal/kg metabolisable energy in the starterphase, the percentage crude protein was 20% and 3042.8 to 3053.6cal/kg metabolisable energy for the finisher phase. The ingredients, chemical composition and calculated analysis of the experimental diets for both starter and finisher phase were shown in table 1 and 2 respectively.

Data collection

Feed given to the birds were weighed daily in each treatment and itsreplications. The leftover were also collected and weighed every morningbeforefeeding. Daily record of feed supply and feed consumption were obtained by dividing the total feed consumed by the number of live birds.

Birds were weighed weekly to observe body weight changes with the use of a weighing balance. The weight was recorded and the weight gain was calculated by subtracting the initial weight gain from final weight gain

Feed conversion ratio, was obtain by dividing the average feed intake per bird per day by the total weight gain for all the treatment.

Blood samples were collected from the wing of the broiler chickens using 2mlsyringe. The vein was disinfected using methylated spirit, the blood was then transferred into a labeled sample bottle, containing an anti-coagulant, ethylene diamine tetra acetic (EDTA). Blood sample were taken to the pathology laboratory and the following parameters were analyzed: packed cell volume (PCV), Hemoglobin count (HC) and Total protein (TP). The procedure used to determine the above parameters is by statistical analysis of variance reported by Steel and Torries (2000).

DATA ANALYSIS

Data generated were subjected to analysis of variance technique as described by Steel and Torrie (2000). Differences between treatments means were further separated using the least significant difference

RESULT AND DISCUSSION

The result of the growth performance of broiler fed supplemental ascorbic acid is presented in table 3, 4 and 5 showed no significant difference at the starter phase with lowest value in treatment 1(47.07) and highest in treatment 5(55.22g) also no significant difference was obtained at the finisher phase with lowest in treatment 1(102.60g) and highest in treatment 5 (104.71g). The overall performance showed no significant difference with lowest value in treatment 1(75.15g) and highest in treatment 5 (80.10g). These agreed with the

finding of Saha et al., 2009 that supplementation of ascorbic acid increase feed intake.

The result of the broiler birds fed supplemental ascorbic acid is presented in table 3,4 and 5 showed no significant effect at the starter with lowest weight gain in treatment 1 (11.23g) and highest in treatment 3(20.g). These agreed with the findings of Mbajiorgu et al., (2005) also corroborate with the findings of Druseibo and Alu (2006); Raja and qureshi, (2000) who reported depressed weight gain of heat stressed birds fed supplemental ascorbic acid diet.

The study revealed that feed conversion ratio at starter was not significantly affected with lowest feed conversion ratio in treatment 1(4.42) and highest in treatment 4(3.54) while the finisher phase also showed no significant difference with lowest feed conversion ratio treatment 1(6.50) and highest in treatment 3(5.03). The overall feed conversion ratio showed no significance where birds fed 0.22mg/kg synthetic ascorbic acid had the best feed conversion ratio and lowest value of 4.40 among the dietary treatments. This report is in line with the findings of Akpa, *et al.*, (2000) that ascorbic acid may be important in facilitating and utilization of some nutrients under condition of stress.

The result of the performance revealed that performance of broiler fed supplemental ascorbic acid in diet had no significant effect in starter phase with lowest feed efficiency in treatment 1(0.23) and also lowest feed efficiency was obtained in treatment 1 (0.16) in the finisher phase. While the highest value was obtained in the starter phase in treatment 2 and 4 having the same value (0.28) and 0.20 in treatment 3 finisher phase showed high feed efficiency, this result was in line with the finding of Druseibio and Alu (2006) that the decrease in feed efficiency was due to decrease efficiency of nutrient utilization.

The effect of ascorbic acid supplementation on performance and hematological profile in broiler chicken.

1. The result of the packed cell volume (PCV) revealed no significant effect. Lowest value was obtained in treatment 5 (23.34) fed 0.3mg/kg supplemental ascorbic acid diet and highest in treatment 1(29.11).
2. The study revealed no significant difference across dietary treatments, lowest performance was obtain in treatment 5(7.85) and highest in treatment 1(9.87) as the control with supplemental ascorbic acid.
3. The result of the experiment revealed less blood count in broiler fed supplemental ascorbic acid 0.30mg/kg (6.60) and highest value in treatment 4 for broiler fed 0.22mg/kg (7.75).
4. The study of the performance of broiler birds fed supplemental ascorbic acid diets showed no significant difference across the dietary treatments. Lowest value was obtained in treatment (3.80) and highest in treatment 1(4.87).
5. The result of the performance of broiler fed supplemental ascorbic acid showed no significant. Lowest value was obtained in treatment 3 fed 0.15mg/kg (3.42) and highest in treatment 2 fed 0.075mg/kg (3.68).The recommended level of ascorbic acid inclusion in broiler diets lays between 0.15mg/kg to 0.075mg/kg as reported by Akpa, *et al.*, (2000).

CONCLUSIONS

The inclusion level of ascorbic acid up to 0.30mg/kg (30%) in broiler diets is good and

recommended for normal growth and hematological indices.

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Table 1: Composition of experimental diet for broiler starter phase (%)

Ingredients	Graded Level of s Ascorbic Acid (mg/kg)				
	T1	T2	T3	T4	T5
Maize	53.01	52.93	52.85	52.77	52.69
Groundnut cake	38.10	38.10	38.10	38.10	38.10
Wheat offal	4.00	4.00	4.00	4.00	4.00
Limestone	1.50	1.50	1.50	1.50	1.50
Salt	0.30	0.30	0.30	0.30	0.30
Bone meal	2.50	2.50	2.50	2.50	2.50
Lysine	0.12	0.12	0.12	0.12	0.12
Methionine	0.15	0.15	0.15	0.15	0.15
Vit. Premix	0.25	0.25	0.25	0.25	0.25
Ascorbic Acid	0.00	0.07	0.15	0.22	0.30
Total	100.00	100.00	100.00	100.00	100.00
Feed cost (₦/kg)	70.10	70.12	70.15	70.18	70.20
Calculated analysis					
Metabolisable	2897.2	2894.7	2892.2	2892.2	2889.7
Energy Kcal/kg					
Crude Protein (%)	24.00	24.00	24.00	24.00	24.00
Crude fibre (%)	3.30	3.30	3.30	3.30	3.30
Lysine (%)	0.90	0.90	0.90	0.90	0.90
Methionine (%)	0.43	0.43	0.43	0.43	0.43

Calcium (%)	1.50	1.50	1.50	1.50	1.50
Phosphorus (%)	0.70	0.70	0.70	0.70	0.70

Table 2: Composition of experimental diet for broiler at finisher phase (%)

Ingredients	Graded Level of Ascorbic Acid (mg/kg)				
	T1	T2	T3	T4	T5
Maize	62.23	61.15	61.07	60.99	60.91
Groundnut cake	27.90	27.90	27.90	27.90	27.90
Wheat offal	4.00	4.00	4.00	4.00	4.00
Palm Oil	2.00	2.00	2.00	2.00	2.00
Limestone	1.50	1.50	1.50	1.50	1.50
Salt	0.30	0.30	0.30	0.30	0.30
Bone meal	2.50	2.50	2.50	2.50	2.50
Lysine	0.12	0.12	0.12	0.12	0.12
Methionine	0.15	0.15	0.15	0.15	0.15
Vit. Premix	0.25	0.25	0.25	0.25	0.25
Ascorbic Acid	0.00	0.07	0.15	0.22	0.30
Total	100.00	100.00	100.00	100.00	100.00
Feed cost (₦/kg)	70.10	70.12	70.15	70.18	70.20
Calculated analysis					
Metabolisable	3053.6	3050.9	3048.2	3045.5	3046.3
Energy Kcal/kg					
Crude Protein (%)	20.00	20.00	20.00	20.00	20.00
Crude fibre (%)	3.00	3.00	3.00	3.00	3.00
Lysine (%)	0.80	0.80	0.80	0.80	0.80
Methionine (%)	0.40	0.40	0.40	0.40	0.40
Calcium (%)	1.50	1.50	1.50	1.50	1.50
Phosphorus (%)	0.75	0.75	0.75	0.75	0.75

Table 3: Performance of broiler chicks fed diet supplemented with graded levels of ascorbic acid at starter phase (1-4 weeks)

Parameters	Diets					SEM
	1	2	3	4	5	
Daily feed intake (g)	47.74	49.41	49.70	50.56	55.55	3.07 ^{NS}
Daily weight gain (g)	11.23	13.63	13.70	14.30	13.00	1.00 ^{NS}
Feed conversion ratio	4.42	3.36	3.65	3.54	4.39	0.45 ^{NS}
Feed efficiency	0.23	0.28	0.27	0.28	0.24	0.02 ^{NS}
Mortality %	2.00	1.00	0.00	0.00	0.00	

SEM: Standard Error of Means, NS: Not Significant

Table 4: Performance of broiler chicks fed diet supplemented with graded levels of ascorbic acid at Finisher phase (5-8 weeks)

Parameters	Diets					SEM
	1	2	3	4	5	
Daily feed intake (g)	102.60	104.14	104.32	104.54	104.71	4.50
Daily weight gain (g)	15.90	18.10	20.80	19.82	18.10	18.1 ^{NS}
Feed conversion ratio	6.50	5.63	5.03	5.40	5.83	0.55 ^{NS}
Feed efficiency	0.16	0.18	0.20	0.17	0.18	0.02 ^{NS}
Mortality %	-	-	-	1.00	1.00	

SEM: Standard Error of Means, NS: Not Significant

Table 5: The overall Performance of broiler chickens fed diet supplemented with ascorbic acid (1-8 weeks)

Parameters	Diets					SEM
	1	2	3	4	5	
Daily feed intake (g)	75.15	77.28	76.91	77.55	80.10	2.87 ^{NS}
Daily weight gain (g)	13.56	16.30	17.24	17.07	15.92	0.87 ^{NS}
Feed conversion ratio	5.45	4.64	4.40	4.50	5.12	0.39 ^{NS}
Feed efficiency	0.20	0.23	0.24	0.23	0.21	0.01 ^{NS}

SEM: Standard Error of Means, NS: Not Significant

Table 6: Hematological profile of broiler chickens fed supplemental ascorbic acid

Parameters	Diets					SEM
	1	2	3	4	5	
Packed cell volume (%)	29.11	26.70	26.90	27.11	23.34	2.13 ^{NS}
Hemoglobin (g/L)	9.67	8.87	8.93	8.98	7.85	0.70 ^{NS}
White blood cell (μ L)	7.37	7.34	7.53	7.75	6.60	0.37 ^{NS}
Red blood cell (μ L)	4.87	4.44	4.48	4.12	3.80	0.32 ^{NS}
Total protein (g/L)	3.49	3.68	3.42	3.58	3.61	0.19 ^{NS}

SEM: Standard Error of Means, NS: Not Significant