EFFECT OF CALCIUM AND PHOSPHORUS LEVELS ON THE PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKENS

Matanmi I. O., A.A. Fatufe* and M. T. Adua
Department of Animal Sciences, Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria.
***Corresponding author**: *aafatufe@oauife.edu.ng*

Abstract
The study was conducted to determine the influence of varying levels of calcium (Ca) and available phosphorus (aP) on growth performance and carcass yield of growing broiler chickens. A total of 360 twenty-one-day old broiler chicks were assigned to twelve dietary treatments in a 4×3 factorial design comprising of four Ca levels (0.6%, 0.75%, 0.9% and 1.2%) and three aP levels (0.25%, 0.35% and 0.45%). Each treatment groups consisted of 30 birds each and each treatment had three replicates of ten birds and the study lasted for thirty five days. The highest ($p < 0.05$) daily feed intake was observed for birds on 1.2% Ca: 0.35% aP treatment group and birds fed 1.2% Ca: 0.45% aP had the highest ($p < 0.05$) final body weight (1979 g/bird) and daily weight gain (46 g/bird; which were similar to those of birds on 0.6% Ca and 0.35%aP and 1.2% Ca: 0.35% aP levels) comparedto the other treatment groups. This feed conversion ratio followed the trendobserved for final body weight and daily weight gain. The dressing weight increased as the Ca levels increased but Ca and aP levels had no significant effect on othercarcass portions. It was concluded that the 0.6% Ca and 0.35% aP levels and a Ca/aP ratio of 1.7:1may be adequate for performance in growing broiler chickens.

Keywords: calcium-phosphorus levels, growth performance, carcass yield, mineral requirement.

Introduction

Calcium and phosphorus play many important rolesas the main constituents of the skeleton and other metabolicfunctionsin farm animals (Coon *et al.*, 2002). Low calcium (Ca) leads to development of rickets, increased chick's mortality and reduced body weight in older birds. Inadequacy of phosphorus (P)also results in similar anomalies such as loss of skeletal integrity, loss of appetite, subnormal growth in young birds and weight loss in older birds (Narcy *et al.*, 2009). However, when in excess, Ca impedes the availability of other minerals like P, Mg, Mn, Zn and may reduce the energy value of the diet through the chelation of lipids (Driver *et al.*, 2005). Having excess phosphorus and calcium in feed poses a host of problems including nutrient loading of the environment and increasing feed costs (Tahir *et al.*, 2012).There is high prevalence of metabolic disorders in broilers resulting from Ca and P imbalance, inadequacy or oversupply, which is evident in lameness and other leg disorders around the world(Knowles et al.,2008) and this is a major welfare concern in the poultry industry. The range of reported Ca and P requirements for broilers in literature is wide and appears inconclusive and levels as low as 0.90% Ca and 0.19% aP for performance in 21- 42 days broilers (Cobb 500; Yan *et al.*, 2001) and as high as 1.44% Ca and 0.47% aP for performance in 28 - 63 days broilers (Hybro; Adamu *et al.*, 2012) have been reported. The objective of the present study was to evaluate the effect of Ca and P levels on growth performance and carcass characteristics of growing broiler chickens.

Materials and Methods

The study was carried out at the Poultry Unit of the Teaching and Research Farm of the Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria and the study lasted for 5 weeks. A total of three hundred and sixty (360) twenty-one-day old Arbor Acre unsexed broiler chicks were used for this study. The experimental design was a 4×3 factorial arrangement, consisting of twelve dietary treatments (T1-T12) with four levels of calcium and three levels of available phosphorus. The broiler chicks were randomly assigned into twelve treatments comprising thirty (30) birds per treatment and each treatment consisted of three replicates of ten birds each. The experimental diets were formulated to contain 0.6%, 0.75%, 0.9% and 1.2% Calcium levels and within each calcium level, there were three levels of 0.25%, 0.35% and 0.45% available phosphorus.Birds on T1 to T3 were fed diets containing 0.6% Ca with0.25%, 0.35% and 0.45% aP levels, while birds on T4-T6 were fed diets containing0.75%Ca with 0.25%, 0.35% and 0.45% aP levels. Similarly, birds on T7-T9 were fed diets containing0.9%Ca with 0.25%, 0.35% and 0.45% aP levels and birds on T10 -T12 were fed diets containing1.2%Ca with 0.25%, 0.35% and 0.45% aP levels. Initial body weights of

other nutrient components of feed ingredients for poultry. *Poultry Science*

Table 1. Gross Composition of the Experimental Diet (%)

	TRT 1	TRT 2	TRT 3	TRT 4	TRT 5	TRT 6
Ca Levels (%)	0.60	0.60	0.60	0.75	0.75	0.75
aP Levels (%)	0.25	0.35	0.45	0.25	0.35	0.45
Ca:aP Ratios	2.4:1	1.7:1	1.3:1	3:1	2.1:1	1.6:1
Ingredients						
Maize	57.00	57.00	57.00	57.00	57.00	57.00
Soybean meal	31.00	31.00	31.00	31.00	31.00	31.00
Wheat Offal	8.95	8.90	8.50	8.51	8.55	8.10
Palm oil	1.00	1.00	1.00	1.00	1.00	1.00
Bone meal	0.75	1.40	0.50	0.75	1.40	0.50
Dicalcium phosphate	-	-	1.30	-	-	1.30
Limestone	0.70	0.10	0.10	1.14	0.45	0.50
Others[1]	0.60	0.60	0.60	0.60	0.60	0.60
Total	100	100	100	100	100	100
Calculated analysis[2]						
Energy (kcal/kg)	3043.59	3042.65	3035.17	3035.36	3036.11	3027.69
Crude protein (%)	20.24	20.23	20.16	20.17	20.17	20.10
Calcium (%)	0.60	0.61	0.60	0.75	0.75	0.75
Available phosphorus (%)	0.25	0.35	0.45	0.25	0.35	0.45
Ca Levels (%)	0.90	0.90	0.90	1.20	1.20	1.20
aP Levels (%)	0.25	0.35	0.45	0.25	0.35	0.45
Ca:aP Ratios	3.6:1	2.5:1	2:1	4.8:1	3.4:1	2.6:1
Ingredients						
Maize	57.00	57.00	57.00	57.00	57.00	57.00
Soybean meal	31.00	31.00	31.00	32.00	32.00	32.00
Wheat Offal	8.05	8.10	8.16	6.33	6.38	6.40
Palm oil	1.00	1.00	1.00	0.90	0.90	0.90
Bone meal	0.75	1.40	2.10	0.75	1.45	2.10
DCP	-	-	-	-	-	-
Limestone	1.60	0.90	0.14	2.42	1.67	1.00
Others[1]	0.60	0.60	0.60	0.60	0.60	0.60
Total	100	100	100	100	100	100
Calculated analysis[2]						
ME (kcal/kg)	3026.76	3027.69	3028.81	3013.41	3014.34	3014.72
Crude protein (%)	20.09	20.10	20.11	20.22	20.22	20.23
Calcium (%)	0.91	0.91	0.90	1.20	1.20	1.20
Available phosphorus (%)	0.25	0.35	0.45	0.25	0.35	0.45

*Trt-Treatment, Ca-Calcium, aP-Available phosphorus, DCP-Dicalcium Phosphate. [1]Methionine - 0.10%, Salt-0.25%, Premix-0.25; [2]Crude fibre-4.16-4.31%, Lysine-1.07-1.08%, Methionine- 0.49%.

Table 2. Effects of calcium and phosphorus Levels on the performance of growing broilers

Parameter	Treatments												Pooled	P (ANOVA)		
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	SEM	Ca	P	Ca×P
IBW (g/b)	385.47	380.97	382.77	379.63	382.73	382.67	383.53	381.30	387.43	380.13	389.47	38740	0.792	0.2897	0.2937	0.1523
FBW (g/b)	1443	1880	1683	1805	1522	1615	1631	1753	1815	1820	1864	1979	27.829.	<.0001	0.0132	<.0001
DWG (g/b)	30.20	42.83	37.15	40.72	32.54	35.20	35.65	39.18	40.80	41.15	42.13	45.47	0.794	<.0001	0.0161	<.0001
DFI (g/b)	105.41	105.79	105.01	107.13	104.49	105.53	106.49	108.80	108.67	107.99	111.20	107.95	0.371	<.0001	0.2896	0.0191
FCR	3.49	2.47	2.84	2.63	3.21	3.02	3.02	2.78	2.67	2.63	2.64	2.38	0.569	0.0001	0.0149	<.0001
Mort (%)	6.67	3.33	3.33	0.00	3.33	6.67	0.00	6.67	3.33	6.67	3.33	3.33	-	-	-	-

Ca- Calcium, P -Phosphorus, IBW(g/b) - Initial Body Weight (g/bird), FBW (g/b) - Final Body weight (g/bird), DWG (g/b) - Daily Weight Gain (g/bird), DFI (g/b) - Daily Feed Intake (g/bird), FCR - Feed Conversion Ratio, Mort- Mortality (%).

Table 3. Effects of calcium and phosphorus levels on carcass parameters of growing broilers

Parameter	Treatments												Pooled	P (ANOVA)		
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	SEM	Ca	P	Ca×P
DW (%)	63.07	65.10	68.39	64.92	66.48	69.21	68.48	70.26	66.65	69.49	68.75	66.55	0.456	0.0225	0.2968	0.0116
Wings (%)	16.88	15.38	17.14	14.81	13.14	14.48	14.56	13.87	14.36	14.60	15.75	13.45	0.361	0.1106	0.7490	0.7547
Back (%)	20.73	21.14	22.29	21.05	21.43	21.88	22.22	22.96	22.96	21.48	21.14	21.84	0.205	0.2483	0.2483	0.2483
Breast (%)	26.23	27.72	24.29	26.98	28.58	27.33	27.94	27.95	28.18	28.17	26.13	25.30	0.414	0.2483	0.4697	0.9051
Thigh (%)	14.70	15.07	14.52	15.32	14.82	14.88	14.72	13.69	14.96	15.32	14.03	15.91	0.169	0.5604	0.2258	0.4790
DS (%)	14.53	14.17	14.83	14.74	14.99	14.56	13.81	14.33	14.00	14.73	15.60	15.58	0.164	0.0837	0.6880	0.9027

* Dw- dressing percentage, DS-Drumstick, T-Treatments, Ca- Calcium, P-Phosphorus.