EFFECT OF DIFFERENT CALCIUM AND PHOSPHORUS SOURCES ON SERUM BIOCHEMISTRY OF BROILER CHICKENS

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ABSTRACT
8weeks study was carried out to evaluate the serum biochemistry of broiler chickens at finisher phase. Birds were fed commercial diet (T_1) as control and different dietary sources of calcium and phosphorus mineral nutrients in on-farm formulated diets fortified with bone meal (T_2), egg shell meal (T_3)and limestone (T_4). Ninety six unsexed broiler birds were raised through the starter phase (week 1-4) to the finishers phase (week 4-8) before random allotment into the four treatment groups. The experimental diets were fed to four groups of 24 broilers and each treatment group was replicated thrice of 8 birds in a Completely Randomized Design (CRD) experimental model. Data obtained were subjected to statistical Analysis of Variance (ANOVA). The result obtained at the end of the experiment showed that birds on egg shell meal, bone meal and limestone competed favorably ($P<0.05$) with the birds on control diet (commercial feed) in all the serum biochemical parameters measured; in terms of total protein, albumin, globulin, urea, Alanine aminotransferase (ALT), Aspartate aminotransferase (AST) and createnine except calcium (T_4) which may be attributed to the amount of calcium in limestone without supplemental phosphorus source. It may be concluded from this study that Eggshell meal and Bone meal are excellent sources of calcium and phosphorous minerals, for good serum biochemistry and overall performance of broilers. However, limestone should be accompanied with readily available source of phosphorus for adequate calcium and phosphorus balance for better feed utilization.

Keywords: Broiler chicken, serum biochemistry, egg shell meal, bone meal, limestone.

INTRODUCTION
Donald *et al.*, (1992) noted that calcium and phosphorus represent the third most expensive nutrient after energy and protein. In addition to this, dysfunctional biochemistry in broiler birds has been attributed to inadequate intake and utilization of calcium and phosphorus due to high expenses. To solve this problem, there is an urgent need to source for cheaply available feedstuffs that meet requirement for high performance within reasonable production cost.
Bone meal and egg shell meal are excellent dietary sources of calcium and phosphorus (Shirley and Parsons, 2001). The economic value for such products in poultry diets has been attributed to their mineral content (Waldroup, 2002). This experiment was intended to leverage on the availability of discarded abattoir bones, eggshell, marble (limestone) dust found locally as mineral supplement to alleviate physiological and biochemical disorders in broiler birds and thereby improve productivity and profitability of their production. This study has potential advantage to recycle farm and industrial waste materials for wealth generation inform of mineral feed ingredient and thereby reducing environmental pollution.

MATERIALS AND METHOD
The research work was conducted at the Poultry Unit of the Teaching and Research farm of Kogi State University, Anyigba. Anyigba lies between latitude 7° 28' 51.39" N of the equator and longitude 7° 11' 14.86" E of the Greenwich meridian. Ninety-six broiler chicks were subjected to four (4) dietary treatments. Commercial feed(with unknown source and quantity of calcium and phosphorus mineral) as T_1, on-farm prepared diets consisting Bone meal (T_2), Eggshell meal (T_3), and Limestone (T_4). Birds at week five (5) were allotted in a Completely Randomized Design into four (4) treatments and three (3)

replicates each such that each treatment had twenty-four (24) birds and eight (8) birds in a replicate. The day old chicks were brooded for three (3) weeks and reared up to finisher phase for the commencement of trial up till eight (8) weeks.

STATISTICAL ANALYSIS

Data obtained were subjected to statistical analysis of variance (ANOVA) as outlined in SPSS (2011) version 20 Statistical software. Significant mean levels were separated using Least Significant Difference (LSD).

RESULTS AND DISCUSSION

Dietary Composition

The Gross composition and calculated Analysis of Commercial and on farm formulated finishers diets supplemented with Different sources of Calcium and phosphorus is presented in Table 1below.

Table 1: Gross Composition of Commercial and Formulated Finisher Diets Supplemented with Different Sources of Calcium and Phosphorus.

Nutrients	T_1 (Commercial based feed Diet)	T_2(Bone Meal)	T_3(Eggshell Meal)	T_4(Limestone)
Maize	-	45.00	45.00	45.00
Soyabean Full Fat	-	24.00	24.00	24.00
Palm Kernel Cake	-	8.00	8.00	8.00
Maize offal	-	15.00	15.00	15.00
Fish Meal	-	4.20	4.20	4.20
Bone Meal	-	3.00	-	-
Eggshell Meal	-	-	3.00	-
Limestone	-	-	-	3.00
Methionine	-	0.25	0.25	0.25
Salt	-	0.30	0.30	0.30
Premix	-	0.25	0.25	0.25
Total	**-**	**100.00**	**100.00**	**100.00**
Calculated Analysis				
Metabolizable Energy (Me Kcal/kg).	2900.00	2822.64	2822.64	2822.64
Crude Fat	6.00	7.26	7.26	7.26
Crude Fiber (C F%)	6.00	4.45	4.45	4.45
Phosphorus (P %)	0.40	0.47	0.41	0.39
Calcium (Ca %))	1.00	1.40	1.45	1.46
Crude protein (Cp %)	18.00	19.00	19.00	19.00
Methionine (Met. %)	0.30	0.30	0.30	0.30
Lysine (%)	0.85	0.94	0.94	0.94

As shown in Table 2 below, The total protein recorded in T_1 over birds on T_2, T_3 and T_4 are not significant($P>0.05$) . T_1 recorded the highest value (mg/dl) in total protein of 6.72±0.55 followed by T_3, 6.50±0.1 6; T_4, 6.00±0.75 and T_2, 5.73+0.42 respectively. Serum phosphorus is highest in the control (T_1) diet with 4.03-±0.84mg/dl while values (mg/dl) of, T_2, T_3 and T_4 are: 3.93±0.6, 3.60±1.47 and 2.97±0.85 respectively, all of which are not significant ($P>0.05$). The result of creatinine, ALT. AST albumin, globulin and urea are closely related among the treatments and are not significantly ($P>0.05$) affected as well. Birds on T_4 (limestone) diet recorded a significant ($P<0.05$) higher value of calcium level (mg/dl) of

6.27+:3.26 over those birds on T_1, 5.63±2.36; T_2, 4.57±1.18 and T_3,5.83±3.03while the result for phosphorus (2.97±0.55) in this treatment is very low and this may be attributed to imbalance of calcium and phosphorus in T_4(limestone).As shown in Table 2, all the serum biochemistry parameters measured showed no significant ($p>0.05$) difference compared with the control, except calcium level in 4 (limestone) that show significant effect on the birds. A number of biochemical parameters such as creatinine, AST, ALT and albumin measured in the dietary treatment are within normal value as reported by Banerjee (2009). The normal range for some of the biochemical profile (mg/dl) as stated by Banerjee (2009) are Total Protein, 5.20-6.90; Albumin, 2.10-3.45; Urea, 1.50-6.30; Creatinine, 0.90-1.85; AST, 88.0-208.0; ALT, 9.50-37.2 and Triglyceride, 62.0-148.0. The values of Total Protein, Creatinine, ALT, AST, Urea, Albumin, Globulin, Phosphorus and calcium obtained in the various treatments were within the normal range as presented by Okunlola *et al.*, (2015). The similarity in serum albumin, creatinine, urea, phosphorus and total protein implied that there was normal protein metabolism. The uniformity in the levels of AST and ALT showed that there was no liver damage cause by the toxicity of the experimental diets. This was in line with the findings of Ekpenyong and Biobaku (1986) who stated that the value of AST and ALT are normally low in blood but becomes high when there is occurrence of liver damage by toxic substances in feed. Calcium level in T_4 recorded the highest value (6.27±3.26) due to its high concentration in limestone, consequently, T_4 also recorded the lowest value of Phosphorus (2.97± 0.55).

Table 2: Serum Biochemistry of broiler finishers offered different dietary sources of calcium and phosphorus mineral supplement

Parameters	T_1 (control) (Commercial based feed Diet)	T_2 (Bone Meal)	T_3 (Eggshell Meal)	T_4 (Limestone)	SEM	LOS
Total Protein (mg/dl)	6.72 ± 0.55	5.73 ± 0.42	6.50 ± 0.16	6.00 ± 0.75	0.71	NS
Creatinine (mg/dl)	0.60 ± 0.10	0.87 ± 0.12	0.60 ± 0.10	0.83 ±0.35	0.20	NS
Alanine Transaminase (ALT) (iu/l)	34.53 ± 6.59	36.03 ± 6.06	35.40 ± 15.12	34.50 ± 3.69	2.67	NS
Aspartate Transaminase (AST) (iu/l)	43.10 ±10.84	40.63±10.06	42.57 ±9.19	42.13 ± 2.61	2.19	NS
Phosphorus (mg/dl)	4.03 ± 0.84	3.93 ± 0.76	3.60 ± 1.47	2.97 ± 0.85	0.28	NS
Calcium (mg/dl)	5.63 ± 2.36^{c}	4.57 ± 1.18^{bc}	5.83 ± 3.06^{b}	6.27 ± 3.26^{a}	0.67	*
Albumin (mg/dl)	3.42 ± 0.61	3.40 ± 0.47	3.45 ± 0.62	3.35 ± 0.50	0.49	NS
Globulin (mg/dl)	4.97 ± 0.61	5.10 ± 0.69	4.95 ± 0,95	4.87 ± 0.68	0.63	NS
Urea (mg/dl)	6.23 ± 0.58	5.90 ± 2.65	5.81 ± 5.77	5.67 ± 2.52	0.87	NS

Conclusion and recommendations

Based on the result obtained from this experiment, it may be concluded that birds on egg shell meal, bone meal and limestone treatment diets competed favorably non significantly ($P>0.05$) with the birds on the control diets consisting of commercial feed in the serum biochemical parameters measured. Therefore, these dietary mineral sources used in this experiment are excellent sources of calcium and phosphorus for good serum biochemistry and the overall all wellbeing of broiler birds.

Therefore, it is recommended that farmers can use any of these mineral sources as an alternative source of calcium and phosphorus mineral supplement at 3% level of inclusion. However, the usage of limestone should be deliberately accompanied with readily available source of phosphorus for adequate calcium and phosphorus balance. This experiment also helps to control environmental pollution posed by these otherwise discarded farm wastes.

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