

MON -71

Effects of Different Marine Shell Sources on the Performance of Broilers

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Abstract

An experiment was conducted to investigate the effects of marine shells as sources of calcium on the performance of broiler chicks. 144 day-old Cobb broiler chicks were used for the 9-week study and were acclimatized and re-acclimatized in the first and fifth weeks, respectively. They were randomly assigned to 6 treatment groups replicated twice with 12 chicks each, and housed in deep litter pens. Four types of marine shells (periwinkle, sea snail, clam, and oyster) were procured, washed, dried, ashed, ground, and incorporated into the experimental diets. The diets were T1 (positive control- with limestone), T2 (negative control-without any calcium source), and T3, T4, T5, and T6 containing periwinkle, sea snail, clam, and oyster shells, respectively. The calcium and phosphorus content of the marine shells were determined. Feed and water were offered *ad libitum*. Data were collected on feed intake, weight gain, and feed conversion ratio. There were no significant differences ($p>0.05$) in the performance parameters measured during the starter and finisher phases. Therefore, these marine shells can be used as alternative sources of calcium in the diets of broilers without deleterious effects on their performance.

Key words: Marine shells, calcium sources, broilers, performance.

Introduction

Good quality feed, which is a major determinant of successful animal production (Akpet *et al.*, 2016) must contain the right concentration of some macro and micro minerals. Macrominerals such as calcium are needed in the diets of all monogastric animals for optimum performance (Olomu, 2010). Calcium is one of the most abundant elements in the body of animals. It is essential for the body's overall nutrition and health, making up approximately 2% of total body weight. It is also important in bone formation, glucose metabolism, enzyme reactions, activation of the immune system, cell division, formation of eggshell, etc., (Olomu, 2010; Harty, 2014). It is usually deficient in commercial feeds because of cost consideration (Skinner *et al.*, 1992). The conventional source of calcium in poultry rations is calcium carbonate (limestone). Calcium sulfate, calcite, oyster shell meal, aragonite, eggshells, calcified marine seaweed, etc., are other sources of calcium (Pelicia *et al.*, 2007).

Owing to cost implications, and the insufficiency and unavailability of calcium in plant materials (Taylor, 1965), it is imperative to explore non-conventional sources of calcium in the diets of broiler chickens. Moreover, they do not synthesize minerals in their bodies. Marine shells are abundant and cheap, and cause environmental pollution in many of the coastal cities of Nigeria (Ohimain *et al.*, 2009). Therefore, this study was undertaken to determine the effects of marine shells, as alternative calcium sources in poultry rations, on the performance of broiler chickens.

The results of this study may help to determine the effect of different marine shell sources that can serve as a perfect replacement for limestone in poultry diets.

Materials and Methods

The experiment was carried out in the Poultry Unit of the Teaching and Research Farm, Rivers State University, Nkpulu-Oroworukwo, Port Harcourt. One hundred and forty-four (144) day- old Cobb broiler chicks were randomly assigned to six treatment groups after one week of acclimatization. Each treatment had two replicates with twelve (12) chicks per replicate. The treatments were fed broiler starter and finisher diets in which four different marine shells were incorporated as follows: T1 (positive control) - limestone, T2 (negative control) - no calcium source, T3 – periwinkle, T4 – clam, T5 - sea snail, and T6 – oyster. The composition of the starter and finisher diets are shown in Table 1. The calcium and phosphorus composition of the marine shells, determined by Atomic Absorption Spectroscopy (Allen *et al.*,

1984), are presented in Tables 2. The experiment was carried out in two phases- starter (2-4wks), and finisher (6-9wks)-with re-acclimatization in the fifth week. Initial weights of the chicks, brooded and raised in deep litter pens under routine management practices, were taken after acclimatization, re-acclimatization, and thereafter weekly. Feed and water were given *ad libitum*. Weights of the birds, feed offered and leftover, were recorded weekly using a digital scale. Average weight gain and feed intake were determined, and feed conversion ratio (FCR) was computed. One way Analysis of Variance (ANOVA) was done on the data and means were separated by Duncan Multiple Range Test (DMRT) using SPSS Version 18.0 (SPSS, 2009).

Table 1: Composition of the starter and finisher diets

Ingredients	T1		T2		T3		T4		T5		T6	
	S	F	S	F	S	F	S	F	S	F	S	F
Maize	54.5	50.7	54.5	50.7	54.5	50.7	54.5	50.7	54.5	50.7	54.5	50.7
Soya bean cake	36.65	14.00	36.65	14.00	36.65	14.00	36.65	14.00	36.65	14.00	36.65	14.00
Wheat bran	2.00	14.00	2.00	14.00	2.00	14.00	2.00	14.00	2.00	14.00	2.00	14.00
Palm kernel cake	2.00	3.5	2.00	3.5	2.00	3.5	2.00	3.5	2.00	3.5	2.00	3.5
Bone meal	3.00	13.00	3.00	13.00	3.00	13.00	3.00	13.00	3.00	13.00	3.00	13.00
Salt	0.35	3.00	0.35	3.00	0.35	3.00	0.35	3.00	0.35	3.00	0.35	3.00
Premix	0.25	0.35	0.25	0.35	0.25	0.35	0.25	0.35	0.25	0.35	0.25	0.35
Lysine	0.10	0.25	0.10	0.25	0.10	0.25	0.10	0.25	0.10	0.25	0.10	0.25
Methionine	0.15	0.10	0.15	0.10	0.15	0.10	0.15	0.10	0.15	0.10	0.15	0.10
Limestone	1.00	1.00	-	-	-	-	-	-	-	-	-	-
PS	-	-	-	-	1.00	1.00	-	-	-	-	-	-
SSS	-	-	-	-	-	-	1.00	1.00	-	-	-	-
Clam shell	-	-	-	-	-	-	-	-	1.00	1.00	-	-
Oyster shell	-	-	-	-	-	-	-	-	-	-	1.00	1.00
Total	100	100	99	99	100	100	100	100	100	100	100	100
Calc. composition:												
CP (%)	23.32	21.33	23.32	21.33	23.32	21.33	23.32	21.33	23.32	21.33	23.32	21.33
ME (Kcal/kg)	2887	2939	2887	2939	2887	2939	2887	2939	2887	2939	2887	2939
Calcium (%)	1.36	1.46	0.98	1.08	1.36	1.46	1.36	1.46	1.36	1.46	1.36	1.46
P (%)	0.91	0.31	0.91	0.31	0.91	0.31	0.91	0.31	0.91	0.31	0.91	0.31

Key: S-Starter; F-Finisher; T1-Limestone; T2-No calcium source; T3-Periwinkle shell (PS); T4-Clam shell; T5-Sea snail shell (SSS); T6-Oyster shell.

Table 2: Calcium and Phosphorus Composition of Marine Shells and Limestone

Nutrient (%)	Oyster shell	Periwinkle shell	Sea snail shell	Clam shell	Limestone
Calcium	37.91	38.54	35.75	38.80	37.23
Phosphorus	0.1024	0.04604	0.1200	0.05606	0.00030

Results and Discussion

The performance of broiler starters fed the experimental diets is presented in Table 3. The treatments did not elicit significant differences ($p>0.05$) in feed intake, average final weight, and average weight gain of the broiler chicks. This is in consonance with the reports of Guinotte *et al.* (1991), who observed no significant effects ($p>0.05$) of different calcium sources on weight gain and feed conversion of broilers. However, it disagrees with the report of Bintvihok and Kositcharoenkul (2006) that the addition of dietary calcium had positive effects on body weight gain of broilers. Manangi and Coon (2007) reported that there was greater physiological threshold in broilers fed 0.9% dietary calcium as compared to those fed 0.5% dietary calcium. The normal content of calcium in starter diets -10 g/kg (i.e.1%) (Flemming, 2008), was maintained in all the experimental diets. This indicates non-toxic calcium level in the diets, confirming the report of Ramazan *et al.* (2007) that up to 1.6% dietary calcium has no adverse effect on broiler performance.

The effects of marine shells on the performance of broiler finishers are also shown in Table 3. There were no significant differences ($p>0.05$) in all performance parameters except initial body weight. This does not concur with the report of Leytem *et al.* (2007) that there was a linear relationship between dietary calcium and performance of broilers fed different dietary calcium levels (0.47, 0.70, 0.93, and 1.16%). The poor performance of the chicks disagrees with the findings of Ramazan *et al.* (2007) that there were no adverse effects on the performance of broilers fed up to 1.6% calcium. For optimum growth rate

and utilization of calcium, there must be an adequate level and ratio of calcium and phosphorus and sufficient vitamin D.

Table 3: Effects of Marine Shells on the Performance of Broiler Starters(S) and Finishers(F)

Parameter	T1 (PC)		T2 (NC)		T3 (PS)		T4 (SSS)		T5 (CS)		T6 (OS)	
	S	F	S	F	S	F	S	F	S	F	S	F
AIW(kg)	0.12	0.91 ^{ab}	0.13	0.91 ^{ab}	0.13	0.88 ^b	0.13	0.86 ^b	0.13	0.94 ^a	0.12	0.89 ^{ab}
AFW(kg)	0.73	1.27	0.66	1.27	0.78	1.38	0.67	1.45	0.67	1.38	0.76	1.46
AWG(kg)	0.61	0.37	0.53	0.36	0.65	0.51	0.54	0.59	0.54	0.44	0.63	0.58
AFI(kg)	0.61	0.61	0.53	0.53	0.65	0.65	0.54	0.54	0.54	0.54	0.63	0.63
FRC	1.00	5.26	1.00	5.97	1.00	4.27	1.00	3.60	1.00	4.57	1.00	3.52

^{a,b,c} Means within the same row having different superscripts are significantly different ($p < 0.05$); AIW- Average initial weight ; AFW – Average final weight; AWG- Average weight gain ; AFI- Average fed Intake; FRC – Feed conversion ratio; PC – Positive control; NC- Negative control ; PS – Periwinkle shell; SSS – Sea snail shell; CS – Clam shell; OS – Oyster shell

Conclusion and Recommendations

This study found out that incorporation of marine shells in the diets of broiler starters and finishers had no deleterious effects on their performance. Therefore, they can be used as alternative sources of calcium in broiler diets. Further studies on egg production and quality, and bone mineralization are recommended.

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