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EGG WEIGHT AND EGG SHELL THICKNESS AS AFFECTED BY DIETARY CALCIUM

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ABSTRACT

Graded levels of dietary inclusions of oyster shell and bone meal were used as calcium sources to determine their influence on egg weight and egg thickness for laying chicken in cages, under tropical conditions. Birds were allocated at random to 8% oyster shell and 2% bone meal in treatment 1; 7% and 3% in treatment II; 6% and 4% in treatment III; 5% and 5% in treatment IV respectively. Egg weight and egg shell thickness did not show significant differences (P> 0.05). Increasing calcium level above 2% depresses egg shell quality, obtained by using 5% oyster shell and 5% bone meal in the diet.

Keywords: Dietary calcium, oyster shell, bone meal and caged laying chicken.

INTRODUCTION

Poultry out numbers all other forms of livestock in Nigeria with chicken as the most common. According to the Nigerian livestock production estimate, the number of chicken is put at 82, 400, 000 (Bourn *et al.*, 1994). In the tropics, the emphasis is now on egg production. However, throughout the world the domestic fowl (chicken) is unique for its popularity in producing both meat and eggs, while the other species are kept primarily for meat (Oluyemi and Roberts, 1979).

There is lack of agreement with regards to the calcium and phosphorous requirements of animals, and appropriate methods of estimating these requirement in terms of minimum level needed to produce maximum shell thickness specific gravity of eggs (NRC, 1960).

Oyster shell and limestone of the same particle size was shown to produce similar effect in their solubility rate in the gizzard (Roland *et al.*, 1974). Calcium level of diet do not influence the response to level of dietary phosphorous (Hunt and Chancey, 1970).

This paper reports on a follow –up study to determine dietary calcium level influence on egg shell quality in laying chicken in cages.

MATERIALS AND METHODS

The experiments were conducted at the University of Ibadan, Teaching and Research Farm, with laying chickens in conventionally laying hen cages. 16 caged hens (Harco) twenty -two weeks of age were allocated at random to four treatment groups. A treatment group consisted of two replicates of four hens each. Eggs were collected twice daily and measurement of shell thickness taken daily (using micrometer calibrated to 0.01mm) over the experimental period which lasted 42 days. Oyster shell and bone meal were sources of dietary calcium. Feed ingredients were purchased locally and ground, only 2mm sized particles of oyster shell and bone meal was used for the study. Formulation of experimental diets, was based on analyzed value using A. O. A. C., (1980) methods. Diets in mash form and water were offered *ad libitum*.

Data collected were subjected to analysis of variance and means of significant differences were compared using Duncan's New Multiple Range Test (Steel and Torrie, 1980).

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RESULTS

Feed consumption values did not differ significantly ($P > 0.05$) as shown in Table II. Diet II was the least consumed, with a mean value of 1. 593+ 1. 421 (Kg / dozen egg), while diet IV had the highest value of 1.714+ 1.172 (Kg / dozen egg). Significant differences ($P < 0.05$) and were observed in the hen housed egg production in this study, although values of treatments I and III were similar.

The highest mean egg weight of 40. 414+ 3.370g was associated with diet IV which had the lowest calcium / phosphorous ratio of 1. 97: 1 (Table I and II). Egg weight was however not significantly different ($P > 0.05$). There was similarity in shell thickness amongst treatments I, III and IV, however treatment II containing 7% oyster shell and 3% bone meal depressed this parameter.

No mortality was recorded during the experimental period.

DISCUSSION

Ademosun and Kalango, (1973) reported that feed intake increased as the level of calcium increased from 2% to 3.5%. These authors further suggested that using ground oyster shell to furnish the various levels of calcium resulted in dilution in energy content as calcium levels increased and that birds tend to adjust energy intake by eating more of low energy diet. In this study, 2mm sized oyster shell and bone meal were used to furnish calcium needs of the birds. Feed intake was not adversely affected by the levels of calcium inclusion.

Shell thickness of 36.625 ($x10^{-2}$) mm was recorded for the highest available calcium source in diet 111 (Table 11), it appears that calcium in

TABLE 1: EXPERIMENTAL DIETS (TREATMENTS)*

	I	II	III	IV
* * Basal mixture %	90.00	90.00	90.00	90.00
Oyster shell %	8	7	6	5
Bone meal %	2	3	4	5
Calculated Ca %	3.773	3.793	3.813	2.100
Calculated P %	0.618	0.763	0.918	1.068
Ca/P ratio	6.11 : 1	4.49:1	4.15:1	1.97:1
Analysed Ca %	3.544 35g/Kg)	3.604 36g/Kg)	3.689 (37g/Kg)	2.047 (20g/Kg)
Analysed P %	0.432 (4g/Kg)	0.581 (6g/Kg)	0.820 (8g/Kg)	0.928 (9g/Kg)

* Calculated energy 2639.65 Kcal/Kg, Calculate crude protein 18.26%

** Maize 43.50% soyabean 20.00%, fish meal 3.00%, wheat offal 10.00%, corn bran 13.00%, salt 0.25% and *** premix 0. 25%.

*** Premix supplied the following nutrients/kg of ration, 9000000 IU vit. A, 1200000 IU vit D_3, 3200 IU vit E, 800mg vit K, 800mg vit. B_2, 480mg vit B_6, 4800mg vit B_{12}, 12mg Biotin, 400mg Niacin, 240mg Folic acid, 400mg vit C, 2800mg Pantothenic acid, 2000mg Chlorine Chloride, 24000mg Fe, 32000mg Mn, 40000mg Mg, 32000mg Cu, 180mg Co,40mg Se and 800mg I.

TABLE 11: SUMMARY OF MEANS* OF PERFORMANCE OF LAYERS FED GRADED DIETARY TREATMENTS DIET

Parameter	I	II	III	IV
Hen house egg prod. (%)	51.292[b]	49.120[c]	52.138[b]	54.612[a]
	±1.311	±3.200	±21.311	±2.315
Feed consumed (Kg/doz. eggs)	1.623	1.593	1.616	1.714
	±1.311	±1.421	±2.816	±2.712
Egg weight (g)	38.698[a]	30.684[b]	36.407[ab]	40.414[a]
	±2.034	±4.617	±3.182	±3.370
Shell thickness ($x10^{-2}$mm)	35.665[a]	32.230[b]	36.625[a]	34.563[a]
	±0.478	±0.982	±0.500	±0.418
Final body wt. (Kg)	1.550[a]	1.625[b]	1.775[b]	1.600[b]
	±0.010	±0.011	±0.021	±0.013
Initial body wt. (Kg)	1.480[a]	1.500[b]	1.635[b]	1.575[b]
	±0.126	±0.0118	±0.042	±0.012

* Mean ± standard error of mean. [a,b,c], means in the same row With common superscript do not differ statistically (p>0.05).

the diet may have a faster availability rate. However, this result does not seem to support the observation of Scott *et al* (1971), who postulated how a "metering" system of calcium in the gizzard was used to explain the slow availability of calcium from large particle sized sources. Calcium above 3.544% did not improve egg shell thickness which does not compare with results obtained by Hinner *et al* (1963). These authors expected shell thickness to increase with dietary calcium intake even when the requirement for maximum egg production had been satisfied.

Mean egg weight values were associated with feed consumption recorded in this study, but less than those reported by Ademosun and Kalango (1973).

Chicken body weights in cages recorded were independent of calcium availability which agrees with the report of Deobald *et al* (1986).

Results of this study compares with those of Oluyemi and Fowokan (1973) who reported that calcium and phosphorus were available in direct relation to levels of oyster shell and bone meal in the diet.

Tion *et al* (2000) advised that, routine use be made of bone meal, oyster shell and limestone which are available locally, as these sources have good calcium availability values that are high (87% - 92.8%), which are better than imported dicalcium phosphate for feeding laying chickens.

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