COMPARATIVE PERFORMANCE AND HAEMATOLOGICAL CHARACTERISTICS OF BROWN EGG TYPE LAYERS FED DIETS CONTAINING DIFFERENT CALCIUM SOURCES

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Abstract

The study assessed the effects of dietary inclusion of different calcium supplements (limestone, oyster shell, snail shell and egg shell) in layers' diets on the performance characteristics of layers kept in cages. A total of seventy-two point-of-lay Black Nera Strain hens (20 weeks old) were used for the study. Eighteen birds were randomly assigned to each of the four dietary treatments with each treatment replicated three times (6 birds/ replicate) in a completely randomized design (CRD). The feeding trial lasted for twelve weeks during which the growth and laying performance, as well as haematological parameters were determined. Average daily weight gain, average final live weight, daily feed intake, feed: gain ratio and cost of feed/Kg live weight and gain were not significantly (P>0.05) influenced by the dietary treatments. There was no significant (P>0.05) difference among the dietary treatments in haemoglobin (Hb), packed cell volume (PCV), red blood cells (RBC),. monocytes, eosinophils in both base line and final samples of blood parameters. White blood cells (WBC), neutrophils and lymphocytes were significantly (P>0.05) affected. Different dietary source of calcium in laying birds was found not to influence egg shell weight, shell thickness and egg weight. Comparatively, the most available material and the cheapest source of calcium in the study is limestone. It was concluded that the supplement with the most available calcium was limestone.

Keywords: Calcium, Performance, Egg weight, Haematological parameters, Black Nera.

Introduction

Calcium plays a vital role in egg-production and metabolic processes. Calcium is found in the blood of chickens as well as other animals in three forms: bound to plasma proteins, bound to inorganic compounds and freely disassociated or ionized (Gerry, 1980). According to the author, the physiologically active component is ionized calcium, which has been firmly established to have a major role in many biochemical processes, including nerve conduction, muscle contraction and blood clotting. Consequently, the regulation of blood ionized calcium (Ca++) within a narrow range is of great importance since this blood calcium fraction affects the function of the aforementioned biological processes.

Calcium has an essential role in nutrition and calcium turnover determines the optimal calcium level for bone formation, including the tibia (Cransberg, 2001). The initial calcium reserves when chickens are in lay may be compromised if the diet is not correctly balanced, with consequent influence on egg production.

Calcium availability in dietary calcium sources present great variability as a function of their chemical composition and their capacity to physically bind to other dietary components, forming compounds that present low solubility and availability (Mcnaughton and Deaton, 1981). Sa, (2004) reported 99% relative calcium availability in dicalcium phosphate, 84% in calcitic limestone, and 75% in dolomitic limestone.

It is important that calcium should be provided in the right amounts to layers, because the provision of calcium in the right amounts serves two important purposes, i.e. ensuring that the eggs produced are of the right quality, both in terms of shell texture and nutrition value, and ensuring that layers do not resort to bone demineralisation in attempts to compensate for calcium deficiency. Bone resorbtion leads to layers with weak bones and this often leads to fractures that ultimately impact on production. Bone fractures in layers towards the end of lay are in fact a cause for concern. There are estimates that 30% of layers suffer bone fractures during their lifetime (Gibson and Roberfriod, 1995; Hurwitz and Bar, 1989). Lower levels in the supply of calcium will lead to weaker eggshells, which will have serious consequences in terms of viability of the egg in hatcheries and also for supply of intact eggs to the consumer (Ahmad and Balander, 2003).

Materials and Methods

The experiment was carried out at the Poultry Unit, Teaching and Research Farm, Ladoke

Akintola University of Technology, Ogbomoso.

Experimental Diets: Four diets were compounded based on the four calcium sources. These calcium sources were limestone (control), Oyster shell, snail shell and egg shells. Bone meal was supplied in the diets to supply the minimum phosphorus requirement for the layers according to NRC, (1986) recommendations. The dietary composition is presented in Table 1.

Animals and Management

Seventy-two point - of – lay (20 weeks old) Black Nera Strain of layers were used for the experiment. There were four dietary treatments with each replicated three times. There were six birds per replicate to make to total of 18 birds per treatment in a completely randomized design (CRD).

The birds were fed experimental diets for two weeks to get them acclimatized to the diets before data collection started. Water was supplied *ad libitum.* The birds were given Kommorov NDV vaccine at the point of caging and routine medication was done to keep the birds healthy.

Data Collection

Egg Collection and Analysis

A total of sixty eggs were collected and analyzed from each treatment group. Ten eggs were randomly selected from each treatment at two weeks interval. The eggs were cleaned with damp hand towel to remove any adhere feed and faecal materials before analysis for external and internal qualities of egg. The sampled egg collected for the egg quality assessment was done for a period of twelve (12) weeks.

Body weight (g): On arrival, the initial body weight of the birds was recorded. The weight gain for each hen was obtained by taking the difference between the initial body weights of the hens from that of the final body weights during the twelve (12) weeks when the experiment was terminated.

Average daily weight gain/bird/grammes = <u>Total weight gain</u>

Numbers of days

Chemical Analysis: The proximate analysis of the experimental diets was done using the procedure of AOAC (2005).

Haematological Analysis

Blood samples for analysis were collected from 72 layers at the beginning of the experiment and the end of the experiment. Blood specimens were sampled from the wing veins of all the birds using sterilized needle and syringe into the collecting tube containing ethylene diamine tetra acetic acid (EDTA) as anticoagulant. Standard haematological assay procedures according to Dacie and Lewis (1991), Kelly (1979) and Jain (1986) were used in determining the packed cell volume (PCV), total red blood cell counts (RBC) and total White blood cell counts (WBC) respectively. Haemoglobin concentrations (Hb) were also determined.

Statistical Analysis: The data collected were subjected to One Way Analysis of Variance (ANOVA) using the General Linear Model of SAS (2000). Means were separated by Duncan's Option of the same statistical package.

Results and Discussion

The result of different inclusion levels of calcium sources on the performance characteristics of the layers is presented in table 2. The result shows that all the parameters were not significantly ($P>0.05$) affected. The body weight gains of the layers fed diets containing different supplements showed no significant ($P>0.05$) differences which contradicted the report of Anderson *et al.* (1984) who reported lower weight gain and bone ash content when layers (22-32 weeks) were fed a diet with powdered limestone compared to medium sized particles of limestone. However it agreed with the report of Guinotte *et al.* (1991) that calcium origin or particle size had no effect on live weight of hens, but those fed coarse particles had slightly higher body weight, it also agreed with the findings of Voeder (1994). Factors like origin, purity and solubility of calcium as well as age of layers and diet could contribute to these variations in findings.

It is clear that the supplements of calcium did not significantly ($P>0.05$) influence the rate of egg production of layers. The results were in agreement with Hurwitz *et al.* (1989), Guinotte and Nys (1990) and Watkins *et al.* (1999) who reported that production was not affected by particle size in Leghorn hens fed ground calcium particle. There was no significant ($P>0.05$) difference in the hen-day egg production, this is in agreement with the findings of Sreenivas (1997) which indicated that egg production remained constant just around peak production in order to lengthen the egg formation time.

There was no significant ($P>0.05$) difference in the egg weight of the birds, this is contrary to the findings of Watkins *et al.* (1999) that the inclusion of coarse particle sizes of limestone in layer diets improved egg weight.

The result of different inclusion levels of calcium sources on haematological parameters of the layers is presented in table 3. The result shows that all the parameters were not significantly ($P>0.05$) affected. The result obtained for haematology falls within the normal range recommended by Watkins *et al.*, (1977).

Conclusion

The result from the study shows that the four dietary calcium supplements investigated had no significant effect on the parameters measured. However, limestone is the most available materials and the cheaper source of calcium. It was concluded that the supplement with the most available calcium was limestone.

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Table 1: Gross Composition of experimental diets (%)

	DIETS			
Ingredients (%)	**1(Limestone)**	**2(Oyster shell)**	**3(Snail shell)**	**4(Egg shell)**
Maize	40.18	40.18	40.18	40.18
Maize offal	12.00	12.00	12.30	12.00
Wheat offal	12.00	12.00	12.00	12.00
Soybean meal	14.00	14.00	14.00	14.00
GNC	10.00	10.00	10.00	10.00
Fish meal (72% CP)	1.50	1.50	1.50	1.50
Limestone	7.00	-	-	-
Oyster shell	-	7.00	-	-
Snail shell	-	-	6.70	-
Egg shell	-	-	-	7.00
Bone meal	2.80	2.80	2.80	2.80
Lysine	0.01	0.01	0.01	0.01
Methionine	0.01	0.01	0.01	0.01
Vit-Min-Prem.*	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Crude Protein (%)	17.70	17.70	17.70	17.70
Determined Calcium (%)	3.47	3.47	3.47	3.47
Calculated Phosphorus (%)	0.30	0.30	0.30	0.30
Feed (₦ /Kg)	23.26	24.30	23.85	26.54
Metabolizable energy (Kcal/Kg)	2582.90	2582.90	2582.90	2590.40

**Premix supplied per kg diet: Vit. A 100,000IU; Vit. D 200,000IU; Vit. E 23,000mg; Vit k3 2,000mg; VitB1 3,000mg; VitB2 6,000mg; Niacin 50,000mg; Calcium 800mg; Panthotenate 10,000mg; VitB6 5,000mg; Folic acid 100mg; Biotin 50mg; Choline chloride 40,000mg; Selenium 120mg and Antioxidant 120,000mg.*

Table 2: Performance characteristics of the layers fed different calcium supplements (kg/bird).

	DIETS				
Parameters	**1 (Limestone)**	**2(Oyster Shell)**	**3(Snail Shell)**	**4(Egg Shell)**	**SEM**
Average initial live weight (kg)	1.31	1.37	1.45	1.40	0.01NS
Average final live weight (kg)	1.55	1.66	1.58	1.60	0.02NS
Average total weight gain (kg)	0.24	0.28	0.13	0.17	0.03NS
Average daily gain (g/bird/day)	3 .43	4.00	1.86	2.43	0.01NS
Average feed intake(g/bird/day)	87.70	89.86	93.31	92.96	0.01NS
Average daily consumption of calcium (g/bird)	3.04	3.12	3.24	3.23	0.01NS
Average egg weight (g)	54.41	52.61	54.84	53.97	0.48NS
Average hen day production(%)	62.26	63.49	66.37	68.25	5.03NS
Feed: gain ratio	25.57	22.47	20.17	38.26	0.14NS
Feed/dozen egg (Kg)	1 .80	1.85	1.87	1.90	0.04NS
Cost/dozen egg (₦)	75.20	75.00	74.50	75.30	0.02NS

NS=No significant treatment effect (P>0.05).

Table 3: Haematological characteristics of the layers (final values).

	Diets				
Parameters	**1(Limestone)**	**2(Oyster shell)**	**3(Snail shell)**	**4(Egg shell)**	**SEM**
Packed Cell Value (%)	21.20	19.10	21.33	21.67	0.44 NS
Haemoglobin (g/dl)	6.83	6.37	6.67	7.07	0.18 NS
White Blood Cell (x10^3mm^3)	5.46	5.50	4.77	5.33	0.17NS
Red Blood Cell (x10^6/mm^3)	3.00	3.07	3.20	3.63	0.14 NS
Neutrophils (%)	55.43	54.43	59.47	57.30	1.44NS
Lymphocytes (%)	31.10	32.00	29.67	33.23	0.71NS
Monocytes (%)	2.13	1.90	1.77	1.57	0.16 NS
Eosinophils (%)	5.43	7.47	8.23	7.47	0.50 NS

NS= Not significant (P > 0.05).