EFFECTS OF VARYING CALCIUM/PHOSPHORUS RATIOS ON THE PERFORMANCE OF LIGHT BREED EGG-TYPE CHICKS IN A SEMI ARID ENVIRONMENT

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ABSTRACT

This study attempted to establish an optimum dietary Ca:P ratio for egg type chicks under a semi arid condition using 150 day old chicks. They were reared on five isocaloric-isonitrogeneouss diets of varying Ca:P ratios ad libitum for a period of eight weeks. The chicks were randomly assigned to the five dietary groups of 30 birds made up of three replicates of 10 birds each. Feed intake varied significantly ($P<0.05$) among the five groups with a definite trend of decrease in feed intake as Ca:P ratio increases. FCR (4.47) of 2:1 group was significantly ($P<0.05$) better than all the other diets (6.48 – 9.62). The group on 6:1 Ca:P ratio showed 6.67% incidence of leg deformity. The study concluded that dietary Ca:P ratio of 2:1 was best for egg type chicks, while, higher Ca:P ratios than 3:1 results in reduced feed intake, poor FCR and possible leg deformity.

INTRODUCTION

The role of minerals in the nutrition of chickens can never be over emphasized. At chick stage, the essentiality of notable macro minerals like calcium (Ca) and phosphorus (P) is very critical, so much so that their deficiency could be as devastating as any disease in the flock. Furthermore, balance between the two manifests a pseudo deficiency of the other. Rickets, Tibial dyschondroplasia, osteoporosis, curl-toe-paralysis among others are important diseases to reckon with in the poultry industry. The report of Huyghebeart (1977) showed that the optimum Ca:P ratio for chicks was 2.2:1 and that 1.04% Ca in the diet gave the best concentration of tibial ash. Later, Schutte and Cinkwiller (1984) opined that, Ca:P of 1:1 to 1.5:1 is most effective for all monogastrics. However, Lebbies and Ademosun (1988) reported that, under tropical conditions, Ca:P should be in the range of 1.3:1 to 2:1 while, Van Eekeren *et al.* (1995) and Smith (2001) showed that, the Ca:P for growing birds should be within the range of 1:1 to 2:1. Therefore, the Sole objective of this study was to determine the optimum dietary calcium-phosphorus ratio for egg-type chicks under a typical hot dry environment of Nigeria.

MATERIALS AND METHODS

Experimental Site

The study was conducted at the Teaching and Research Farm of the Department of Animal Science, University of Maiduguri. Situated on latitude 11^0 15' N and longitude 30^0 05', Maiduguri is a typical Semi arid Zone where temperature of $\geq 40^OC$ is not uncommon for most part of the year. As such variation in mineral metabolism should be expected.

Experimental birds, diet and design

A total of 150 day old *Harco* strain of egg-type chicks were randomly allotted to five treatment groups of thirty chicks, with each group being made up of three replicates of ten chicks. Normal routine husbandry practices were observed. The chicks were reared on five isocaloric-isonitrogeneous diets of varying calcium/phosphorus ratios namely: 2:1, 3:1, 4:1, 5:1 and 6:1 (Table 1). The study lasted for eight weeks.

Data collection

Basically six parameters were collected i.e. Feed intake, Live Weight, live we weight gain, feed conversion ratio, leg deformity and mortality in that order. Feed intake was determined by difference between the quantity of feed offered and the left over the following morning.

Live weight was determined by weighing the chicks individually on an electronic sensitive balance and weight taken to the nearest whole number. This was done weekly. Variation between two adjacent weeks gives the live weight gain. The ratio between feed consumed and live weight gain gave the FCR for a particular week. Leg deformity was established by mere physical observation for any deviation from normalcy in terms of gait and/or posture. In the event of mortality, carcasses

were post mortemed to ascertain the cause of death.

RESULTS AND DISCUSSIONS

Result of this study showed that feed consumption varied significantly ($P<0.05$) among the various groups. The parameter tended to decrease with increase in Ca:P ratio. The control (2:1) recorded mean daily intake of 42.5g (Table 2) while the 6:1 group recorded significantly ($p<0.05$) the least intake of 34.87g. This indicated that, lower Ca/P ratios of 2:1 – 3:1stimulated more appetite than higher ones. Perhaps appetite centre in the chicks was more stimulated than the satiety centre. In other words, the requirement for Ca in chicks may not be met at lower ratios as such they have to "over consume" This was in line with the observations of Rolphsey (1987) and Roland *et al.* (1996) who observed inverse relationship between dietary Ca level and feed intake. No significant ($P>0.05$) difference was observed in terms of live weight gain. This implied that dietary Ca/P ratio had no significant influence over weight gain of egg-type chicks. However, FCR was significantly ($P<0.05$) better at 2:1 ratio than all the other ratios (Table 2). Therefore, this ratio gave rise to efficient utilization of feed in chicks. This finding agreed with the report of SAF (2000) which recommended a Ca:P ratio of 2:1 for chicks on account of better performance. None of the five groups but 6:1 showed incidence of leg deformity. Two chicks (6.67%) from replicate 2 of this group came down with bow legs and crooked legs. This indicated that Ca:P ratio of 6:1 was too high at chick stage. The birds might not have been able to adequately metabolize P at higher concentration of Ca. Similarly, absorptive capacity of the chick's intestine might not have been developed enough to withstand such a higher ratio. This observation buttressed the earlier report of SAF (2000). Mortality of 6.67% was recorded in 6:1 group (Table 2). This could indirectly be linked to treatment effect, because the deformed chicks died of starvation due to their inability to readily access feeders and drinkers. This showed that the Ca:P ratio of 6:1 was too high for proper legs development in chicks. This observation partly agreed with the reports of Bains and Watkins (1993) and Watkins *et al.* (2004) which revealed that critical bone growth in the shaft of limb bones of chicks and poults makes them sensitive to nutritional manipulations, especially Ca and \P balance. It further reaffirmed the opinion of Smith (2001) which places growing birds at a Ca:P range of 1:1 to 2:1.

CONCLUSION

This study concluded that, a range of Ca:P ratio of 2:1 to, at most, 3:1 favours feed intake and improves feed conversion ratio. Higher Ca:P ratios of $\geq$ 4:1 depresses the appetite centre in egg-type chicks and predisposes the birds to leg deformity. The study recommended a Ca:P ratio of 2:1 for egg-type chicks under the semi arid condition of Northern Nigeria.

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Table 1: Composition and calculated Analyses of the experimental chicks mash used (%)

	Various Ca/P ratios in the diets				
Ingredients	2:1	3:1	4:1	5:1	6:1
Maize	50.00	50.00	50.00	50.00	50.00
Wheat offal	18.00	18.00	18.00	18.00	18.00
Full fat soya	11.00	11.00	11.00	11.00	11.00
Groundnut cake	10.00	10.00	10.00	10.00	10.00
Fish Meal	4.00	4.00	4.00	4.00	4.00
Blood Meal	1.00	1.00	1.00	1.00	1.00
Bone meal	5.00	2.85	1.49	0.77	0.31
Lime stone	-	2.15	3.52	4.23	4.69
Min-Vit Premix	0.40	0.40	0.40	0.40	0.45
NaCl	0.30	0.30	0.30	0.30	0.30
Methionine	0.30	0.30	0.30	0.30	0.30
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis					
Crude Protein	19.85	19.85	19.85	19.85	19.85
Crude Fibre	3.69	3.69	3.69	3.69	3.69
Calcium	2.17	2.19	2.09	2.08	2.07
Phosphorus	1.05	0.73	0.52	0.41	0.34
ME (Kcal/kg)	2792.80	2792.80	2792.80	2792.80	2792.80

* Composition of the chicks premix used.

The mineral – vitamin premix supplied the following per kg of feed: Vitamin A = 10,000 I.U., Vitamin D3 = 3000 I.U, Vitamin E = 30,000 I.U., Vitamin K = 2300mg, Thiamine (B_1) = 1700mg, Riboflavin (B_2) = 5000mg, Pyridoxine (B_6) = 3100mg, Cyanocobalamine (B_{12}) = 16000mg, Biotin = 6000mg, Niacin = 3100mg, Pantothenic acid = 8000mg, Folic acid = 800mg, Manganese = 8,500mg, Zinc = 50,000mg, Iron = 2500mg, Copper 6000mg, Iodine = 1100mg, selenium 120mg, Cobalt 220mg, BHT 60000mg, Ethoxyquin = 65000mg, Choline chloride = 20000mg.

Table 2: Performance of *Harco* Chicks reared on varying dietary CA/P Ratios

	Treatment groups					
Parameter	2:1	3:1	4:1	5:1	6:1	SEM
Daly Feed Intake (g/bird)	42.50^{a}	40.23^{b}	37.80^{c}	39.99^{b}	34.87^{d}	1.77
Live weight(g)	443.88^{a}	429.06^{bc}	434.88^{b}	428.69^{bc}	424.20^{c}	9.41
Weight gain(g)	10.8	11.47	11.69	11.58	11.44	2.19^{NS}
Feed Conv. Ratio	4.70^{b}	9.62^{a}	6.48^{a}	8.38^{a}	6.54^{a}	5.12
Leg Deformity (%)	0	0	0	0	6.67	-
Mortality (%)	0	0	0	0	6.67	-

a,b,c means in the same row bearing different superscripts differed significantly (P<0.05)