Indian J. Anim. Res., 49 (1) 2015: 77-80
Print ISSN:0367-6722 / Online ISSN:0976-0555

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
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Transitional pullet feed and its significance at sexual maturity

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Received: 24-07-2012 Accepted: 27-04-2013 doi: 10.5958/0976-0555.2015.00016.3

ABSTRACT

Two biological experiments were carried out to find out the optimum energy, protein and calcium requirements in pre-lay pullet diets. Experiments involved different protein, energy and calcium levels during pre-lay period, two to three weeks before sexual maturity. It was revealed that a pre-lay diet with 2700 kcal/kg of energy, 18 per cent protein with 1.5 or 2 per cent calcium produced pullet at lower cost, had better body protein and fat and influenced bone status in terms of higher defatted dry tibial bone weight and longer and wider tibial bone. It could be concluded that pre-lay diet containing 2700 kcal/kg of dietary energy, 18 per cent C.P. and 2 per cent calcium is advisable for pullets before sexual maturity.

Key words: Body composition, High dense pre-lay diet, Tibial bone, Sexual maturity.

INTRODUCTION

A pre-lay period (transitional phase) of two to three weeks before the commencement of egg production is an extremely important period in the life of a successful layer. Good body reserve (fat and protein), positive energy balance and calcium reserves in the medullary bone at the onset of production is essential for sustained egg production and egg size (Williams *et al.*, 2000). Establishment of the required energy reserve and medullary bone formation takes place during pre-lay phase (Miles and Jac, 2008). Based on this metabolic changes taking place before on set of egg mass production, traditionally low density diets (Bureau of Indian Standards, 2007) during pre-lay stage may not support a high yielding layer to establish essential reservoirs. Hence, the present investigation was undertaken to study the effect of pre-lay feeding strategy during transition period on pullet body composition and physical morphometry of tibial bone.

MATERIALS AND METHODS

Two biological experiments were conducted to study the effect of pre-lay feeding strategy during transition period (15 weeks to sexual maturity) on pullet body composition (Body reserve) and physicomorphometry of tibial bone at sexual maturity.

Day old, Bovans' white commercial strain of pullets were raised in conventional floor pens up to 13 weeks. At the end of thirteenth week, pullets were transferred to cages with four birds per cage (309.6 cm^2). Birds were managed as per standard procedure in both experiments.

Experiment I: All birds were fed *ad libitum* feed as per BIS (2007) recommendation from 0 to 14 weeks of age. Birds were provided with 20 per cent CP(Crude Protein) and 2800 kcal /kg ME chick ration for the first 8 weeks and fed a 16 per cent CP and 2500 kcal /kg ME grower ration from 9 to 14 weeks of age. At 15 weeks of age, pre-lay pullets were randomly assigned to one of five pre-lay dietary treatments in a completely randomized design. Each diet was given to six replicates consisting of 12 birds per replicate. Dietary treatments comprised of T_1 (BIS control): Diet with 16 per cent crude protein (CP) and ME of 2500 kcal/kg; T_2 (High energy diet): Diet with 16 per cent CP and ME of 2700 kcal/kg; T_3 (High energy + high protein diet): Diet with 18 per cent CP and ME of 2700 kcal/kg; T_4 (High energy with 10% extra amino acids): Same as T_1 supplemented with synthetic lysine and DL-methionine by 10 per cent higher than BIS; T_5 (High energy , 10% extra amino acids with 2% oil): Same as T_4 with two per cent addition of rice bran oil to meet this energy level. Ingredient and nutrient composition of the pre-lay rations are shown in Table 1.

Carcass composition: Six birds per treatment were slaughtered at five per cent egg production and subjected for proximate analysis as per AOAC (2000).

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TABLE 1: Per cent ingredient and nutrient composition of experimental rations

		Pre-layer Feed (15 weeks - 5% Egg production) Experiment I					Pre-layer Feed (15 weeks - 5% Egg production) Experiment II						
		T_1 (BIS control)	T_2	T_3	T_4	T_5	T_1	T_2	T_3	T_4	T_5	T_6	T_7
1	Yellow Maize	24.00	38.97	38.50	37.00	28.00	30	24	25	40	40	37.36	37.6
2	Broken rice	13.00	10.00	10.75	10.00	12.00							
3	Cumbu/Bajra	22.00	17.00	12.75	20.00	20.25	26	15	15	17	17	10.83	12
4	Ragi	-	-	-	-	-	0	20	19.27	10.34	11	16	17
5	Deoiled rice bran	12.50	10.00	10.75	8.87	13.00	14	11.97	8.6	10	9.25	7.5	4
6	Wheat bran	8.00	2.00	1.00	2.00	3.50	9	9	10	0	0	0	0
7	Sunflower oil cake	4.80	4.00	1.00	4.00	2.50							
8	Soybean oil cake	9.50	11.00	18.25	11.00	11.50	9.5	11	11	11	11.5	19	18.3
9	Dry fish	4.00	5.00	5.00	5.00	5.00	4	6	7	5.5	7	6.5	7
10	Rice bran oil	-	-	-	-	2.00							
11	Mineral mixture*	1.55	1.55	1.55	1.55	1.55	2	2	2	2	2	2	2
12	Dicalcium phosphate	0.52	0.48	0.45	0.45	0.44	0.34	0.18	0.14	0.26	0.2	0.19	0.15
13	Shell grit	-	-	-	-	-	0	0.7	1.94	0.85	2	0.6	1.93
14	Lysine	-	-	-	0.05	0.02							
15	DL-Methionine	0.05	0.05	-	0.08	0.09	0.05	0.05	0.05	0.05	0.05	0.02	0.02
16	Salt	0.08	-	-	-	-	0.08	0.1	0	0	0	0	0
	Total	100	100	100	100	100	100	100	100	100	100	100	100
Nutrients composition													
1	Crude protein (%)*	15.94	16.06	18.33	15.93	16.23	15.94	15.95	16.06	16.23	15.93	18.33	18.4
2	Metabolizable Energy ** (kcal / kg)	2543	2715	2705	2716	2729	2525.72	2527.3	2518.05	2713.12	2714.04	2709.03	2712.23
3	Calcium (%)*	1.23	1.05	1.33	1.11	1.08	1.09	1.5	2	1.5	2	1.5	2
4	Total phophorus (%)*	0.60	0.59	0.57	0.60	0.59	0.4	0.4	0.4	0.4	0.4	0.4	0.4
5	Lysine (%)**	0.71	0.73	0.87	0.77	0.77	0.72	0.76	0.77	0.72	0.75	0.91	0.89
6	Methionine (%)**	0.35	0.35	0.37	0.39	0.39	0.35	0.35	0.35	0.35	0.35	0.35	0.35
7	Crude fibre(%)*	7.41	6.15	5.93	5.99	6.55	6.93	5.79	5.29	5.22	4.42	4.65	4.04

Composition of feed supplements: 100 g Ultra Vite-M contains Vit A-3,20,000 IU,Vit B2-0.1g, Vit D3- 69,000 IU, Vit B12- 0.6mg, Vit E -30 IU, Vit K-0.04g, Niacinamide-0.4g, Calcium pantothenate-0.1 g,Choline chloride-12 g, Calcium-30.4 g, Copper-0.08g, Iodine-0.08g Iron-0.8g, Manganese-2.2 g, Zinc-2.08 g and Cobalt-4 mg; 100 g Ultra Sil-TCF contains Sodium Alumino Silicate-95.25 %, predigested protein -20 ppm, Cobalt and Organic acid-2 ppm; 100 g Ultra Phos –D3 contains Calcium-21.6 g, Phosphorus-15.6 g, Vit D3-12,000 IU, Vit B12-80 Mcg, Manganese-1080 mg and Zinc-1040 mg; 100 g Ultra- B12-FS contains Vit B12-10 mg, Elemental Cobalt -10 mg, Elemental Calcium -22.5 % and Protein Hydrolysate- 5 ppm

*Mineral mixture(TANUVAS) Composition : Calcium- 23%, Phosphours-12%, Magnesium-6.5 %,Iron -0.5 %, Iodine -0.026 % ,Copper- 0.077 %, Manganese- 0.12 % , Cobalt -0.012 % ,Zinc -0.38 % , Sulphur-0.5%,Fluorine-0.07 (max) and Selenium- 0.3 ppm

Experiment II: In the second trial the best two nutrient compositions with respect to body composition of pullets from Experiment I were taken. Ingredient and nutrient composition of the pre-lay rations are shown in Table 2.

Bone physical morphometry: Six birds from each dietary treatment were subjected to slaughter at five percent egg production and at 55 weeks of age. The left tibiae were dissected out for measurement of physical morphometry as per the method described by Shrivastava *et al.* (1996). Cost of pullet production was calculated for various pre-lay feeding treatments and statistical analysis of data was carried using the SPSS 10.0 program package (SPSS, 2001).

RESULTS AND DISCUSSION

Carcass composition at sexual maturity: The treatment group of 2700/18 recorded significantly (P<0.05) highest carcass protein of 24 per cent (Table.2). Similarly, high pre-lay energy groups recorded significantly (P<0.05) high carcass fat of 11 per cent. All the treatments having same level of either energy or protein were comparable in their respective body nutrient. A particular ratio of body protein and fat in pre-lay pullets is required to initiate growth of reproductive organ and for high production. As per Yannakopoulous *et al.* (1995), the suggested carcass fat for sexual maturity is approximately 10%. Accordingly, the present study on high pre-lay energy and protein had had conditioned the body to fall well within the recommended body composition at age of sexual maturity.

Tibial bone characteristics: a) Defatted dry weight (g) : At five per cent egg production pullets fed with a high dense pre-lay diet (2700/18) with two per cent calcium level had the highest defatted dry tibial bone weight (Table 3.). It was accorded with observations of Cassius (2005) and Fosnaught (2009). Increased dietary pre-lay calcium had favourable influence on the bone weight.

b). Physical morphometry of tibial bone : Pullets fed with pre-lay diet of 2700 Kcal ME with 18 or16% CP and with 2 and 1.5 per cent calcium had consistently exhibited best tibial length and width (Table 3). Higher calcium (1 and 2%) fed pullets irrespective of energy and protein levels, had significantly longer and wider tibia than pullets fed with 1 per cent calcium. Cassius (2005) observed the same. As higher pre-lay energy and protein levels with high calcium levels had also exhibited significantly (P<0.05) longer and wider tibial bones.

Cost of pullet production: Pullet production cost (Table 4.) with high dense pre-lay feed was lower by Rs. 8.35 compared to the control. It was similar between higher calcium levels, but between one per cent and the higher calciumlevel the difference was Rs.5.30.

Dietary energy, crude protein levels and calcium need to be increased at-least three to four weeks before sexual maturity for an effective pre-lay diet.

TABLE 2: Mean (±SE) Effect of varying Pre-lay energy and protein diets on body composition of pullets at sexual maturity – Experiment I

Treatments (ME/CP/Ca)	Crude protein per cent*	Fat per cent*
2500/16	$21.54^{b} \pm 0.25$	$7.31^{b} \pm 0.09$
2700/16	$21.34^{b} \pm 0.15$	$11.29^{a} \pm 0.35$
2700/18	$24.38^{a} \pm 0.48$	$11.44^{a} \pm 0.14$
2700/16/+10% L+M	$21.34^{b} \pm 0.15$	$11.29^{a} \pm 0.35$
2700/16/+10% L+M +2% oil	$21.54^{b} \pm 0.31$	$13.32^{a} \pm 0.05$

* - Significant(P<0.05) ,NS-Not Significant; **L+M-Lysine and methionine Values bearing different superscript in a row differ significantly

TABLE 3: Mean (±SE) Characteristics of Tibial bone and pullet production cost as influenced by various pre-lay feeding strategies – Experiment II.

Treatments/Parameters	Defatted dry tibial bone weight (g)	Tibial length (mm)*	Tibial width (mm)*	Production cost per pullet (Rs.)
T1(2500/16/1)	$3.50^{b} \pm 0.11$	$85.75^{c} \pm 0.53$	$5.64^{b} \pm 0.31$	161.7
T2 (2500/16/1.5)	$4.03^{ab} \pm 0.10$	$87.43^{bc} \pm 1.08$	$7.32^{a} \pm 0.11$	158.6
T3 (2500/16/2)	$4.06^{ab} \pm 0.16$	$88.48^{b} \pm 1.11$	$7.63^{a} \pm 0.08$	158.7
T4 (2700/16/1.5)	$4.10^{ab} \pm 0.35$	$88.51^{b} \pm 0.80$	$7.71^{a} \pm 0.14$	155.7
T5 (2700/16/2)	$4.13^{ab} \pm 0.23$	$90.99^{a} \pm 0.36$	$7.74^{a} \pm 0.16$	156.4
T6 (2700/18/1.5)	$4.30^{a} \pm 0.35$	$92.33^{a} \pm 0.72$	$7.75^{a} \pm 0.11$	155.3
T7 (2700/18/2)	$4.37^{a} \pm 0.27$	$92.87^{a} \pm 0.76$	$7.84^{a} \pm 0.07$	153.4

*- Significiant (P<0.05), NS- Not Significant; Values bearing different superscript in a column differ significantly

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