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THE EFFECTS OF VARIOUS PROTEIN AND ENERGY IN THE DIET ON NATIVE CHICKEN GROWTH PERFORMANCE

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Abstract

This study was carried out to determine the effect of feeding with various energy and protein ratio in the diets on the performance and carcass values of native chicken. The rations have six different combinations of energy and protein : PE1 (18% protein and 2800 kcal/kg energy; PE2 (18% protein and 3000 kcal/kg energy; PE3 (18% protein and 3200 kcal/kg energy; PE4 (20% protein and 2800 kcal/kg energy; PE5 (20% protein and 3000 kcal/kg energy; and PE6 (20%protein and 3200 kcal/kg energy; were fed to native chicken for 60 days period. The experiment consisted of 6 x 4 x 3 factorial design. Results indicated that no interactions were found between dietary energy and protein level. Different protein levels, in the diets have no significant differences (P > 0.05) on any parameter measured, whereas different dietary energy has significantly (P <0.05) influenced on feed efficiency. It can be concluded that with adequate balance of calorie and protein, low energy and low protein combination in the diet could be fed to improve the performance of native chickens.

Key words: dietary energy, protein levels, performance, carcass, native chicken

INTRODUCTION

The relationship between protein and energy requirements has been discussed by many researchers around the world. It is clear that protein requirements have little meaning unless energy requirements have been considered. Several workers have chosen to expressed these nutrient requirements in terms of protein and energy ratios. The protein and energy studies have been conducted with rats [5], chickens [14; 4], and pigs [3; 15; 8]. In poultry production, the regime of dietary protein and energy were established both in the tropics and temperate climates [10; 11]. The performance of broilers were evaluated [12] and reported that 23% crude protein (CP) with either 2800 or 3000 kcal/kg metabolizable energy (ME) was adequate as the requirement for broiler starters, while [13] recommended 22% CPand 2900 kcal/kg ME. On the other hand, a range of 23 - 24% CP and 2800 – 3000 kcal/kg ME for starter broiler and 19 – 21% CP with same energy level for the finisher phase was recommended [6].

The physiological and practical implications of the interaction between energy intake and protein metabolism and between protein intake and energy metabolism must then be considered whenthe dietary requirements for either nutrient is assessed.

But there is little information about the effects of a varying dietary energy and protein level on native chicken. The objectiveof this investigation was to determine the performance of native chicken when fed with diets containing different combinations of energy and protein.

MATERIAL AND METHOD

A total of 72 day-old native chicken were randomly divided into 24 experimental units of 3 chicks each and randomly feeding with experimental rations. Birds were vaccinated for Newcastle disease on day 6 and 24. The brooding temperature was kept at 33-35°C

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during first week and then was gradually decreased by 2°C each week. Twenty-four hours light was provided by electric tube lights in the rearing house throughout the experimental period. Each pen was equipped with three separate feeders and drinking tube. Fresh water and feed were provided ad libitum throughout the experimental period. The birds were orally administered antibiotics, fortified with vitamins as anti-stress in drinking water on arrival, for seven days. All other required medication schedule and routine management practices were carried out during the trial that lasted 60 days.

Table 1 Composition of the improved native chicken experimental diets (%)

Ingredients	Diets*)					
	PE1	PE2	PE3	PE4	PE5	PE6
Yellow corn	45.0	46.0	46.0	46.0	45.0	47.0
Rice bran	16.5	13.5	15.5	11.5	11.5	10.0
Copra meal	17.0	15.0	11.0	16.5	13.0	10,0
Fish meal	10.0	9.5	11.5	13.5	14.5	15.0
Soybean meal	10.0	12.0	10.0	11.0	12.0	12.0
Coconut oil	0.5	3.0	5.0	0.5	3.0	5.0
Top mix**)	1.0	1.0	1.0	1.0	1.0	1.0
	100	100	100	100	100	100
Nutrients Composition:						
ME(k cal /kg)	2808	3009	3189	2809	3026	3193
CP (%)	18.4	18.3	18.1	20.0	20.2	19.9
E:P	154.3	164.4	170.6	140.5	149.8	155.4
EE (%)	6.64	8.90	9.08	6.45	9.03	10.8
CF (%)	6.04	5.58	5.09	5.51	5.06	4.51
Ca (%)	0.94	0.91	0.90	0.91	0.96	0.98
P (%)	0.81	0.78	0.80	0.84	0.85	0.83

Notes: PE1=18% protein and 2800 kcal/kg energy;
PE2=18% protein and 3000 kcal/kg energy;
PE3=18% protein and 3200 kcal/kg energy;
PE4=20% protein and 2800 kcal/kg energy;
PE5=20% protein and 3000 kcal/kg energy; and
PE6=20% protein and 3200 kcal/kg energy.
**)Top mix is a mixture of vitamins and mineral premix supplied the following per kilogram of feed: vitamin A= 6000IU, D3 = 1000 IU, E = 12.50mg, vitamin K=1.450mg, B1= 4.50mg, B2 = 2.250mg, vitamin B6=0.450mg, B12 = 2.250mg, niacin = 5.500mg, pantothenic acid = 0.150mg, iron = 18.50mg, copper = 2.5mg, manganese = 50.0mg, zinc = 27.50mg, iodine = 4.0mg, and selenium = 0.0500mg. ME = Metabolizable energy, CP=Crude protein, E:P=Energy:Protein ratio, CF=Crude fiber, Ca-Calcium, and P=Phosphorus.

The dietary treatments were in a 2 x 3 factorial arrangement with two crude protein levels (18 and 20%) and three metabolizable energy levels (2800, 3000, and 3200 kcal/kg ME) as shown in Table 1. The treatment combinations were as follows: diet with 18% of protein and 2800 kcal/kg of energy (PE1); diet with 18% of protein and 3000 kcal/kg of energy (PE2), diet with 18% of protein and 3200 kcal/kg of energy (PE3), diet with 20% of protein and 2800 kcal/kg of energy (PE4), diet with 20% of protein and 3000 kcal/kg of energy (PE5), and diet with 20% of protein and 3200 kcal/kg of energy (PE6). The ME and CP ratio for PE1, PE2, PE3, PE4, PE5, and PE6 treatment diets was at 154.3; 164.4; 170.6; 140.5; 149.8 and 155.4; respectively. Each treatment was replicated three times;had three birds. Feed and water were provided *ad libitum*.

The ME and CP ratio and other nutrients such as Calcium, Phosphor and amino acids per CP were similar in all diets. The ingredient composition of six diets and calculated nutrients in starter, grower and finisher periods are shown in Table 1. The nutrient compositions of diets were formulated to be in between native and broiler chickens recommendations [10]. The birds were raised under standard management conditions and

feed and water were supplied *ad libitum* throughout the experimental period.

Data collection

The performance characteristics were feed intake, body weight gain, and feed conversion ratio (FCR), digestibility trials, and dressing percentage; were measured during the finisher phase. Feed intake and weight gain were recorded at the end of the experiment and feed conversion ratio (FCR) was calculated. All three birds were taken from each replicate to monitor the dressing percentage. The birds were fasted overnight but allowed access to water. The live weights were measured; the following morning and then slaughtered by decapitating the head; were thoroughly bled and the carcass defeathered, cleaned with water and properly drained.

Statistical analysis

The experimental feeds and the faecal samples were analyzed as described [2]. All the data collected were analyzed by ANOVA [16] and means separated by the application of Duncan's multiple range test. The valuesof data were expressed as mean±SD.

RESULTS AND DISCUSSIONS

The results indicated, of the experimental birds are presented in Table 2. The feed intake of the birds fed PE2, PE3, PE5, and PE6; was significantly lower ($P < 0.05$) compared to PE1 and PE 4. The body weight gain (BWG) and feed conversion ratio (FCR) were not significantly ($P > 0.05$) affected by energy and protein levels of in the diets and also its interaction. Diets with either 18 or 20% protein and energy level of 3.200kcal/kg gave the lowest feed consumption, compared to other treatments. Nutrient digestibility values are presented in Table 3. Dry matter, nitrogen, fat, and fiber digestibility values were all not significantly ($P > 0.05$) affected by treatment diets.

Table 2 Performance characteristics of native chicken fed six regimes of energy and protein in the diets

Parameters	Protein Levels	Energy levels (kcal)			Average
		2.800	3.000	3200	
FI (g)	18%	60.1^{a}±0.6	61.6^{a}±0.5	59.2^{b}±0.3	60.3±0.4
	20%	62.3^{a}±0.4	60.9^{a}±0.4	59.8^{b}±0.3	61.0±0.4
	Average	61.2±0.5^{a}	61.2^{a}±0.4	59.5^{b}±0.3	
BWG (g)	18%	21.50±0.2	21.60±0.2	20.90±0.3	21.3±0.2
	20%	21.80±0.2	21.10±0.3	20.90±0.3	21.2±0.3
	Average	21.65±0.2	21.35±0.3	20.90±0.3	
FCR	18%	2.80±0.3	2.85±0.4	2.82±0.3	28.2±0.3
	20%	2.86±0.4	2.88±0.3	2.86±0.2	28.6±0.4
	Average	2.83±0.3	2.86±0.3	2.84±0.3	

FI=Feed intake, BWG=Body weight gain, FCR=Feed conversion ratio.
a, b, Means on the same row with different superscripts differ significantly ($P < 0.05$).

Table 3 Nutrient digestibility of improved native chicken fed six regimes of energy and protein (%)

Parameters	Protein Levels	Energy levels (kcal)			Average
		2.800	3.000	3200	
Dry matter	18%	54.2±0.1	55.0±0.2	55.1±0.2	54.8±0.2 55.1±0.1
	20%	55.2±0.2	55.1±0.2	55.0±0.1	
	Average	54.7±0.2	55.1±0.1	55.1±0.1	
Nitro-gen	18%	75.4 ±0.2	74.8 ±0.3	75.7±0.2	75.3±0.2 75.8±0.3
	20%	76.1 ±0.3	74.9 ±0.2	76.3±0.4	
	Average	75.7 ±0.2	74.9 ±0.2	76.0 ±0.2	
Fat	18%	68.0 ±0.6	68.1 ±0.5	68.8 ±0.6	68.3±0.6
	20%	68.4 ±0.5	68.9 ±0.4	69.2 ±0.6	68.8±0.6
	Average	68.2 ±0.5	68.5 ±0.5	69.0 ±0.5	
Fiber	18%	58.1±0.3	58.9±0.2	61.0±0.3	59.3±0.3
	20%	58.3±0.2	58.7±0.3	59.6±0.2	58.8±0.2
	Average	58.2±0.3	58.8±0.3	60.3±0.3	

The carcass percentage, abdominal fat percentage, and liver weight percentage of the experimental birds are shown in Tables 4. The carcass percentage and liver were not significantly (P > 0.05) affected by levels of energy and protein in the diets. Abdominal fat was the only parameter affected by treatment diets. Birds fed with 3.200 kcal/kg energy diet, with either 18% or 20% protein had higher abdominal fat percentage compared to other treatment diets.

The feed intake of the experimental birds was influenced by the dietary levels of energy and protein. The feed intake was lower for birds fed diets with high energy andprotein of either 18 or 20% protein. The dietscalorie and protein ratio had a prominent rolein the broiler performance [10; 1].

Table 4 Carcass percentage (%), abdominal fat (%), and liver (%) of improved native chicken fed six regimes of energy and protein (%)

Parameters	Protein Levels	Energy levels (kcal)			Average
		2.800	3.000	3200	
Carcass percentage	18% 20%	72.8±0.1 72.0±0.2	72.2±0.2 73.6±0.2	75.0±0.2 72.9±0.1	73.4±0.2 72.8±0.3
	Average	72.4±0.2	72.9±0.1	73.9±0.1	
Abdominal fat	18% 20%	0.85±0.1 0.77 ±0.1	2.11±0.1 1.67±0.1	2.33±0.1 1.83±0.1	1.76±0.1 1.43±0.3
	Average	0.8^{a} ±0.1	1.89^{b}±0.1	2.08^{b}±0.2	
Liver	18% 20%	68.0 ±0.6 68.4 ±0.5	68.1 ±0.5 68.9 ±0.4	68.8 ±0.6 69.2 ±0.6	68.3±0.5 68.8±0.6
	Average	68.2 ±0.5	68.5 ±0.5	69.0 ±0.5	

a, b, Means on the same row with different superscripts differ significantly (P < 0.05)

A range of calorie and protein ratio of 132 to 155:1 for broiler was suggested could be lowered to between 155 and 195 or 10% of the recommended levels when broilers are fed low crude protein concentration [1]. In this study, the calorie and protein values of each treatment diets, were met the recommended values; except for PE2, PE3, PE5, and PE6 (164.4:1, 170.6:1, 149.8:1, and 155.4:1) for the starter and finisher phases; because of the poor performance of broiler chickens fed with PE1 and PE4, with low protein content diet. Quite a lot of the amino acids excess that may have been available in the diet might have been metabolically utilized and hence "wasted" [9]. The carcass compositions of the broiler were affected by the different energy and protein levels in dietary. Results showed, that even the protein and energy have been increased up to 20% and 3.200 kcal/kg respectively; had no simultaneous effects to increase the chickens performance. These results indicated that excess high protein content to improved native chicken has no advantage. The excess protein in the diet has been reported to be dissipated as heat increment after consumption; usually in the order of protein > carbohydrate > fat [9; 7]. This means there is a threshold above and below, which the protein concentration as a nutrient is not justifiable [17], hence there has no positive result is expected in terms of growth and other performance indices. Native chicken with high dietary protein level of either 18% or 20% and high energy (3200 kcal/kg) gave a fatter carcass (Table 4). According to [19], the body fat deposition significantly increased in birds fed high and normal energy inclusion in the diets; resulting a high calorie and protein ratio were same with this study. The addition of palm oil in the diet obviously must have increased the level of the unsaturated fatty acid (even though this was not evaluated) thereby facilitating better utilization of the diet for enhanced body growth and fat deposition. The dietary fat concentration has no effect on body fat in broilers at constant calorie and protein ratio [18]; were also same with this study.

CONCLUSIONS

It can be concluded that with adequate balance of calorie and protein low energy and low protein combination diet could be fed to improve the performance of native chickens.

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