ENERGY AND PROTEIN REQUIREMENTS OF KHAKI CAMPBELL × THAI NATIVE LAYING DUCKS

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Summary

The experiment was carried out to estimate the energy and protein requirements of Khaki Campbell × Thai Native laying ducks. To estimate the energy requirement, 5 experimental diets were formulated at levels of 2.70, 2.75, 2.80, 2.85 and 2.90 Mcal ME/kg. These diets were equal in ME/CP ratio (170/1). A total of 150 18-week old laying ducks were assigned to 5 energy level treatments, each comprising 3 replicates of 10 birds each, and they were fed the diets for 18 weeks. To estimate the protein requirement, 90 18-week old laying ducks were divided into 9 groups of 10 birds each, and they were assigned to 3 protein level treatments, each comprising 3 replicates. The levels of protein in the diets were 13.5%, 15.0% and 16.5%, and all diets were isocaloric (2.8 Mcal ME/kg). As a result, the 16.5% protein diet gave significantly better egg production than the 13.5% and 15.0% protein diets, however, no significant difference in egg production was found among the energy levels. Feed cost to produce 1kg eggs was lower in the 2.70 Mcal and 16.5%protein diets than in the higher ME and lower protein diets.

(**Key Words**: Energy/Protein Requirement, Laying Duck, Khaki Campbell × Thai Native)

Introduction

Energy and protein requirements of laying birds are the sum of the requirements for maintenance and egg formation (Bondi, 1987). The requirements for maintenance are rather constant and those for egg production are closely associated with the rate of egg production. Energy and protein requirements for egg production of ducks were reported by Wu (1980) with Chinese laying ducks, Bulbule (1982) with Pekin ducks Pan et al. (1981) with Tsaiya ducks, Tan et al. (1988) with Putain ducks and Wiseman (1987) with Barbary and Pekin breeding ducks, however, few information is available on energy and protein requirements of Khaki Campbell × Thai Native ducks which are being used in Thailand for egg production. The present experiments were carried out to estimate the energy and protein requirements for egg production of above mentioned ducks from 18 to 35-36 weeks of age.

Materials and Methods

This experiment consisted of 2 trials; one was for energy requirement and another for protein requirement. In the both trials 18-week old female Khaki Campbell × Thai Native ducks were used. The chicks were purchased from a commercial hatchery and raised in the MIAT farm with the diets commonly used here. All ducks had started laying before starting the experiment. In each trial 10 ducks were confined together in a bamboo slat floor pen of 1.20 m × 1.85 m, and fed experimental diets as moist mash *ad libitum* from 18 to 36 weeks (for energy level trial) or 35 weeks (for protein level trial) of age under the practical environmental conditions. Average initial body weight was 1.43 kg in the energy requirement trial and 1.47 kg in the protein requirement trial. During the experimental period, egg production and egg weight were recorded every day by group measurment. Feed intake was determined every week and feed conversion ratio was calculated as kg feed consumed per kg egg produced. Mortality was also recorded.

Experimental diets were formulated using ingredients commonly used in Thailand. In the

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trial for energy requirement, 5 diets having 2.70, 2.75, 2.80, 2.85 and 2.90 Mcal ME/kg diet were used. The diets were formulated to be equal in ME/CP ratio of 170/1. In the trial for protein requirement, 3 diets having 13.5%, 15.0% and 16.5% of protein were used. ME content was fixed to 2.8 Mcal/kg. Calcium and phosphorus contents were 2.75% and 0.6%, respectively, in all the diets. The diets were formulated using linear programming, and the least cost was estimated using retail prices. The ingredient compositions of the experimental diets are indicated in table 1.

The results obtained were subjected to an analysis of variance for a completely randomized design (Steel and Torrie, 1980). Duncan's new multiple range test was employed to determine which means were significantly different (Duncan, 1955). All statements of significance were based on 0.05 level of probability.

Results and Discussion

Effects of dietary energy and protein levels on egg production and feed conversion ratio of the laying ducks are presented in table 2. These data showed that egg production rate was not affected by the dietary ME level from 2.70 to 2.90 Mcal/kg, but affected by the protein level, being significantly higher in the 16.5% protein

TABLE 1. INGREDIENT COMPOSITION OF THE EXPERIMENTAL DIETS

(1) For energy requirement[1]

ME level (Mcal/kg)	2.70	2.75	2.80	2.85	2.90
Broken rice	63.04	65.00	68.35	68.71	67.63
Rice bran	1.78	0.40	–	1.75	1.90
Rough rice bran	7.00	5.66	2.98	0.70	–
Fish meal (55%)	14.40	14.70	15.00	15.20	15.50
Soybean meal (44%)	4.58	5.00	5.00	5.00	5.54
Tallow	3.50	3.59	3.07	3.04	3.90
Limestone	5.10	5.05	5.00	5.00	4.93
Common salt	0.35	0.35	0.35	0.35	0.35
Premix[3]	0.25	0.25	0.25	0.25	0.25
Price (Baht/kg)	6.39	6.53	6.64	6.72	6.86

(2) For protein requirement[2]

Protein level (%)	13.5	15.0	16.5
Ground corn	10.43	10.34	10.00
Broken rice	66.53	63.00	59.05
Soybean meal (44%)	6.30	9.20	12.35
Fish meal (55%)	8.20	9.10	10.00
Tallow	1.62	1.64	2.00
Ground shell	4.67	4.70	5.00
Bone meal	1.65	1.42	1.00
Common salt	0.35	0.35	0.35
Premix[3]	0.25	0.25	0.25
Price (Baht/kg)	4.55	4.73	4.93

[1] ME/CP ratio : 170/1.

[2] ME content : 2.8 Mcal/kg diet.

[3] Contributed per kg diet : Vitamin A 9000 IU, Vitamin D_3 1600 ICU, Vitamin E 1.4 mg, Vitamin K 1.2 mg, Vitamin B_1 0.4 mg, Vitamin B_2 4 mg, Vitamin B_6 3 mg, Vitamin B_{12} 0.015 mg, Ca pantothenate 7 mg, niacin 40 mg, folic acid 0.4 mg, biotin 0.04 mg, Co 1 mg, Cu 8 mg, I 1 mg, Mn 25 mg, Se 0.1 mg, Zn 50 mg, Fe 50 mg, ethoxyquin 4 mg.

TABLE 2. THE EFFECTS OF DIETARY ENERGY AND PROTEIN LEVELS ON EGG PRODUCTION, FEED INTAKE AND THF FEED CONVERSION RATIO (FCR) FROM 18 TO 36 (ENFRGY) OR 35 (PROTEIN) WEEKS OF AGE

Energy level (Mcal/kg)	2.70	2.75	2.80	2.85	2.90	SEM
Egg productivity (%)	49.2	42.6	45.5	45.9	47.2	4.9
Average egg weight (g)	60.8	60.0	59.5	60.3	60.0	0.7
Feed intake (kg)	23.9	24.0	24.1	24.0	24.1	0.2
FCR (kg diet/kg egg)	6.3	7.0	7.1	6.9	6.8	0.9
Protein level (%)	13.5		15.0		16.5	SEM
Egg productivity (%)	44.0[a]		46.7[a]		52.4[b]	2.9
Average egg weight (g)	55.4[a]		57.1[ab]		59.0[b]	0.7
Feed intake (kg)	17.3		17.0		17.4	6.8
FCR (kg diet/kg egg)	5.9		5.4		4.7	0.4

Means not sharing a common superscript letter are significantly different ($p < 0.05$).

diet than in the 15.0% and 13.5% protein diets. Pan et al. (1981) reported that the ME level of 2.6-2.8 Mcal/kg did not show any significant effect on egg production of Tsaiya laying ducks, but the 19% protein diet produced significantly higher egg production than the 15% protein diet. Singh and Pal (1978) reported that egg production of White Pekin ducks to 34 weeks of age was not affected by the level of protein from 17% to 22%. From these results, for egg production of Khaki Campbell × Thai Native ducks less than 15% of protein level seemed to be inferior to the higher levels of protein.

Average egg weight was also not affected by the ME level, but was significantly heavier in the 16.5% protein diet than in the 13.5% protein diet. Wu (1980) reported that egg weight of Chinese laying ducks was slightly decreased with an increase in dietary ME, and Pan et al. (1981) also reported that Tsaiya laying ducks produced significantly heavier eggs with the diet lower in ME than 2.85 Mcal.

Both feed intake and feed conversion ratio were not significantly different among the energy or protein levels. Reddy et al. (1981) reported that in Khaki Campbell layers better feed conversion ratio was observed with the 19% protein diet than with the 17% and 15% protein diets. In the present experiment, the diet of 16.5% protein tended to show better feed efficiency than the lower protein diets.

As shown in table 3, the body weight incre-

TABLE 3. BODY WEIGHT CHANGES AND MORTALITY DURING THE EXPERIMENTAL PERIOD

Energy level (Mcal/kg)	2.70	2.75	2.80	2.85	2.90	SEM
Initial (18 wks) (kg)	1.43	1.42	1.42	1.43	1.44	0.02
Final (36 wks) (kg)	1.59	1.60	1.62	1.63	1.64	0.01
Number of birds died	0	1	1	0	1	
Protein level (%)	13.5		15.0		16.5	SEM
Initial (18 wks) (kg)	1.48		1.47		1.47	0.03
Final (35 wks) (kg)	1.64		1.64		1.66	0.05
Number of birds died	1		2		1	

Each treatment had 30 birds at the beginning (18 weeks of age).

ased about 0.2 kg in all groups during the experimental period of 17 or 18 weeks, and no difference was found among the treatments. This result is in disagreement with the result of Cherry (1979), who reported that hens given a diet high in ME (3.0 Mcal/kg) gained more weight than those given a low ME (2.75 Mcal/kg) diet. Mortality rate was also not affected by the energy and protein levels used in this experiment.

Feed costs for producing eggs are presented in table 4. The feed price increased as the dietary energy level was increased, (table 1), however, the feed cost for producing 1 kg eggs tended to be lower in the 2.70 Mcal diet than in the higher energy diets. The feed price was also increased with the increase in protein level, however, the feed cost was reduced with the increase in protein levels.

National Agricultural Council of Japan (1984) recommended 2.70 Mcal ME/kg and 16 % protein for Japanese laying ducks, and Bulbule (1982) recommended 2.65 Mcal ME and 18% protein for Pekin breeders. Wu (1980), Pan et al. (1981), Wiseman (1987) and Tan et al. (1988) also reported the ME and protein requirements for maximum egg production of laying ducks, 3.10 Mcal for Chinese layers, 2.85 Mcal and 19% protein for Tsaiya layers, 2.80 Mcal and 14% protein for Barbary and Pekin layers, and 16-18% protein for Putain breeders, respectively. According to Reddy et al. (1981), Khaki Campbell laying ducks required 2.40 Mcal ME and 19% protein for optimal performance. In the present experiment, it might be concluded that Khaki Campbell × Thai Native laying ducks required 2.70 Mcal ME/kg and 16.5% protein for optimal performance.

TABLE 4. FEED COST FOR PRODUCING EGGS

Energy level (Mcal/kg)	2.70	2.75	2.80	2.85	2.90
Baht/day	1.20	1.25	1.27	1.28	1.31
Baht/kg egg	40.53	45.44	46.97	46.20	46.27
Protein level (%)	13.5		15.0		16.5
Baht/day	0.63		0.63		0.70
Baht/kg egg	26.95		25.35		23.21

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