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Effect of Feeding Different Dietary Level of Energy and Protein on Nutrient Utilization and Production Economy in Vanaraja Chicken under Hot Humid Environment

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Abstract The present study planned to investigate the effect of feeding different level of energy and protein on retention of nutrients and production economy in Vanaraja chicken. The experiment was conducted for a period of 56 days on 540 day-old chicks, which were individually weighed and distributed into nine groups having sixty birds in each. Each group were further sub-divided into triplicates having 20 birds in each. Nine different experimental rations were formulated with three levels of protein viz. 17, 19 and 21% each with three level of energy (2600, 2800 and 3000 kcal ME^{-1}), respectively. Group T_8 serves as control fed with 21% protein and 2800 kcal energy as per PDP, Hyderabad given requirement. After end of the experiment, a five days metabolic trial was conducted to observe the balance of major nutrients such as protein, energy, calcium and phosphorus. The effect of feeding different level of energy and protein on nutrient balance such as nitrogen retention, energy metabolizability, calcium and phosphorus retention were not significantly influenced. Present study shown that higher energy with medium protein diet positively reflects to obtain desirable performance economically.

Keywords Energy, Economy, Nitrogen retention, Protein, Vanaraja birds.

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Introduction

In present scenario poultry farming is gaining strength with fast pace of development both in developed and developing countries, especially in India major population is dependent upon agriculture and allied for their livelihood security. Currently the total poultry population in our country is 729.21 million numbers [1] and egg production is around 74. 75 billion numbers during 2013-14. The current per capita availability (2013-14) of egg is around 61 eggs per year. The

poultry meat production is estimated to be 2.69 million metric tonnes.

Backyard poultry farming by and large was a low input venture [2]. Besides income generation, backyard poultry farming helps in alleviation of malnutrition of the rural people through production of valuable animal protein and empowers rural women [3, 4]. In spite of low productivity, the contribution of backyard poultry towards Indian egg production is about 30 to 40% Panda et al. [5]. The backyard breed namely Vanaraja developed by Project Directorate of Poultry (PDP), Hyderabad are very well acclimatized to village climate with good growth and moderate egg production as per the performance study conducted in our research unit as well as in farmer's field. Vanaraja, a dual purpose chicken has become popular among the rural people of as one of the income generating activity especially for the rural women Niranjan et al. [6]. Particularly these backyard breed is resistant to some common poultry diseases also. However, scanty information [7, 8], is available on nutritional requirements of native chickens or strains for sustainable low input rural poultry production. Vanaraja strain is gaining popularity among poor farmers in India because of low input cost of production, however, there is no systemic study in done on this strain regarding nutrient retention and production economy with different level of energy and protein under hot humid environment.

The two essential components like protein and energy costs about 90% of the total feed cost which should be utilized most efficiently for the shake of desired economy of production and formulation of poultry ration. The scanty of information available regarding protein and energy requirement and nutrient balance of these birds are however not known. So, keeping in view, the present study was undertaken to investigate the effect of different level of protein and energy sources on nutrient retention and economics of Vanaraja birds production during 1 to 56 days of age.

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Materials and Methods

The experiment was conducted for a period of 56 days with a view to investigate the influence of various level of energy and protein on nutrient retention and economics of Vanaraja birds production at Poultry Nutrition Research unit of Animal Nutrition Department, Bihar Veterinary College, Patna, India. Feed ingredients were procured in one lot for whole experiment and its proximate principles were determined as per AOAC [9] along with calcium and phosphorus using the method modified by Talapatra et al. [10] before compounding experimental rations and feed formulation was done as per BIS [11]. Different ingredients used in experiment were yellow maize, soya bean meal, wheat bran, de-oiled rice bran, soybean oil, common salt, calcite powder, mineral mixture and additives (Tables 1, 2).

Six hundred day old chicks of Vanaraja strain were procured from PDP, Hyderabad during early winter season and temperature was approximate 32°C. The crippled chicks and those with extreme body weights were discarded from study. Finally, 540 day-old chicks were individually weighed and distributed into nine groups having sixty birds in each. Each group were further sub-divided into triplicates having 20 birds in each. Nine different experimental rations were formulated with three levels of protein viz. 17, 19 and 21% each with three level of energy (2600, 2800 and 3000 kcal ME^{-1}) in a 3×3 factorial arrangement, respectively. Group T_8 serves as control fed with 21% protein and 2800 kcal energy. Finally, economics of poultry production was calculated on the cost of feed per kg live weight gain.

After end of the experiment, a five days metabolic trial was conducted to observe the balance of major nutrients such as protein, energy, calcium and phosphorus. In each trial four birds from each group were randomly selected and transferred to metabolic cages. Preliminary feeding was given for adaptation of birds to the new system of housing. Polythene sheets of appropriate size were spread over the dropping trays for the collection of mixed excreta. The chicks were offered a weighed amount of experimental ration at a fixed morning hour everyday during the

Table 1. Nutrient content of experimental diet (%, on DM basis). DM=Dry matter, CP=Crude protein, EE=Ether extract, CF=Crude fiber, TA=Total ash, AIA=Acid insoluble ash, NFE=Nitrogen free extract, Ca=Calcium, P=Phosphorus, ME=Metabolizable energy.

Ingredients	DM	CP	EE	CF	TA	AIA	NFE	Ca	P	ME (kcal/kg)
Yellow maize	91.2	9.50	3.35	2.08	2.80	0.20	82.27	0.08	0.36	3330.18
Soyabean meal	92.1	45.0	0.82	5.85	7.05	1.03	41.28	0.23	0.58	2450.62
Wheat bran	89.5	14.0	3.60	11.50	6.60	1.40	64.30	0.21	1.18	2000.82
De-oiled rice bran	92.5	13.0	1.78	13.25	6.40	2.70	65.57	0.07	0.98	1800.51

trial period. The mixed droppings were also quantitatively collected at the end of 24 h at fixed hours and pooled to know the total amount of excreta voided for five days. Daily feed intake was collected after deducting weight of feed residue left from the feed offered. Representative feed samples were drawn from the bulk, finely ground and stored in bottles for proximate, Ca and P analysis in laboratory. Aliquots from dropping after thorough mixing with the help of spatula was drawn for dry matter and follow up analy-

Table 2. Percentage composition of different experimental diets.CP=Crude protein, ME=Metabolizable energy, Ca=Calcium, P=Phosphorus. Mineral mixture composition: Retinol (210 mg), Cholecalciferol (1.75 mg), Alpha–tocopherol (250 mg), Nicotinamide (1000 mg), Cobalt (150 mg), Copper(1200 mg), Zinc (9600 mg), Manganese (1500 mg), Iodine (325 mg), Iron (1500 mg), Potassium (100 mg), Magnesium (6000 mg), Selenium (10 mg), Sodium (5.9 mg), Sulfur (72 g), Calcium (255 g) and Phosphorus (127 g).

Ingredients (%)	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
Yellow maize	50.50	60.00	67.00	48.00	59.00	68.00	46.00	54.00	61.00
Soyabean meal	19.00	21.00	22.00	25.00	27.00	27.50	31.00	32.00	33.50
Wheat bran	13.50	7.50	3.00	11.00	5.00	0.00	10.50	5.00	0.00
De-oiled rice bran	13.50	7.50	3.00	12.50	5.00	0.00	9.00	5.00	0.00
Soya oil	0.00	0.50	1.50	0.00	0.50	1.00	0.00	0.50	2.00
Common salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Calcite	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Mineral mixture	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Premix	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Analyzed value									
CP (%)	17.05	17.10	17.15	19.04	19.20	19.15	21.08	21.10	21.19
ME (kcal/kg)	2607	2815	3009	2624	2810	3019	2609	2814	3012
Ca (g/kg)	12.06	12.12	12.22	12.11	12.32	11.16	12.14	12.10	12.09
Av. P (g/kg)	5.42	5.34	5.40	5.26	5.42	5.18	5.41	5.43	5.45
Av. Methionine (g/kg)	4.19	4.36	4.42	4.56	4.71	4.18	4.32	4.49	4.53
Av. Lysine (g/kg)	9.15	9.58	9.91	10.56	11.03	9.14	9.36	9.87	10.64

Table 3. Effect of different level of energy and protein on nutrient balance, at 8th week in Vanaraja chicken. [abc]Values with different superscripts in a row differ significantly ($p < 0.05$).

Attributes	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
Nitrogen retention %	50.56 ± 0.67[a]	50.90 ± 0.88[a]	50.58 ± 1.53[a]	52.95 ± 0.73[ab]	53.10 ± 1.02[ab]	53.10 ± 0.88[ab]	54.84 ± 0.29[b]	54.87 ± 0.75[b]	54.83 ± 0.49[b]
Energy metabolizability %	66.77 ± 1.89[ab]	69.06 ±0.83[bc]	70.67 ± 0.45[c]	65.76 ± 0.43[a]	69.64 ± 0.47[c]	71.47 ±0.81[c]	66.00 ± 0.12[a]	70.22 ±0.10[c]	71.74 ±0.66[c]
Calcium retention %	51.39 ± 1.06[a]	51.59 ±0.30[a]	51.95 ± 1.18[a]	52.22 ± 0.33[a]	52.40 ± 0.72[a]	52.14 ± 1.05[a]	51.08 ±0.90[a]	51.99 ± 0.13[a]	52.55 ±0.90[a]
Phosphorus retention %	55.26 ± 1.07[a]	55.62 ±0.50[a]	56.14 ± 0.73[a]	55.72 ± 1.40[a]	57.04 ± 1.19[a]	56.48 ±1.50[a]	55.39 ± 1.50[a]	56.99 ± 1.12[a]	56.27 ±1.29[a]

sis for nitrogen estimation. Aliquots of five days were pooled together for nutrient analysis.

Data obtained were subjected to analysis completely randomized design with the simple analysis of variance technique [12] using Statistical Package for the Social Sciences [13]. Homogenous subsets were separated using Duncan's multiple range test described by Duncan [14]. Differences among treatments were considered to be significant when $p \leq 0.05$.

Results and Discussion

Effect of feeding different level of energy and protein on retention of nutrients and production economics in Vanaraja chicken is presented in Tables 3, 4. Average nitrogen retention was highest in control group fed with 21% CP and 2800 kcal ME containing ration and lowest in T_1 group having 17% CP and 2600 kcal ME/kg and found to be significantly similar among the groups. However, energy metabolizability percentage was found to be highest in T_9 group but significantly there was no difference among treatment groups T_5, T_6 and control. Result showed that the effect of feeding different level of energy and protein had similar effect on energy metebolizability. During entire experimental period (1—8th) week it was observed that calcium and phosphorus was not significantly different ($p > 0.05$) from control and other treatment groups. The balance study showed that all were significantly difference ($p < 0.05$) except calcium and phosphorus retention percentage, indicating the effect of feeding different level of energy and protein in Vanaraja strain of broilers.

Total input cost per bird was calculated on the basis of total feed cost and cost of chicks, medicines and other miscellaneous. As the level of protein and energy increases in diet increased the cost of experimental ration also increases. However, when cost of feed per kg live weight gain considered it was found maximum in T_6 group fed diet containing 19% CP and

Table 4. Economics of Vanaraja birds as influenced by different dietary treatments.

Attributes	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
Feed cost/kg ration (Rs)	18.00	18.50	19.00	20.00	21.00	22.20	23.40	25.00	23.50
Cost of ration consumed (Rs)	30.80	32.10	34.15	36.50	37.0	38.50	39.60	44.10	41.10
Total feed cost (Rs)	30.80	32.10	34.15	36.50	37.0	38.50	39.60	44.10	41.10
Cost of Chicks+Medicines+Misc (Rs)	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50	43.50
Total cost (Rs)	74.30	75.60	77.65	80.00	80.50	82.00	83.10	87.60	84.60
Average live weight of bird (kg)	0.999	1.028	1.071	1.112	1.028	1.356	1.109	1.364	1.265
Market price of bird (Rs) at the rate of Rs 100/-	99.90	102.8	107.1	111.2	120.8	135.6	110.9	136.4	126.5
Net profit/bird (Rs)	25.60	27.20	29.45	31.20	40.30	53.60	27.80	48.80	41.90
Profit/kg live weight (Rs)	25.85	26.45	27.49	28.05	33.36	39.52	25.06	35.7	33.12

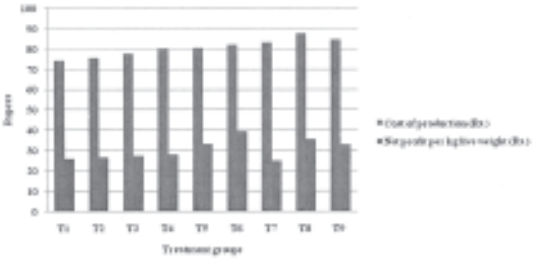

Fig. 1. Economy influenced by different dietary treatment.

3000 kcal ME kg^{-1} and minimum in T_1 group fed with 17% CP and 2600 kcal ME. Net profit per bird was also found highest in T_6 and lowest in T_1 group. Result of economics also indicated that the profit margin was found to be more on the ration containing 19% crude protein 3000 kcal ME kg^{-1} than other dietary protein energy levels. Previously work related to economics production with energy protein interaction on Vanaraja chicken was not reported. The best economical efficiency was recorded by quail chicks fed 20% crude protein with 1.05% lysine up to 42 days of age Alagawany et al. [15]. In contrast to the present result, Rao et al. [16] attain more profit margins in a ration containing 16% crude protein.

Conclusion

It has been observed that to obtained desirable performance economically, ration containing 19% crude protein with 3000 kcal ME kg^{-1} diet should be adopted for Vanaraja chicken under farm condition. Present investigation will also help to reduce protein cost and environmental pollution by decreasing the level of nitrogen as waste materials in environment though less dietary protein supplements.

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