Indian J. Anim. Nutr. 2023. 40 (3): 347-353
doi:10.5958/2231-6744.2023.00043.9

Indian Journal of Animal Nutrition

Optimization of Energy and Protein Requirements in Rajasri Grower Birds

Bhasker Enapally, M. Hanmanth Rao and S.V.Rama Rao,
M.Venkateshwarlu, Srinivas Gurram, T.Srilatha and K. Sushmasri
Poultry Research Station, P.V. Narsimha Rao Telangana Veterinary University,
Rajendranagar, Hyderabad, Telangana State
*Correspondence: gurramsrinivas4@gmail.com

ABSTRACT

The aim of this experiment was to study the effect of optimization of energy and protein requirements in Rajasri grower birds from 9-18 weeks of age on growth and carcass parameters. 360 Rajasri female birds at the age of 9 weeks were randomly allotted to 9 treatments with 8 replicates each replicate consists of 5 birds which are reared in cages upto 18 weeks of age. Nine experimental diets constituted with three levels of energy (2500 kcal, 2600 kcal, 2700 kcal/kg ME) each with three levels of protein (15%, 16%, 17% CP).The results shown that the group of birds supplemented with ME 2700 kcal/kg with 17% CP shown significantly ($P<0.05$) improved body weights, feed conversion ratio (FCR) dressing percentage, weight of liver, heart and gizzard when compared to the remaining. However, ME 2500 kcal/kg with 15%CP fed group shown lowest body weight and higher feed conversion ratio. The mean feed intake of Rajasri grower birds fed with diet containing 2500 kcal/kg ME and 15%CP recorded significantly ($p<0.05$) highest feed consumption while lowest feed intake was observed in birds fed with 2700 kcal/kg ME and 17% CP. Based on the overall results, it was concluded that supplementation of 2700 kcal ME /kg diet with 15% CP diet is optimum for growth performance of Rajasri grower birds.

KEY WORDS: Crude protein, Body weight, Metabolizable energy, Rajasri Growers

Article received: 17 June 2023; Article accepted: 13 September 2023

INTRODUCTION

Poultry production is the fastest growing sector of Indian agriculture having long history of backyard farming. Backyard farming is low input venture with low technology requirement. Although modern poultry production rapidly increasing towards vertical integration, backyard poultry production still offers opportunities for enhancing household food security and income generating activities, especially if this system is adopted in a scientific manner with improved chicken varieties. Simple, affordable interventions based on improved stock coupled with good husbandry practices such as feeding and management can have a substantial impact on productivity.

Rajasri is one type of backyard chicken variety developed at PV Narasimha Rao TelanganaVeterinary University, Rajendranagar, Hyderabad which is medium in size with long shanks and colorful plumage resembling indigenous chicken. It is a prolific egg laying chicken variety capable of producing 160-180 eggs per year under scavenging system (Srinivas et al., 2017). It is important to provide better nutrition for effective multiplication of this variety and also to step up the productive performance of parent flocks. Hence balanced nutritive rations suitable under different situations are quite essential during all stages of growth to exploit the genetic potential of breeder stock. No information is available regarding the nutrient requirements of Rajasri birds during grower phase.

MATERIALS AND METHODS

A feeding trial was conducted on 360 Rajasri female grower chicks from 9-18 weeks of age which were wing banded for identification were evenly allotted to nine treatments with eight replicates and each replicate consists of five birds in a 3*3 factorial manner and raised in cages under uniform

environment following the standard management practices. Maize, soybean meal (SBM), sunflower cake (SFC) and de-oiled rice bran (DORB) were used to formulate the nine experimental diets (Table 1). The experimental diets were constituted with three levels of metabolizable energy (2500, 2600 and2700 kcal/kg) each with three levels of protein (15%, 16% and 17% CP).The concentrations of other essential nutrients (Methionine, lysine, calcium and non-phytate phosphorous) excepting energy and protein were kept constant levels as per the recommendations of - Nutrient Requirements of Animals - Poultry (ICAR-NIANP), 2013 for improved chicken varieties.

Weekly body weight and feed intake were recorded and feed conversion ratios were calculated as feed intake per unit bodyweight gain at weekly intervals. The mortality rate was recorded throughout the experiment. On the day of mortality, the leftover feed was weighed for the sake of accuracy in data collection in feed consumption. At the end of the trial period (18th week), eight birds per treatment were randomly selected, weighed and slaughtered. Individual dressing percentage and giblet weight percentage was recorded.

The obtained data was subjected to analyze two-way analysis of variance using SPSS analysis package (version 15). The differences between the means were tested by level of significance ($P<0.05$) using Duncan's multiple range test (Duncan, 1955). All the statistical procedures were carried out as per the procedures of Snedecor and Cochran (1980).

Table 1. Ingredient and nutrient composition (%) of nine experimental diets fed to Rajasri growers.

INGREDIENTS (%)	T1	T2	T3	T4	T5	T6	T7	T8	T9
Maize	50.4	50.5	49.2	53	54.5	53	60	59	56.5
Soybean meal	8.08	9.6	12	8.8	11.8	14	11.6	12.4	13.5
DORB	25.56	21.53	19.95	23.19	17.81	16.26	15.46	13.68	13.39
SFC	12	14.5	15	11	12	12.9	8.9	11	12.8
Salt	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Trace mineral mixture	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
AB2D3K	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
DCP	1.50	1.50	1.54	1.55	1.50	1.50	1.55	1.50	1.50
Stone grit	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
DL-Methionine	0.09	0.07	0.06	0.09	0.09	0.08	0.12	0.12	0.06
Lysine Hcl	0.12	0.05	0	0.12	0.05	0.01	0.12	0.05	0
Vitamin B-Complex	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Choline Chloride	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Antibiotic	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Toxin binder	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100	100	100	100	100
NUTRIENT COMPOSITON (calculated values)									
ME(Kcal/kg)	2500	2500	2500	2600	2600	2600	2700	2700	2700
Crude protein (%)	15	16	17	15	16	17	15	16	17
Calcium (%)	1.01	1.02	1.01	1.02	1.02	1.02	1.02	1.01	1.02
Available Phosphorous (%)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Lysine (%)	0.703	0.703	0.728	0.711	0.727	0.757	0.742	0.737	0.748
Methionine (%)	0.405	0.402	0.406	0.402	0.413	0.418	0.419	0.438	0.396
Na (%)	0.18	0.18	0.19	0.19	0.18	0.18	0.17	0.18	0.18

RESULTS AND DISCUSSION

Body weight gain

The present study revealed that significantly($P<0.05$) lowest and highest body weights were noticed at ME 2500 kcal/kg with 15% CP and ME 2700 kcal/kg with 17%CP fed groups respectively (Table 2).During 18th week, significantly ($P<0.05$) higher body weight (1239g) was observed in T9 (2700 Kcal/kg + 17 % CP diet) group and lowest (1158g) in T1 group (2500 kcal/kg +15 % CP) compared to all other treatment groups. However, the body weight in T2, T5, T6, T7 and T8 were similar to those fed highest ME and CP (T9) diet. The mean body weights were significantly ($P<0.05$) influenced by dietary ME levels during 9 - 18 weeks of age and shown in Table3.Significantly ($P<0.05$) highest body weight (1222.92 g) recorded in 2700 kcal /kg ME group followed by 2600 kcal / kg ME diet (1197.83 g) and the least was in 2500 kcal/ kg ME diet (1184.75 g).

Kingori et al. (2003) concluded that the body weight gains increased significantly with increase 100 to 160g CP/kg diets for growing Kenya indigenous chicken.Gunawardhana et al. (2008) observed that increased dietary energy level significantly ($P<0.05$) increased the body weight. Haunshi et al. (2015) observed that body weight gain (25 to 40 weeks) was significantly higher ($P<0.05$) in high density diet than the low-density diet.

Feed intake

Rajasri grower birds supplemented with 2500 kcal/ kg ME and 15%CP recorded significantly ($P<0.05$) highest feed consumption while lowest feed intake was observed in birds fed with 2700 kcal/kg ME and 17% CP. The cumulative feed consumption (CFI) of Rajasri grower birds was significantly ($P<0.05$) higher in T1 (4202g),T2(4178g) and T3(4197g) groups and lowest feed consumption in T9 (3913g) group compared to all other treatment groups (Table 2). Feed intake decreased with increase in dietary ME levels which may be attributed to the fact that chickens consume feed basically to meet their energy requirements, so there was higher intake of diets having lesser ME content. The feed intake suggests progressive reduction in feed intake with increase in dietary ME levels during majority of weeks (9-18 weeks). Though the feed intake was significantly influenced by CP levels in the diet, the cumulative feed consumption (CFI) was significantly ($P<0.05$) higher in 15% and 16% protein groups compared to 17% CP (Table 3).

Toppo et al. (2004) found that feed intake ($P< 0.01$) was higher in low energy diet in egg type (CARI Sonali) starter chicks. Kamran et al. (2008) reported that feed intake increased ($P<0.001$) linearly as dietary protein and energy decreased during grower and finisher periods. Zaman et al. (2008) observed increased the feed intake at low dietary protein 190g/kg and high energy (3000 kcal/kg ME) significantly affected feed intake, while CP had no effect on feed intake. Kamble et al. (2019) reported significantly ($P<0.01$) lower feed intake in high energy and high protein fed groups.

Feed conversion ratio (FCR)

The diets supplemented with high ME 2700 kcal/ kg resulted in significantly ($P<0.05$) better feed conversion ratio (FCR) compared to those fed the low energy diet (ME 2500 kcal/kg). FCR improved with the increasing levels of ME in the diet this could be correlated to the fact that birds consume feed primarily to meet energy requirements. The cumulative feed conversion ratio (CFCR) value at 9-18 weeks was significantly ($P<0.05$) lowest in T9 (4.164), T7 (4.503), T6 (4.575), T8 (4.590) and T5 (4.612) groups and highest in T1 (5.178) group compare to other treatment groups (Table 2 and 3). Similar findings were observed by Bhanja and Mandal (2007) they reported that chicks fed high energy (3200kcal/kg ME) diet had better feed conversion ratio (FCR) compared to low energy (3000kcal/kg ME) diet. Gunawardhana et al. (2008) observed that increased dietary energy and protein levels significantly (Pd"0.05) observed better feed conversion ratio (FCR).

Haunshi et al. (2012) reported that better feed conversion ratio (FCR) seen in diet containing 2800 kcal/kg ME and 16% CP compared to low calorific

diets containing 2400kcal/kg ME and 16% CP and 2600kcal/kg ME and 18% CP. Perween et al. (2016) indicated that the effect of feeding different CP and ME levels on feed conversion ratio (FCR) was found significantly (P<0.05) higher containing 19% and 21% CP with 3000 kcal/kg ME in Vanaraja birds. In the present study, significantly(P<0.05) better feed conversion ratio (FCR) was observed at ME 2700 kcal/kg with 17% CP and highest feed conversion ratio (FCR) was observed at lowest ME (2500 kcal/kg) and CP 15% level fed diets. Based on the results, it can be inferred that dietary levels of 2700 kcal/kg ME with 17% CP are sufficient to attain the best feed conversion ratio (FCR) in Rajasri grower birds.

Table 2. Performance of Rajasri grower birds as influenced by three different levels of energy & protein during 9-18 weeks of age

TREATMENTS	Interaction		BWT	CFI	CFCR
	ME Kcal/Kg	CP%			
T1	2500	15	1158^{c}	4202^{a}	5.178^{a}
T2	2500	16	1204^{ab}	4178^{a}	4.775^{b}
T3	2500	17	1193^{bc}	4197^{a}	4.794^{b}
T4	2600	15	1190^{bc}	4118^{b}	4.791^{b}
T5	2600	16	1198^{abc}	4068^{c}	4.612^{c}
T6	2600	17	1205^{ab}	4011^{d}	4.575^{c}
T7	2700	15	1228^{ab}	3946^{e}	4.503^{c}
T8	2700	16	1202^{ab}	3993^{d}	4.590^{c}
T9	2700	17	1239^{a}	3913^{f}	4.164^{d}
	N		1202	8	8
	P Value		8	0.001	0.001
	SEM		0.008	12.761	0.034

Values bearing different superscripts within a column are significantly (P<0.05) different

Table 3. Performance of Rajasri grower birds as influenced by three different levels of energy and protein during 9-18 weeks of age

ME (kcal/kg)	BWT	CFI	CFCR
2500	1184^{b}	4192^{a}	4.91^{a}
2600	1197^{b}	4066^{b}	4.66^{b}
2700	1222^{a}	3951^{c}	4.41^{c}
N	24	24	24
P value	0.004	0.001	0.001
SEM	7.866	6.151	0.030
CP %			
15	1191	4088^{a}	4.824^{a}
16	1201	4079^{a}	4.659^{b}
17	1212	4041b^{b}	4.511^{c}
N	24	24	24
P value	0.129	0.001	0.001
SEM	7.86	5.15	0.030

Values bearing different superscripts within a column are significantly (P<0.05) different

Carcass parameters

Significantly (P<0.05) higher dressing percentage was recorded in T9 group compared to all other treatment groups and lowest in T2 group. The highest (P<0.05) liver weight was recorded in T7 and T9 than the other treatment groups, where no significant difference was recorded among the groups. Among all the treatment groups, significantly (P<0.05) higher gizzard weight was recorded in T8 and lowest in T5 group. Significantly (P<0.05) higher giblet weights were recorded in T4 and T9 compared to T1, T3, T5 and T6 groups.

The significantly (P<0.05) highest weights of dressing percentage, liver, heart and gizzard observed in high energy diet (ME 2700 kcal/kg) with 17%CP compared to low energy diets. Similar findings were observed Jackson et al. (1982) who reported that increasing energy level in diet increases abdominal fat pad weight, overall carcass weight. Nguyen and Chiyapoom (2005) concluded that the Betong chicken fed with 19% CP and 3000-3200 kcal/kg ME showed better growth performance and carcass quality and the high dietary energy (3200 kcal/kg ME) significantly (P<0.05) increased the abdominal fat content. Zaman et al. (2008) concluded that increasing dietary ME significantly (Pd"0.05) increased the abdominal fat, liver and gizzard weights, breast weight and fat contents of meat increased with increased crude protein levels in diets and low protein 190g/kg diet at high ME 3000 kcal/kg increased the carcass weight.

Table 4. Slaughter parameters of Rajasri grower birds as influenced by different dietary treatments during 9-18 weeks of age

	Interaction		Dressing	Heart	Liver	Gizzard	Giblet
	ME (kcal/kg)	CP %	Percentage %				
T1	2500	15	62.4^{bc}	0.48^{bc}	1.69^{b}	2.66^{c}	4.83^{d}
T2	2500	16	60.1^{d}	0.45^{c}	1.89^{b}	2.92^{b}	5.26^{ab}
T3	2500	17	62.9^{bc}	0.47^{bc}	1.83^{b}	2.63^{c}	4.94^{cd}
T4	2600	15	61.5^{cd}	0.59^{a}	1.85^{b}	3.07^{ab}	5.52^{a}
T5	2600	16	62.0^{bc}	0.43^{c}	1.72^{b}	2.32^{d}	4.48^{e}
T6	2600	17	63.3^{b}	0.47^{bc}	1.76^{b}	2.90^{b}	5.13^{bc}
T7	2700	15	61.9^{bc}	0.55^{ab}	2.28^{a}	2.52^{c}	5.35^{ab}
T8	2700	16	62.2^{bc}	0.44^{c}	1.78^{b}	3.16^{a}	5.39^{ab}
T9	2700	17	64.9^{a}	0.53^{abc}	2.37^{a}	2.53^{c}	5.43^{a}
	N		8	8	8	8	8
	P value		0.050	0.206	0.001	0.001	0.001
	SEM		0.23	0.01	0.03	0.04	0.05

Values bearing different superscripts within a column are significantly (P<0.05) different

Table 5. Slaughter parameters of Rajasri grower birds as influenced by three different levels of energy & protein during 9-18 weeks of age

ME (kcal/kg diet)	Dressing Percentage %	Heart	Liver	Gizzard	Giblet
2500	61.8^{b}	0.47	1.80^{b}	2.74	5.01^{b}
2600	62.3^{ab}	0.50	1.78^{b}	2.77	5.04^{b}
2700	63.0^{a}	0.51	2.15^{a}	2.74	5.39^{a}
N	8	8	8	8	8
P value	0.035	0.229	0.001	0.836	0.001
SEM	0.32	0.02	0.04	0.03	0.05
CP%					
15	61.9^{b}	0.54^{c}	1.94^{a}	2.75^{ab}	5.23^{a}
16	61.4^{b}	0.44^{b}	1.80^{b}	2.80^{a}	5.04^{b}
17	63.8^{a}	0.49^{a}	1.98^{a}	2.68^{b}	5.16^{ab}
N	8	8	8	8	8
P value	0.001	0.001	0.007	0.095	0.049
SEM	0.32	0.02	0.04	0.03	0.05

Values bearing different superscripts within a column are significantly (P<0.05) different

CONCLUSION

Based on the overall results, it was concluded that supplementation of 2700 kcal ME /kg diet with 15% CP diet is optimum for growth performance of Rajasri grower birds.

ACKNOWLEDGEMENT

The authors are thankful to Department of Poultry Science, College of Veterinary Sciences, P.V. Narsimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, India for funding the research.

REFERENCES

Bhanja, S.K. and Mandal, A.B. 2007. Optimising dietary energy and amino acid levels in the diets of naked neck broilers for growth, nutrient utilization and immune response in a hot climate. Journal of the Science of Food and Agriculture. 87: 945-950.

Gunawardana,P., Roland, D.A. and Bryant, M.M. 2008. Effect of energy and protein on performance, egg components, egg solids, egg quality, and profits in molted Hy-LineW-36 hens. Journal of Applied Poultry Research.17: 432-439.

Haunshi, S., Panda, A.K., Rajkumar, U., Padhi, M.K., Niranjan, M. and Chatterjee, R.N. 2012. Effect of feeding different levels of energy and protein on performance of Aseel breed of chicken during juvenile phase. Tropical Animal Health Production.44: 1653-1658.

Haunshi, S., Panda, A.K., Padhi, M.K. and Bhanja, S.K. 2015. Effects of Varying Nutrient Densities on the Production Performance of Aseel Layers. Animal Nutrition and Feed Technology. 15: 51-58.

ICAR-NIANP. 2013. Nutrient Requirements of Animals- Poultry. Indian Council of Agricultural Research, New Delhi.

Jackson, S., Summers, J.D. and Leeson, S. 1982. Effect of dietary protein and energy on broiler carcass composition and efficiency of nutrient utilization. Poultry Science.61: 2224-2231.

Kamble, P., Kadam, M., Kakasaheb, K., Archana, P. and Pratik, R. 2019. Optimization of

Dietary Protein and Energy Requirement of Kadaknath Chicken during the Starter Phase. Journal of Animal Research.9: 135-141.

Kamran, Z., Sarwar, M., Nisa, M., Nadeem, M.A., Ahmad, S., Mushtaq, T. and Shahzad, M.A. 2008. Effect of lowering dietary protein with constant energy to protein ratio on growth, body composition and nutrient utilization of broiler chicks. Asian-Australasian Journal of Animal Sciences.21:1629-1634.

Kingori, A.M., Tuitoek, J.K., Muiruri, H.K. and Wachira, A.M. 2003. Protein requirements of growing indigenous chickens during the 14-21 weeks growing period. South African Journal of Animal Science.33: 78-82.

Nguyen, T.V. and Chiyapoom, B. 2005. Effects of dietary protein and energy on growth performance and carcass characteristics of Betong chicken at early growth stage. Songklanakarin Journal of Science and Technology. 27: 1171-1178.

Perween, S., Kaushalendra, K., Chandramoni, Sanjay, K., Pankaj, K.S., Manoj, K. and Amitava, D. 2016. Effect of feeding different dietary levels of energy and protein on growth performance and immune status of Vanaraja chicken in the tropic. Veterinary World.9: 2231-0916.

Srinivas, G., Kishan, K.M., Swathi, B. and Raju, S. 2017. Impact of rearing Rajasri birds on the livelihood and nutritional security of BPL families in Northern Telangana state. Indian Journal of Poultry Science. 52 (1): 87-90.

Toppo, S., Mandal, A.B. and Elangovan, A.V. 2004. Dietary Energy and Protein Requirements of Egg Type (CARI Sonali) Starting Chicks. Animal Nutrition and Feed Technology.4: 17-22.

Zaman, Q.U., Mushtaq, T., Nawaz, H., Mirza, M.A., Mahmood, S., Ahmad, T., Babar, M.E. and Mushtaq, M.M.H. 2008. Effect of varying dietary energy and protein on broiler performance in hot climate. Animal Nutrition and Feed Technology.146: 302–312.