Haryana Vet. (Dec., 2019) **58(2),** 153-156 **Research Article**

CRUDE PROTEIN REQUIREMENT OF MEAT TYPE BIRDS REARED IN ENVIRONMENT CONTROLLED BROILER HOUSE

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ABSTRACT

A study was conducted to assess the effect of reducing crude protein level without and with the addition of enzyme protease in diet of meat type birds reared in environment controlled broiler house (ECBH). Seven hundred twenty meat type chicks were divided into 5 groups. Five diets were formulated for different phases. Each diet was fed to triplicate group of chicks having 48 birds in each replicate. During all phases, control diet (T0) was formulated as per ICAR specifications and two diets were prepared by reducing 1 and 2% crude protein level (T1 & T2) and another two diets (T3 & T4) with the supplementation of enzyme protease at reduced CP levels by maintaining the required metabolizable energy and essential amino acid levels. Results showed that 1% reduction in CP than prescribed levels improved (p=0.05) weight gain and FCR during starter phase. For overall growth period, 1% CP reduction showed improved (P=0.05) growth and feed efficiency. Dressing percentage and giblet weight were not affected by various treatments during the study. It was observed that addition of enzyme protease in the diets with reduced CP in the grower and finisher phases had no beneficial effect. It was concluded that in ECBH, CP can be reduced by 2% in starter and 1% during overall growth period than the recommended levels without affecting the growth and carcass parameters.

Keywords: Environment controlled broiler house, Growth and carcass parameters, Meat type birds, Protease, Reduced crude protein

Feed alone accounts for about 70% of the total inputs in poultry production. Poultry nutritionists are continuously involved in minimizing the feed cost without affecting the growth performance of birds. Enough information is available with respect to the nutrient requirements of meat type birds in the open sheds. However, nutrient requirements of birds reared in ECBH has not been defined till date. Possibly when better environment is provided to poultry, their requirements of different nutrients may be reduced. The most expensive ingredients used for formulating poultry rations are the protein sources. Use of low CP diets with AA supplementation in broilers has given impetus to reduce feed cost, feed efficiency and flexibility in feed formulation (Kidd and Kerr, 1996). Although, there is a biological limit to which dietary CP can be reduced, some attempts have been made to reduce dietary CP level with no adverse effects on broiler performance (Widyaratne and Drew, 2011). However, some researchers have found that growth rate, feed efficiency and carcass composition were affected in broilers fed low CP diets although the levels of AA and other nutrients were as per requirements (Waldroup *et al.*, 2005). Under tropical condition where environmental temperature goes as high as 48° C and is not congenial for raising broilers, efforts are being made to raise broilers during these critical periods in ECBH. The present study was planned as an attempt to examine the effect of reduced CP diets on broiler performance and carcass characteristics of broilers reared in ECBH without and with use of enzyme protease.

MATERIALS AND METHODS

Grouping and Housing of chicks

Seven hundred twenty day old sexed chicks were wing banded at 0 day, weighed individually and allocated to fifteen groups. Five diets were prepared and offered to triplicate group of chicks having 48 birds in each replicate. Chicks were housed in the ECBH where temperature was maintained as per the requirements of birds. Standard managemental practices were followed during whole experimental period.

Dietary Treatments

Five diets were formulated for this study for all the three phases of growth (Table 1). In starter phase (1^{st} to 14^{th} day), the control diet (T_0) was prepared with 22% CP and 3000 Kcal of ME/kg of diet as per ICAR (2013) specifications. Two experimental diets i.e. T_1 and T_2 with 1% and 2% reduced CP than T_0 at same level of ME were prepared. Similarly, another two diets i.e. T_3 and T_4 were formulated by supplementing enzyme protease @ 15000 Prot units/kg of feed in T_1 and T_2 diets, respectively.

During grower phase (15^{th} to 21^{st} day), five diets were formulated as per protocol used in the starter phase i.e. control diet (T_0) contained 21.5% CP and the other two diets contained 20.5% (T_1) and 19.5% (T_2), respectively. Another two diets were formulated by adding enzyme protease @ 15000 Prot units/kg of feed to T_1 and T_2 rations. The ME level for all the diets were kept at 3050 Kcal/kg in diets during this phase as per ICAR (2013) specifications.

Similarly, in finisher phase, control diet (T_0) was formulated with 19.5% CP (ICAR 2013) and T_1 and T_2 contained 18.5 and 17.5%, respectively. Subsequent two diets T_3 and T_4 were formulated by adding protease @ 15000 Prot units/kg of feed in T_1 and T_2 diets. The ME level for this phase was kept 3100 Kcal/kg of feed. The experimental diets were balanced for meeting the nutrient

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requirement of vitamins, minerals, lysine and methionine. Percent ingredients composition of the diets used during starter, grower and finisher phase is presented in the table 1. *Ad libitum* feeding and watering was done throughout the experimental period and feed was offered twice daily in the morning and evening. Daily feed offered to each replicate was maintained. Body weight was recorded at weekly interval up to 35^{th} day to determine the weekly body weight and body weight gain. Feed residue left in each replicate was recorded at weekly interval to calculate feed intake and feed conversion ratio. Mortality, if any, was recorded daily. At the end of experiment, six birds (three male and three female) of identical body weight from each treatment were sacrificed. The birds were starved for 12 hours before being sacrificed but drinking water was provided *adlib*. The birds were slaughtered by severing the jugular vein and carotid artery on one side of neck and allowed to bleed. Each bird was defeathered and eviscerated maintaining proper hygiene. The eviscerated weight, giblet weight and abdominal fat were recorded and expressed in terms of g/100g of body weight. The data were statistically analysed using one-way analysis of variance (SPSS, version 24.0) and the treatment means were compared for statistical significance by Duncan's Multiple Range Test (Duncan, 1995).

RESULTS AND DISCUSSION

Chemical composition of various diets showed that the CP level, other proximate principles and Calcium and Phosphorous were well within the desired levels (Table 1).

Starter phase (1^{st} to 14^{th} day)

Maximum (P=0.05) final body weight, BWG and best FCR were observed in the group fed T_1 diet. Lowest (P=0.05) final body weight and body weight gain were obtained in the group fed T_4 diet (Table 2). However, body weight and body weight gain in the group fed T_3 diet were comparable with T_1 fed group. Poorest (P=0.05) FCR was obtained in the groups fed T_0 and T_2 diets. Nonsignificant (P=0.05) difference in cumulative feed intake per bird was observed in various treatments during starter phase. Kamran *et al*. (2008) also found non-significant differences in feed intake during the starter phase at constant CP: ME ratio. PER and CCR were highest (P=0.05) in the group fed T_1 and T_3 diets.

Grower phase (15^{th} to 21^{st} day)

During grower phase (Table 2), final body weight was maximum (P=0.05) in the group fed T_1 diet, whereas lowest final body weight was in the group fed T_4 diet. Highest (P=0.05) body weight gain was in the groups fed T_0 and T_1 diets and was lowest (P=0.05) in T_4 diet fed group. Feed intake was not affected (P=0.05) amongst all the groups. Best (P=0.05) FCR (1.934) was observed in the group fed T_1 diet and poorest (P=0.05) FCR was seen in group fed diets T_2 (2.069) and T_4 (2.087). Statistically comparable result of FCR was observed in the group fed T_0 and T_3. PER and CCR values were significantly (P=0.05) better in the T_1 diet fed group.

Finisher phase (22^{nd} to 35^{th} day)

Results (Table 2) obtained in this phase with regards to final body weight shows that groups fed T_0 and T_1 diet had highest (P=0.05) final body weight. Whereas lowest (P=0.05) final body weight was obtained in the groups fed T_2 and T_4 diet. Similarly, body weight gain was highest (P=0.05) in the groups fed T_0 and T_1 diets and lowest (P=0.05) body weight gain was in the groups fed T_2,

Table 1
Percent ingredient composition of experimental diets during starter, grower and finisher phase

Treatments	Starter					Grower					Finisher				
Ingredients (/100 kg)	T_0	T_1	T_2	T_3	T_4	T_0	T_1	T_2	T_3	T_4	T_0	T_1	T_2	T_3	T_4
Maize (Kg)	57.11	57.46	58.74	57.45	58.73	57.00	59.04	60.18	58.34	60.24	62.39	65.00	66.50	64.88	66.38
Soybean Meal (Kg)	29.00	28.00	27.00	28.00	27.00	25.00	24.25	23.00	24.25	23.00	22.00	18.40	19.25	18.40	19.25
Maize Gluten Meal (Kg)	2.75	3.00	2.00	3.00	2.00	4.40	3.25	3.00	3.25	3.00	3.00	3.40	1.70	3.40	1.70
Groundnut Extraction (Kg)	4.50	1.00	1.00	1.00	1.00	4.00	4.00	2.25	4.00	2.25	4.00	4.10	3.00	4.10	3.00
De-oiled Rice Bran (Kg)	—	4.0	4.5	4.0	4.5	3.0	2.9	5.0	2.9	5.0	2.0	3.0	3.3	3.0	3.3
Oil (Kg)	2.50	2.50	2.60	2.50	2.60	3.00	3.00	3.00	3.00	3.00	3.00	2.80	3.00	2.80	3.00
Di-calcium Phosphate (Kg)	2.00	2.00	2.00	2.00	2.00	1.70	1.70	1.70	1.70	1.70	1.40	1.40	1.40	1.40	1.40
Limestone Powder (Kg)	1.50	1.40	1.50	1.40	1.50	1.30	1.25	1.25	1.25	1.25	1.20	1.25	1.20	1.25	1.20
Methionine (g)	140	140	160	140	160	100	110	125	110	125	140	150	150	150	150
Salt (g)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
Enzyme protease* (g)	0	0	0	12	12	0	0	0	12	12	0	0	0	12	12
Additives **(g)	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Analyzed values: Crude Protein (%)	21.97	20.93	19.92	20.93	19.90	21.43	20.46	19.47	20.47	19.40	19.47	18.55	17.43	18.54	17.42
Calcium (%)	0.96	0.97	0.95	0.96	0.94	0.96	0.98	0.95	0.92	0.91	0.78	0.81	0.82	0.84	0.86
Av. Phosphorous (%)	0.43	0.42	0.46	0.47	0.45	0.38	0.39	0.36	0.37	0.39	0.37	0.34	0.32	0.36	0.33

Each 100 kg ration contained: *Enzyme protease 15,00,000 Prot units. **Additives include Vit A 8,25,000 IU, Vit D3 1,20,000 IU/, Vit K 100 mg, Riboflavin 500 mg, Thiamine 80 mg, Pyridoxine 160 mg, Vit E 800 mg, Cynacobalamine 100 mcg, Niacin 1200 mg, Calcium pantothenate 80 mg, Manganeese sulphate 25 g, Ferrous sulphate 10 g, Copper sulphate 500mg, Zinc oxide 8g, Potassium Iodide 100 mg, Coccidiostat 60g.

Table 2
Growth performance of meat type birds during different phases of growth reared in ECBH

Phase	Parameters	Treatments					
		T_0	T_1	T_2	T_3	T_4	S. E. M.
Starter (0-14 day)	IBW (g)	53.2	53.3	53.3	53.2	53.1	0.030
	FBW (g)	317.0^{a}	329.2^{b}	317.1^{a}	325.1^{b}	315.0^{a}	1.700
	BWG (g)	263.8^{a}	275.9^{b}	263.9^{a}	271.9^{b}	261.9^{a}	3.100
	FI (g)	423.5	422.9	421.9	419.0	415.6	4.300
	FCR	1.604^{c}	1.533^{a}	1.599^{c}	1.540^{ab}	1.587^{bc}	0.018
	PER	2.832^{a}	2.966^{b}	2.844^{a}	2.949^{b}	2.865^{ab}	0.018
	CCR	0.207^{a}	0.217^{b}	0.208^{a}	0.216^{b}	0.210^{ab}	0.001
Grower (15-21 day)	FBW (g)	598.2^{bc}	614.3^{d}	587.4^{ab}	601.0^{c}	578.1^{a}	3.600
	BWG (g)	282.5^{c}	285.1^{c}	267.0^{ab}	275.6^{bc}	260.8^{a}	2.900
	FI (g)	553.2	551.4	552.0	544.7	543.7	2.400
	FCR	1.958^{ab}	1.934^{a}	2.069^{b}	1.977^{ab}	2.087^{b}	0.021
	PER	2.376^{bc}	2.405^{c}	2.251^{ab}	2.354^{abc}	2.232^{a}	0.024
	CCR	0.167^{bc}	0.169^{c}	0.158^{ab}	0.166^{abc}	0.157^{a}	0.002
Finisher (22-35 day)	FBW (g)	1321.7^{c}	1328.8^{c}	1240.5^{a}	1274.6^{b}	1249.3^{a}	10.100
	BWG (g)	723.4^{b}	714.4^{b}	653.1^{a}	673.6^{a}	671.2^{a}	7.800
	FI (g)	1871.2	1816.8	1795.6	1748.1	1789.4	19.300
	FCR	2.586^{ab}	2.475^{a}	2.753^{b}	2.596^{ab}	2.678^{ab}	0.038
	PER	2.021	2.140	2.078	2.084	2.149	0.084
	CCR	0.125^{ab}	0.130^{b}	0.117^{a}	0.124^{ab}	0.121^{ab}	0.002

Values with different superscripts differ significantly (p=0.05) within each row
IBW-Initial Body Weight, FBW-Final Body Weight, FI-Feed Intake, FCR-Feed Conversion Ratio, PER-Protein Efficiency Ratio, CCR-Calorie Conversion Ratio, S.E.M-Standard Error of Mean

T_3 and T_4 diets. Cumulative feed intake in this phase remained non significant (P=0.05) amongst various treatments. FCR was best (P=0.05) in the group fed T_1 diet whilst the poorest (P=0.05) FCR was observed in the group fed T_2 diet. Different treatments failed to affect the protein efficiency ratio during this phase. Maximum (P=0.05) CCR was observed in the group fed T_1 diet.

Overall performance (1st to 35th day of age)

Final body weight and body weight gain were significantly (P=0.05) better in the groups fed control (T_0) and T_1 diets. However, groups fed T_2 and T_4 diets showed lowest (P=0.05) final body weight and body weight gain (Table 3). The difference in rate and efficiency of growth probably occurred due to poor efficiency of utilization of ME and CP, although critical amino acids (AA) were according to the requirements. This might be due to inadequate levels of one or more lesser-essential AA like Arginine, Iso-leucine, and Valine in the low-CP diets, because levels of these AA were not taken care, and these lesser-essential AA can be a limiting factor when CP is reduced (Kamran *et al.*, 2008). Hussain *et al*. (2001) reported that broiler feed supplemented with essential amino acids in low CP diets could improve the growth of broilers during starter phase. Conversely Alster *et al*. (1984) reported that a reduction in the protein level in feed and maintaining the energy level resulted in statistically (P=0.05) higher body weight gain in the group fed high protein supplemented diet. Addition of enzyme protease in the T_3 diet, birds could not attain similar final body weight and body weight gain as by group fed T_1 diet but was better (P=0.05) than the T_2 and T_4 diets fed group. These results are in the consonance with Angel *et al*. (2011) and Rada *et al*. (2013). Both reported that the addition of enzyme protease regardless of its concentration in the low CP feed produced similar body weight gain when compared with high CP diet without providing the benefit of enzyme protease. Non-significant (P=0.05) difference was observed in the feed intake of different dietary treatments during the overall experimental period. The results obtained in this study are in agreement with Hussain *et al.* (2001) and Waldrop *et al.* (2005) who also reported non-significant difference in the feed intake of broiler fed diets with reduced CP levels during all the phases of growth.

Best (P=0.05) FCR was observed in the group fed diet T_1. However, FCR was poorest (P=0.05) in the groups fed diet T_2 and T_4. Fru-Nji *et al.* (2011) reported non significant (P=0.05) effect on FCR in low CP fed diets supplemented with exogenous enzyme protease compared to standard CP level fed diet. FCR of diet T_3 fed group

Table 3

Effect of reducing dietary crude protein level and addition of enzyme protease in meat type birds reared in ECBH during overall period of experiment (1st to 35th day)

Parameters	Treatments					
	T_0	T_1	T_2	T_3	T_4	S. E. M.
Initial body wt	53.2	53.3	53.3	53.2	53.1	0.030
Final body wt	1321.7^{c}	1328.8^{c}	1240.5^{a}	1274.6^{b}	1249.3^{a}	10.100
BWG (g)	1268.4^{c}	1275.5^{c}	1187.2^{a}	1221.3^{b}	1196.2^{a}	10.100
FI (g)	2847.8	2791.1	2769.5	2711.9	2748.6	20.400
FCR	2.24^{ab}	2.19^{a}	2.33^{b}	2.22^{ab}	2.30^{b}	0.020
PER	2.20	2.38	2.34	2.33	2.38	0.027
CCR	0.145^{ab}	0.151^{b}	0.139^{a}	0.146^{ab}	0.141^{a}	0.0015

Values with different superscripts differ significantly (p=0.05) within each row

where 1 % CP reduction was done along with the addition of enzyme protease was comparable with control diet. There was no significant (P=0.05) difference in PER amongst all the groups fed different diets. Best (P=0.05) CCR was observed in the group fed diet T_1. CCR of T_0 and T_3 diets fed group was comparable.

Carcass parameters

Non-significant (P=0.05) results (Table 4) were obtained in the dressing percentage and giblet weight (g/100 g) of meat type birds raised in ECBH amongst various treatments studied. Khan *et al.* (2011) reported that there was no significant (P=0.05) difference in dressing percentage and giblet weight among different treatments where CP was reduced. Rada *et al.* (2013) reported non-significant (P=0.05) differences in the carcass parameters among various treatments irrespective of addition of enzyme protease.

Feeding low CP diets with constant ME:CP ratio could not impact the carcass parameters and abdominal fat percentage in broiler chickens (Kamran *et al*, 2008). Reducing the crude protein level in the diet increased the abdominal fat content. The highest (P=0.05) amount of abdominal fat percentage was received in the groups fed T_1 (2.74%) and T_2 (3.07%) diets. However lowest (P=0.05) abdominal fat content was in control (T_0) diet. Addition of enzyme protease to the reduced levels of crude protein diets could compensate the abdominal fat content. Increased abdominal fat at reduced CP level in study corroborate the results of Darsi *et al.* (2012) who also reported that, feeding reduced CP level to the birds increased the fat deposition in the whole body and abdominal cavity.

Table 4

Effect of reduction in crude protein and supplementation of protease in meat type birds reared in ECBH on the carcass parameters

Parameters	Treatments					
	T_0	T_1	T_2	T_3	T_4	S. E. M.
Dressing percentage	54.15	54.19	55.93	53.80	55.07	0.34
Heart wt (g/100g)	0.47	0.48	0.45	0.52	0.47	0.01
Liver wt (g/100g)	2.36	2.20	2.25	2.27	2.40	0.06
Gizzard wt (g/100g)	2.14	2.38	2.15	2.39	2.22	0.05
Abdominal fat (g/100g)	1.67^{a}	2.74^{b}	3.07^{b}	2.29^{ab}	2.58^{ab}	0.15

Values with different superscripts differ significantly ($p \leq 0.05$) within each row

It can be concluded that during starter phase, the CP level can be reduced up to 2% safely in environment controlled broiler houses than the standard recommended levels. The overall growth performance of the meat type birds, showed that CP level can be reduced by 1% in ECBH without affecting the carcass parameters. However, addition of enzyme protease failed to affect the various productive parameters in meat type birds.

REFERENCES

Alster, F.A. and Carew, L.B. (1984). Energy balance and thyroid function in protein-deficient chicks. *Nutri. Rep. Inter.* **30:** 1231–1240.

Angel, C.R., Saylor, W., Vieira, S.L. and Ward, N. (2011). Effects of a monocomponent protease on performance and protein utilization in 7 to 22 days old broiler chickens. *Poult. Sci.* **90:** 2281–2286.

Darsi, E., Shivazad, M., Zaghari, M., Namroud, N.F. and Mohammadi, R. (2012). Effect of reduced dietary crude protein levels on growth performance, plasma uric acid and electrolyte concentration of male broiler chicks. *J. Agri. Sci. Tech.* **14:** 789-797.

Duncan, D.B. (1995). Multiple range and multiple F-test. Biometrics II. 1-42.

Fru-Nji, F., Kluenter, A.M., Fischer, M. and Pontoppidan, K. (2011). A feed serine protease improves broiler performance and energy digestibility. *J. Poult. Sci.* **48:** 239-246.

Hussain, A.S., Cantor, A.H., Pescatore, A.J., Gates, R.S., Burnham, D., Ford, M.J. and Paton, N.D. (2001). Effect of low protein diets with amino acid supplementation on broiler growth. *J. App. Poult. Res.* **10:** 354–362.

ICAR. (2013). Nutrient requirements of animals - Poultry (ICAR-NIANP) (3rd Edn.) Krishi Bhawan. New Delhi.

Kamran, Z., Sarwar, M., Nisa, M., Nadeem, M.A., Mahmood, S., Babar, M.E. and Ahmed, S. (2008). Effect of low-protein diets having constant energy-to-protein ratio on performance and carcass characteristics of broiler chickens from one to thirty-five days of age. *Poult. Sci.* **87:** 468–474.

Kidd, M.T. and Kerr, B.J. (1996). Growth and carcass characteristics of broilers fed low-protein threonine supplemented diets. *J. App. Poul. Res.* **5:** 180–190.

Rada, V., Foltyn, M., Lichovnikova, M. and Musilova, A. (2013). Effects of protease supplements of low protein broiler diets on growth parameters and carcass characteristic. *Mendel Net.* pp. 268- 272.

SPSS. Statistical Packages for Social Sciences Version 24.0. SPSS Inc. Chicago, IL, USA.

Waldroup, P.W., Jiang, Q. and Fritts, C.A. (2005). Effect of supplementing broiler diets low in crude protein with essential and non-essential amino acids. *Inter. J. Poult. Sci.* **4:** 425–431.

Widyaratne, G.P. and Drew, M.D. (2011). Effects of protein level and digestibility on the growth and carcass characteristics of broiler chickens. *Poult. Sci.* **90:** 595–603.