International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
(A Peer Reviewed, Referred, Indexed and Open Access Journal)
DOI: 10.22192/ijarbs Coden: IJARQG (USA) Volume 9, Issue 4 -2022

Research Article

DOI: http://dx.doi.org/10.22192/ijarbs.2022.09.04.012

Influence of protease supplementation on carcass traits of broilers fed with normal and low protein diets

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Abstract

Crude protein is the second most expensive and important nutrients in broiler diets. Protease enzymes were tried to improve crude protein digestibility and production performance. This study was carried out to evaluate growth performance and carcass characteristics of broilers fed with normal and reduced crude protein diets supplemented with protease enzyme. Two hundred and seventy Vencobb430 straight run chicks were randomly alloted into nine treatment groups of 3X3 factorial experiment. Each treatment group contains three replicates with ten chicks in each replicate. The chicks were banded and reared for thirty five days. The diets were formulated with three levels of protein (standard, 5 percent low protein and 10 percent low protein) and supplemented with three levels of protease enzyme (0, 0.035 and 0.07 percent of the diets).Supplementation of protease enzyme did not reveal any significant improvement in body weight, feed consumption, feed conversion ratio while compared with control diets. Reduction of crude protein numerically reduced the percent carcass and breast meat yields. Protease supplementation did not improve carcass characteristics (%) like dressing yield, breast yield, fat, leg, liver and gizzard. Protease supplementation to broiler fed with corn – soyabean meal based normal and low crude protein diets did not have any effect on production performance and carcass characteristics. Reduced crude protein diet did not show any detrimental effect on production performance of commercial broilers.

Keywords: Broiler, protease, production performance, carcass characteristics

Introduction

Poultry industry has attained tremendous development in the past few decades which is due to the improvement in genetic and nutritional interventions. With every new generation there is improvement in production performance with better feed conversion efficiency.

Adequate crude protein level in the diet is important for optimum production performance. Crude protein in the diet is met by various vegetable and animal source feed ingredients. Soyabean meal is the commonly used protein source in broiler diets. With continuous demand, Soyabean meal price is increasing steadily. Improving efficiency of the feed ingredients and reducing feed cost are important for profitable poultry business.

Studies were carried out with supplementation of protease enzymes on production performance of broilers. Few studies were carried out with low crude protein diets with varying performance. However, with the use of enzymes which could improve the digestibility of protein is getting importance. In the present study, the effect of protease enzyme supplementation to the normal and low crude protein diets on growth performance and carcass characteristics in broiler chickens was studied

Materials and Methods

A total 270 newly hatched uniform body weight broiler chicks (VenCobb 430) were obtained from a local hatchery and randomly distributed into nine treatment groups consisting of three replicates per treatment. Each replicate consisted of ten birds. Three basal diets were prepared *viz.*, standard broiler ration (SBR), 5% low protein ration (5%LPR) and 10% low protein ration (10%LPR). Each diet was supplemented with protease enzyme at the rate of 0, 350 and 700 g per ton of feed (Table 1).

Table 1. Experimental design.

Groups	Experimental diets
T1	Standard basal ration (SBR)
T2	5 per cent low protein ration (LPR5%)
T3	10 per cent low protein ration (LPR10%)
T4	SBR + 0.035 per cent protease
T5	SBR + 0.070 per cent protease
T6	LPR5% + 0.035 per cent protease
T7	LPR5% + 0.070 per cent protease
T8	LPR10% + 0.035 per cent protease
T9	LPR10% + 0.070 per cent protease

The protease enzyme used in the present study was alkaline protease having 9 lakhs units per gm and added to the diet as top dress.

The birds were reared for period of 35 days under deep litter rearing system. The birds were fed with three phases of diets namely, pre-starter (0-10 days), starter (11-24 days) and finisher (25-35 days of age) (Table 2). *Ad libdum* feeding and watering was followed during the study period and standard managemental conditions including lighting, vaccination, etc., were followed.

The growth performance parameters of the broiler chicken were studied at weekly basis by individually weighing the bird's body weight at the start of each week before feeding in the morning. The replicate wise feed intake was measured, and the feed conversion ratio was calculated. At the end of the experimental period, 9 birds per treatment (3 per replicate) were sacrificed and carcass parameters were studied.

Statistical analysis

The data obtained by various parameters were subject to analysis of variance using the Statistical Package for Social Sciences (SPSS) version 16.0. The means were compared for significance using Tukey's range test and P values less than 0.05 was considered significant.

Results and Discussion

Body weight

Mean cumulative body weight of broiler chicken fed diets supplemented with three different levels of protease at three different levels of crude protein is presented in Table 3 and graphically represented in Figure 1. The mean cumulative body weight at the end of the fifth week ranged from 2055.97 g (T8) to 2252.57 g (T2). On statistical analysis of the data, it revealed that the mean cumulative body weight of broilers showed no significant difference (P>0.05) among different dietary treatments.

The result revealed that normal growth pattern for all the experimental groups and there was no significant difference between the treatment groups. This finding is in agreement with, Dessimoni *et al*.,(2019) who reported that there was no significant interaction between the reductions in amino acids and protease supplementation on the performance variables of broilers from 1 to 42 days of age. Wang *et al*., (2007) reported that enzyme supplementation had no effect on body weight gain. However, Stark *et al*., (2009) reported that protease supplementation to broiler diets improved body weight significantly (P<0.05).

Feed consumption

Mean weekly feed intake of broiler chicken fed diets supplemented with three different levels of protease at three different levels of crude protein is presented in Table 4 and depicted in Figure 2. The mean overall feed intake per bird ranged from 3074.0 g (T7) to 3269.67 g (T2). On statistical analysis of the data, it revealed that the overall mean feed intake of broilers showed no significant difference (P>0.05) among different dietary treatments.

From the result it may be concluded that addition of protease at various levels of crude protein in the broiler diets resulted a decreased in the feed consumption. However, the result did not show statistical significant difference among various treatment groups. This result is in agreement with Oxenboll *et al*., (2011), Gervais Ndazigaruye *et al*., (2019), Toledo *et al*., (2007) and Palak Tripathi *et al*., (2020) who concluded that inclusion of protease in broiler diets with different protein levels did not affect feed intake at 42 days of age.. However, Lin Yuan *et al*., (2017) and Sonu *et al*., (2018) reported that supplementation of protease to broiler diets improved feed intake significantly (P<0.05).

Table 2: Ingredient and nutrient composition of broiler pre starter diet (%)

Ingredients	Pre-starter			Starter			Finisher		
Ingredients (%)	SBR	LPR5 %	LPR10 %	SBR	LPR5 %	LPR10 %	SBR	LPR5 %	LPR10%
Maize	59.31	62.62	65.65	61.25	64.26	67.27	62.7	65.4	68.1
Deoiled soybean cake	35.30	325.00	29.80	32.0	29.4	26.8	28.7	26.3	23.9
Ricebran oil	2.00	1.50	1.20	3.6	3.2	2.8	5.3	4.9	4.5
Calcite	0.90	0.90	0.90	0.9	0.9	0.9	0.9	0.9	0.9
Mono-dicalcium phosphate	1.40	1.40	1.40	1.3	1.3	1.3	1.2	1.2	1.2
Salt	0.30	0.30	0.30	0.3	0.3	0.3	0.3	0.3	0.3
DL-Methionine	0.30	0.28	0.26	0.25	0.23	0.21	0.22	0.21	0.20
L-Lysine HCl	0.23	0.23	0.23	0.14	0.15	0.16	0.12	0.13	0.14
Sodium bicarbonate	0.10	0.10	0.10	0.1	0.1	0.1	0.1	0.1	0.1
Additive†	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Total	100.0	100.0	100.0	100.0 0	100.00	100.00	99.54	99.44	99.34
Nutrient Composition (%)									
Crude protein	22.5	21.38	20.25	21.0	19.95	18.9	19.5	18.53	17.55
Calcium	0.80	0.80	0.80	0.80	0.80	0.80	0.72	0.72	0.72
Available phosphorus	0.40	0.40	0.40	0.40	0.40	0.40	0.36	0.36	0.36
Dig. Lysine	1.25	1.19	1.13	1.1	1.04	0.99	1.0	0.95	0.90
Dig. Methionine	0.62	0.58	0.55	0.54	0.51	0.48	0.49	0.47	0.44
Metabolizable energy (kcal/kg)	3,000	3,000	3,000	3,125	3,125	3,125	3250	3250	3250

SBR – Standard broiler ration
LPR5% - 5% crude protein reduction ration
LPR10% - 10% crude protein reduction ration
Additive†
Mineral mixture at the added level per kg feed supplied manganese-91 mg, zinc 91 mg, iron-85 mg, iodine-1.82 mg, and copper –30.24 mg and cobalt – 0.365mg.
Vitamin AB2D3K at added per kg feed supplied vitamin A-16500 IU, B2-13 mg, D3-3200 IU and vitamin K-2 mg.
Vitamin B complex at added level per kg feed supplied, thiamine 5 mg, pyridoxine 8mg, Niacin 320 mg, cyanocobalamine 0.05 mg, vitamin E 95 mg, calcium D pantothenate 27.5 mg and folic acid 14 mg, calcium 30.1 mg.
Coccidiostat at the level added per kg feed supplied 125 mg of Di-nitro-ortho-toluamide.
Antibiotic (Oxy tetracycline) 0.5 g was added per kg of feed.

Table 3. Effect protease supplementation at different crude protein reduction diets on body weight (g) in broiler chickens.

Treatments	DAY 1	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35
T_1	49.77±0.603	211.53±3.07	540.70±7.88	1052.40±19.39	1641.00±33.30	2248.30±49.17
T_2	50.60±0.707	211.43±3.04	534.13±7.30	1050.60±16.67	1635.93±28.90	2252.57±43.75
T_3	50.53±0.617	205.40±2.63	518.90±8.26	1011.40^{b}±18.84	1576.60±33.47	2178.40±54.35
T_4	50.47±0.684	210.93±2.29	531.83±6.62	1030.37±19.27	1606.20±33.72	2205.10±49.63
T_5	49.53±0.709	210.00±4.25	530.60±11.26	1024.13±23.97	1597.23±38.62	2191.43±56.34
T_6	50.20±0.628	209.00±2.96	535.80±7.54	1013.43±15.91	1573.23±29.48	2140.47±43.75
T_7	50.33±0.757	208.57±2.52	525.27±5.52	996.97±14.18	1548.3^{b}±24.17	2120.73±37.54
T_8	49.43±0.780	207.23±3.27	521.70±7.85	991.50±18.73	1523.17±31.14	2055.97±46.07
T_9	50.53±0.790	211.73±2.76	531.17±6.47	1010.60±13.42	1575.33±25.98	2149.80±43.91
P value	0.905	0.839	0.608	0.197	0.154	0.089

Fig 1. Weekly body weight (g)

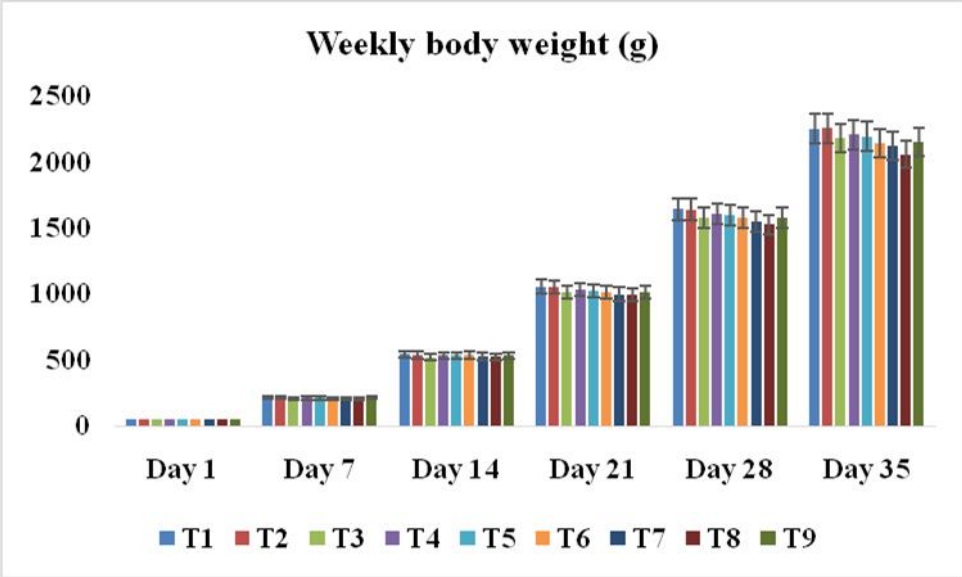
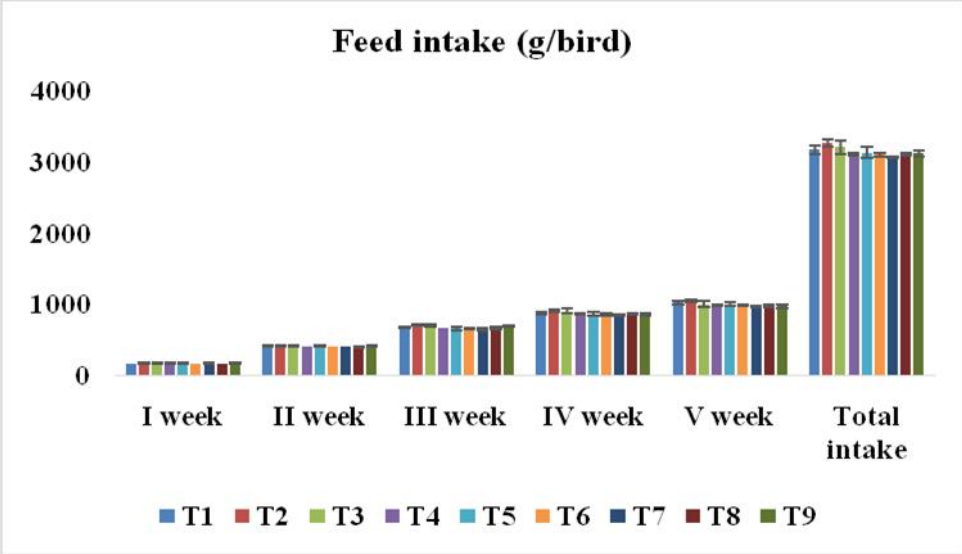


Table 4. Effect protease supplementation at different crude protein reduction diets on feed intake (g/bird) in broiler chickens

Treatments	I week	II week	III week	IV week	V week	FEED INTAKE
T_1	168.67±4.67	415.33±8.25	677.00±13.01	883.67±15.50	1033.67±26.18	3178.00±61.65
T_2	175.00±4.58	421.00±3.61	711.33±12.60	914.33±13.96	1048.00±15.01	3269.67±48.99
T_3	177.67±4.67	416.67±4.48	701.33±20.33	908.33±34.19	1012.33±41.72	3216.00±95.39
T_4	175.33±4.37	414.67±3.48	673.33±3.48	864.00±7.77	991.67±13.30	3118.67±21.31
T_5	177.33±2.73	416.00±7.77	668.00±24.54	867.00±26.00	1010.00±21.93	3138.33±78.81
T_6	172.00±3.79	414.33±2.60	667.67±7.54	868.00±14.93	988.67±7.31	3110.00±23.12
T_7	179.67±13.20	410.00±4.00	658.00±13.20	853.33±3.53	973.33±5.67	3074.00±4.58
T_8	173.67±1.86	409.67±7.84	672.67±17.25	872.33±5.78	982.33±14.77	3110.33±18.82
T_9	176.33±1.86	422.00±3.00	690.33±8.76	859.00±15.28	980.00±23.71	3127.33±43.55
P value	0.938	0.772	0.264	0.241	0.255	0.277

Fig 2. Feed intake (g/bird)



Feed conversion ratio

Mean feed conversion ratio (FCR) of broiler chicken fed diets supplemented with three different levels of protease at three different levels of crude protein is presented in Table 5 and depicted in Figure 3. The mean cumulative FCR of broilers at the end of the fifth week ranged from 1.413 (T1) to 1.513 (T8). On statistical analysis of the data revealed significant difference ($P<0.05$) among different dieteray treatment groups. The best FCR was observed in birds fed standard broiler ration (T1) which is comparable with T4 and T5 that is standard broiler diets supplemented with two levels of enzymes. However the lowest FCR was noted in birds fed with 10 % low a protein diet supplemented with 350g per ton protease (T8). The birds belongs to other dietary treatment groups showed (T6, T7 and T9) intermediate FCR values.

From the above findings it can be inferred that addition of protease enzyme at three different levels of crude protein in broiler diets showed no significant improvement in terms of feed conversion ratio. This result is in agreement with many authors who observed that non-significant effect of protease supplementation to broiler diets. (Café *et al*., 2002; Troche *et al*., 2007; Oxenboll *et al*., 2011 and Hana *et al*. 2010). In contrary, Odetallah *et al.*, (2005) and Ahmed *et al*., (2020) reported that significant improvement ($P<0.05$) in feed conversion ratio by supplementing protease enzyme.

Carcass characteristics

Carcass characteristics (%) of broiler chicken fed diets supplemented with three different levels of protease at three different levels of crude protein is presented in Table 5 and graphically represented in Figure 4. The highest dressing yield was observed in T1 (72.95%) and the lowest in T8 (69.35%). The highest breast yield was observed in T1 (28.40) and the lowest in T8 (24.97%). The result showed that Crude protein levels and protease interaction did not have significant difference ($P>0.05$) on carcass characteristics (%) like dressing yield and breast. Similar results were observed for percent yield of fat and leg also.

From the above findings it may be concluded that reduction of crude protein in the broiler diet numerically reduced the percent carcass and breast meat yield. The addition of protease in the broiler feed did not improve percent carcass and breast meat yield. The findings are in agreement with Freitas *et al*., (2011) who reported that supplementation of protease enzyme did not have any effect on carcass traits. Feeding broiler chickens with low crude protein diets did not affect carcass composition of broilers but increase carcass fat content (Si *et al*., 2001 and Rezaei *et al*., 2004).

Table 5. Effect protease supplementation at different crude protein reduction diets on feed conversion ratio (g feed /g gain) in broiler chickens.

Treatments	Week 1	Week 2	Week 3	Week 4	Week 5
T_1	0.797±0..019	1.080±0.018	1.198^{a}±0.011	1.307^{a}±0.009	1.413^{a}±0.006
T_2	0.829±0.007	1.117±0.020	1.245^{bcd}±0.019	1.359^{d}±0.010	1.452^{b}±0.010
T_3	0.865±0.024	1.146±0.019	1.281^{d}±0.011	1.398^{e}±0.010	1.485^{c}±0.014
T_4	0.832±0.013	1.110±0.017	1.227^{ab}±0.017	1.324^{ab}±0.006	1.414^{a}±0.009
T_5	0.845±0.014	1.119±0.004	1.232^{ab}±0.009	1.332^{abc}±0.003	1.432^{ab}±0.006
T_6	0.822±0.010	1.094±0.008	1.237^{bc}±0.006	1.349^{cd}±0.001	1.453^{b}±0.008
T_7	0.859±0.045	1.122±0.027	1.252^{bcd}±0.018	1.356^{d}±0.003	1.449^{b}±0.005
T_8	0.838±0.009	1.11^{b}±0.006	1.267^{bcd}±0.004	1.397^{e}±0.009	1.513^{d}±0.008
T_9	0.833±0.007	1.126±0.003	1.275^{cd}±0.002	1.363^{d}±0.003	1.455^{b}±0.006
P value	0.455	0.244	0.003	0.0000002	0.0000023

Fig 3. Feed conversion ratio (g feed/g body weight)

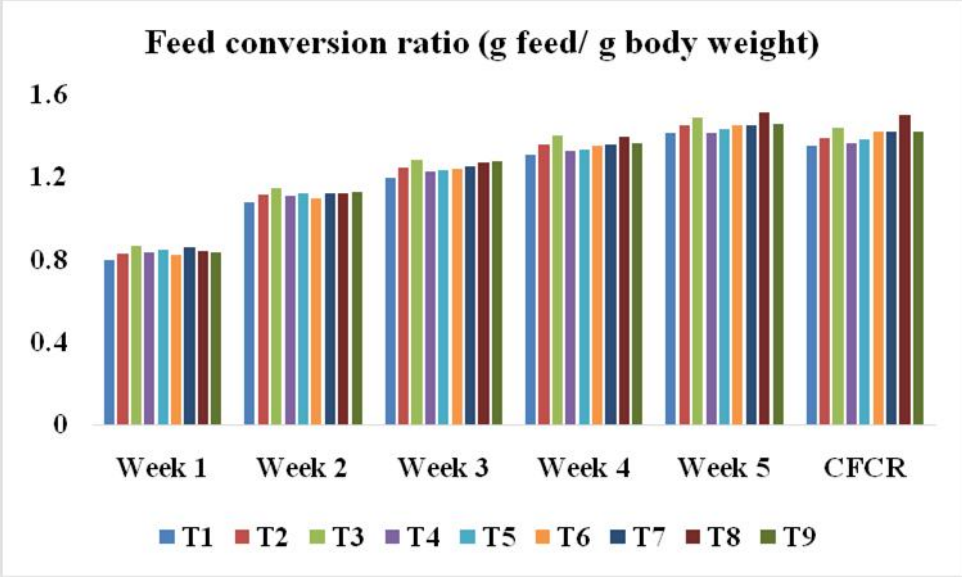
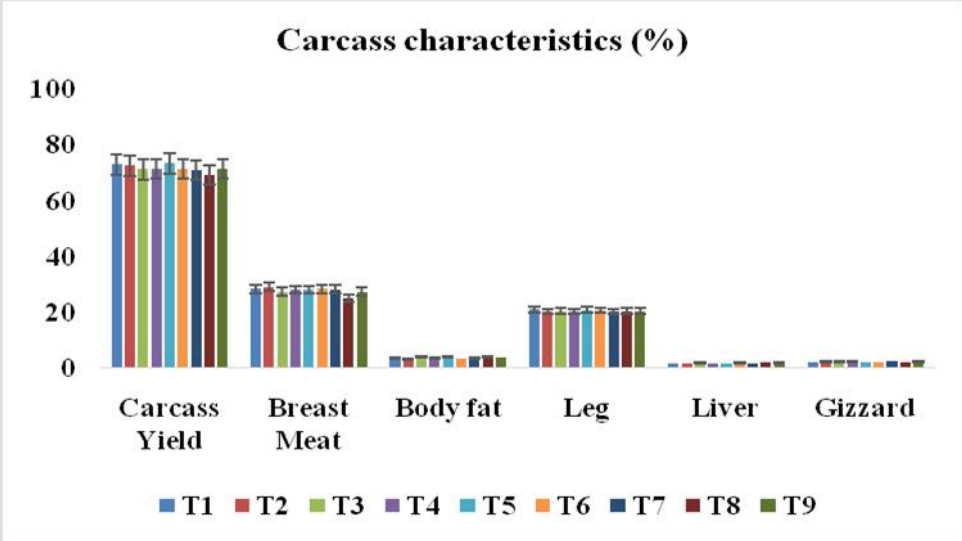


Table 6. Effect protease supplementation at different crude protein reduction diets on carcass characteristics (%) in broiler chickens

Treatments	Carcass Yield	Breast Meat	Body fat	Leg	Liver	Gizzard
T_1	72.95±0.226	28.40±0.707	3.498±0.151	20.97±0.389	1.693±0.115	2.158±0.086
T_2	72.48±0.820	29.00±0.328	3.073±0.185	20.24±0.446	1.698±0.096	2.405±0.178
T_3	71.21±1.598	27.35±0.843	3.968±0.300	20.35±0.497	1.875±0.105	2.230±0.170
T_4	71.34±0.955	28.06±0.636	3.535±0.168	20.27±0.320	1.732±0.096	2.227±0.135
T_5	73.44±1.587	27.99±0.936	3.890±0.377	20.76±0.245	1.665±0.167	2.048±0.106
T_6	71.38±0.999	28.29±1.214	3.358±0.141	20.67±0.444	1.943±0.055	2.153±0.134
T_7	71.01±3.416	28.23±1.458	3.428±0.234	20.32±1.123	1.697±0.119	2.437±0.109
T_8	69.35±1.479	24.97±0.610	3.997±0.243	20.42±0.411	1.980±0.068	2.158±0.073
T_9	71.41±0.617	27.36±0.639	3.790^{b}±0.202	20.48±0.532	1.910±0.078	2.408±0.169
P value	0.772	0.120	0.101	0.215	0.206	0.408

Fig 4. Carcass characteristics (%)



Conclusion

From this experimental, it could be concluded that the protease enzyme supplementation to broiler fed with corn-soybean meal based diet (whether normal, 5 or 10 % reduced crude protein diet) did not have any effect on body weight, feed consumption, feed conversion ratio and carcass characteristics. Reduced crude protein level in the broiler diet did not show any detrimental effect on the production performance of commercial broilers. Since protein is the primary nutrient which plays a vital role to determine the feed cost, it may be concluded that farmers can reduce level of protein in the broiler ration upto 10 percent level to get more profit.

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DOI:10.22192/ijarbs.2022.09.04.012

How to cite this article:

S. Mahendran, A. Ramanathan, P. Ponnuvel. (2022). Influence of protease supplementation on carcass traits of broilers fed with normal and low protein diets. Int. J. Adv. Res. Biol. Sci. 9(4): 109-117.

DOI: http://dx.doi.org/10.22192/ijarbs.2022.09.04.012