Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2017; 6(6): 1539-1542
Received: 04-09-2017
Accepted: 05-10-2017

Ashok Madapurada
Research Scholar, Professor Department of Animal Husbandary and Dairying Sam Higginbottom University of Agriculture, Technology and Sciences, [Naini Agricultural institute] (U.P. state Act No. 35 of 2016, as passed by the Uttar Pradesh Legislature) [Formerly-Allahabad Agricultural Institute], Allahabad, U.P., India

Neeraj
Associate Professor Department of Animal Husbandary and Dairying Sam Higginbottom University of Agriculture, Technology and Sciences, [Naini Agricultural institute] (U.P. state Act No. 35 of 2016, as passed by the Uttar Pradesh Legislature) [Formerly-Allahabad Agricultural Institute], Allahabad, U.P., India

Ramesh Pandey
Associate Professor Department of Animal Husbandary and Dairying Sam Higginbottom University of Agriculture, Technology and Sciences, [Naini Agricultural institute] (U.P. state Act No. 35 of 2016, as passed by the Uttar Pradesh Legislature) [Formerly-Allahabad Agricultural Institute], Allahabad, U.P., India

Sushma
Associate Professor Department of Animal Husbandary and Dairying Sam Higginbottom University of Agriculture, Technology and Sciences, [Naini Agricultural institute] (U.P. state Act No. 35 of 2016, as passed by the Uttar Pradesh Legislature) [Formerly-Allahabad Agricultural Institute], Allahabad, U.P., India

TN Krishnamurthy
Assistant Professor Professor Department of Animal Husbandary and Dairying Sam Higginbottom University of Agriculture, Technology and Sciences, [Naini Agricultural institute] (U.P. state Act No. 35 of 2016, as passed by the Uttar Pradesh Legislature) [Formerly-Allahabad Agricultural Institute], Allahabad, U.P., India

Ananda Manegar G
Associate Professor Department of Animal Husbandary and Dairying Sam Higginbottom University of Agriculture, Technology and Sciences, [Naini Agricultural institute] (U.P. state Act No. 35 of 2016, as passed by the Uttar Pradesh Legislature) [Formerly-Allahabad Agricultural Institute], Allahabad, U.P., India

Correspondence
Ashok Madapurada
Research Scholar, Professor Department of Animal Husbandary and Dairying Sam Higginbottom University of Agriculture, Technology and Sciences, [Naini Agricultural institute] (U.P. state Act No. 35 of 2016, as passed by the Uttar Pradesh Legislature) [Formerly-Allahabad Agricultural Institute], Allahabad, U.P., India

Effect of L-threonine supplementation to diets with reduced crude protein on body weight and survivability in commercial broilers

Ashok Madapurada, Neeraj, Ramesh Pandey, Sushma, TN Krishnamurthy and Ananda Manegar G

Abstract
The present study aimed to investigate the effect of reduced dietary crude protein (CP) and supplementation of threonine on the cumulative body weight (BW) and survivability of commercial broilers. A total of 480 broiler chicks randomly assigned to 4 dietary treatments following completely randomized design, each treatment had six replications of 20 birds each. The control dietary formulation was prepared to meet requirement of nutrients and amino acids as per the NRC (1994) [17]. The dietary CP was reduced by 1, 2 and 3 percent unit to standard recommendation in other 3 treatments, the treatments with reduced CP level were supplied with synthetic threonine to need desired level of threonine as in control and all amino acids were met as per the NRC (1994) [17] by supplying the limiting amino acids. From overall study it was indicated that reduction of CP at 1percent unit with supplementation of L– threonine was not affected body weight gain rather helped in gaining similar BW as in control diet but further reduction of CP at 2 and 3 percent unit in the diets significantly reduced body weight gain compare to control diet. The survivability % was similar among the different treatments ranging from 97.50% to 98.33% during the experimental period from 1 to 42 days.

Keywords: Broilers, crude protein, threonine, body weight and survivability.

Introduction
Poultry is today the primary source of meat in India. Its share in total meat consumption is 28 percent. It has outpaced beef veal and buffalo meat. Poultry meat the most preferred and most consumed meat in India because mutton is expensive, availability of fish is limited to coastal regions, and consumption of beef and pork has a social taboo. The poultry industry in India has a growth rate of 8 to 15 per cent per annum. The per capita recommendation of meat by the National Institute of Nutrition is 11 kg per annum as against the availability of 2.15 kg poultry meat annually (Prabakaran, 2012). The main hurdle to future growth of poultry is the availability of feed, especially maize and soya at reasonable prices. The next requirement for the Indian poultry industry is increased productivity of feed. Maize and soybean meal are the key feed ingredients. The costs of these components are very crucial in sustainable operations of a poultry farm. Maize is the primary source of energy for the Indian poultry industry and constitutes 60% of the compound feed, while soybean is the primary source of protein and forms 30-35% of the feed.

High crude protein diets for broilers results in amino acids excess and elevated nitrogen excretion. Low crude protein broiler diet supplementation with crystalline amino acids may increase in a way that matches maintenance and tissue build up needs. Also, lowering crude protein content in broiler diets may reduce feed cost, allow the use of alternate feedstuffs and improve tolerance to heat stress (Kidd and Kerr, 1997) [11-12]. Poultry nutritionists have decreased the use of protein-rich feed ingredients by supplementing critical amino acids such as DL-methionine and L- lysine which is accepted widely for use in the poultry industry. The extent of decrease in crude protein without compromising on the bird performance remains subject to much debate (Kidd *et al*., 1996) [10].

In corn – soya based feedstuff for poultry, threonine is the third limiting amino acid in for broilers and it becomes more limiting as crude protein decreases (Kidd, 2000) [14]. L-Threonine supplemented in low crude protein diets shown to support the same production that achieved in broilers fed high protein diets (Kidd *et al.,* 1997) [11-12]. Adequate threonine levels are needed to help optimum growth because it serves as an essential component of body protein and plays a vital role as the precursor of L-lysine and serine and additionally for excellent immune response and gastrointestinal mucin production (Kidd *et al.,* 1999) [13].

Although the threonine requirement is established precisely with many dose-response studies with graded levels of threonine, yet there are many contradictory reports to state the extent of crude protein reduction with L-threonine supplementation. Considering the above the present study was taken up to evaluate the supplementation of L- threonine in the broiler diets by lowering crude protein on cummulative body weight gain and survivability in commercial broilers.

Material and Methods

A day-old four hundred and eighty straight run commercial Vencobb-400 broiler chicks of uniform body weight procured from the commercial hatchery were wing banded, weighed and randomly assigned to four dietary treatments following completely randomized design. Each treatment had six replications of 20 birds each. The broiler chicks were housed in deep litter system. Standard management practices were adopted during the experimental period. Threonine Chicks were vaccinated as per the standard vaccination schedule for commercial broilers practiced in India.

The experimental commercial broiler diet was divided into three phases *i.e*., pre- starter, starter and finisher phases. The control (T_1) dietary formulation was prepared to meet the minimum requirement of nutrients and amino acids as per the NRC (1994) [17]. The dietary crude protein was reduced by one per cent unit in T_2, two percent unit in T_3 and three per cent unit in T_4 to the standard recommendations (Table 1). The treatments with reduced protein level were supplied with synthetic threonine to meet desired level of threonine as in control group. In all lowered dietary protein treatments, the minimum requirement of all amino acids were met as per the NRC (1994) [17] by supplying the limiting amino acids. Threonine to lysine ratios was maintained in all the treatments to meet the minimum requirement as per Baker (1994) [6]. The ingredient, nutrient and amino acid compositions of the diet are presented in Table 2, 3 and 4 respectively. Body weights of birds as were recorded at the end of each week and mortality was monitored daily during the experimental period. The data collected in the study was stored in MS excel and analyzed using Statistical Package for Social Science (SPSS). The data pertaining to body weight and survivability parameters for the trial were subjected to statistical analysis by one way analysis of variance (ANOVA). The statistical analysis was done at five per cent level of significance ($P \leq 0.05$). Significant mean difference between the treatments was determined by using Duncan's new multiple range tests.

Table 1: Experimental diets formulated for different growth phases of commercial broilers

Experimental diets	Pre-Starter (1 – 14 days)		Starter (15 – 28 days)		Finisher (29 – 42 days)	
	CP %	Threonine	CP %	Threonine	CP %	Threonine
T_1	23.00	Basal level	21.00	Basal level	19.00	Basal level
T_2	22.00	0.046%	20.00	0.051%	18.00	0.040%
T_3	21.00	0.094%	19.00	0.095%	17.00	0.095%
T_4	20.00	0.145%	18.00	0.140%	16.00	0.140%

CP- Crude Protein

L-threonine was supplemented to meet basal threonine level of 0.86% in pre-starter, 0.76% in starter and 0.70% in finisher rations.

Table 2: Ingredient composition of pre-starter, starter and finisher diets

Ingredient (%)	Pre-starter diets (1-14 days)				Starter diets (15-28 days)				Finisher diets (29-42 days)			
	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4
Maize	49.50	50.85	53.00	55.05	52.42	54.29	57.40	59.50	57.02	59.80	61.95	63.77
Soybean meal	41.40	38.00	34.45	31.07	36.50	33.05	29.80	26.40	31.20	27.85	24.37	20.90
Rice polish	0.00	2.20	4.01	5.46	00.00	1.80	2.15	3.67	0.00	1.00	2.70	4.60
Di-calcium phosphate	1.95	1.95	1.95	1.95	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
Limestone powder	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Salt	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Sodium bicarbonate	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
*Trace mineral mixture	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Vegetable oil	4.50	4.10	3.50	3.20	6.20	5.80	5.40	5.00	6.90	6.30	5.75	5.30
Lysine (98%)	0.012	0.110	0.215	0.325	0.000	0.110	0.215	0.320	0.015	0.110	0.220	0.330
DL- Methionine (99%)	0.288	0.311	0.332	0.355	0.232	0.260	0.295	0.320	0.210	0.240	0.270	0.300
L-Threonine (98%)	0.00	0.046	0.094	0.145	0.00	0.051	0.095	0.140	0.00	0.040	0.095	0.140
** Additives	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

***Trace mineral mixture**: Fe-90000 ppm, I–2000 ppm, Cu–15000 ppm, Mn–90000 ppm, Zn-80000 ppm, Se–300 ppm.

****Additives**: Vit A-10mIU, D_3-2.0 mIU, E-30.0g, C-50 g, B_1-2.0g, B_2-10.0g, B_6-3.0g, B_{12}-0.015, Niacin-30.0g, Calcium-D-Pantothenate 15.0g, Biotin-0.10g, Folic Acid- 2.0g and Vit-K-4.0g; Herbal Liver stimulant-1700g; Semduramicin- 30.0g; Tetracyclin-30.00g; a commercial Toxin binder-2000g.

Table 3: Nutrient compositions calculated for pre-starter, starter and finisher diets

Ingredient (%)	Pre-starter diets				Starter diets				Finisher diets			
	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4
Crude protein (%)	23.02	22.05	21.01	20.00	21.04	20.10	19.02	18.01	19.04	18.03	17.03	16.02
Metabolizable Energy (Kcal/kg)	2999	3001	3007	3003	3104	3108	3106	3104	3204	3201	3205	3202
Calcium (%)	1.02	1.01	1.00	0.99	1.06	1.05	1.04	1.03	1.04	1.04	1.03	1.02
Total phosphorous (%)	0.726	0.731	0.734	0.733	0.747	0.749	0.741	0.741	0.727	0.724	0.726	0.728
Available phosphorous (%)	0.463	0.463	0.461	0.460	0.499	0.498	0.495	0.494	0.493	0.492	0.490	0.489

Fat (%)	6.99	6.90	6.59	6.52	8.74	8.61	8.33	8.17	9.54	9.13	8.85	8.68
Linoleic acid (%)	2.36	2.37	2.32	2.33	2.83	2.83	2.79	2.78	3.07	3.01	2.96	2.95
Crude fibre%	4.73	4.79	4.86	4.89	4.52	4.58	4.52	4.56	4.33	4.33	4.39	4.46

* Amino acid composition calculated based on ingredients analysed

Table 4: Amino acid compositions calculated for pre-starter, starter and finisher diets

Ingredient (%)	Pre-starter diets				Starter diets				Finisher diets			
	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4
Lysine	1.266	1.263	1.261	1.264	1.131	1.134	1.134	1.133	1.009	1.001	1.003	1.006
Methionine	0.577	0.585	0.592	0.600	0.505	0.517	0.535	0.545	0.463	0.477	0.491	0.505
Methionine + Cysteine	0.931	0.926	0.919	0.912	0.833	0.831	0.835	0.831	0.765	0.766	0.766	0.766
Threonine	0.860	0.861	0.861	0.865	0.765	0.760	0.762	0.763	0.708	0.702	0.709	0.707
Valine	1.062	1.013	0.960	0.908	0.973	0.920	0.867	0.815	0.880	0.828	0.776	0.724
Isoleucine	0.975	0.921	0.864	0.809	0.886	0.830	0.775	0.720	0.793	0.738	0.682	0.626
Leucine	1.907	1.828	1.747	1.667	1.774	1.693	1.618	1.539	1.642	1.567	1.486	1.405
Tryptophan	0.270	0.254	0.238	0.222	0.243	0.227	0.211	0.195	0.215	0.199	0.183	0.167
Arginine	1.583	1.498	1.406	1.316	1.432	1.342	1.249	1.159	1.273	1.182	1.091	1.001
Tyrosine	0.898	0.852	0.803	0.754	0.817	0.769	0.720	0.671	0.733	0.685	0.636	0.587
Serine	1.335	1.262	1.185	1.110	1.212	1.136	1.061	0.986	1.084	1.009	0.933	0.857
Histidine	0.616	0.587	0.557	0.527	0.565	0.535	0.506	0.476	0.514	0.485	0.455	0.425
Phenylalanine	1.150	1.091	1.029	0.969	1.051	0.990	0.930	0.870	0.948	0.889	0.828	0.767
Glycine	0.961	0.901	0.841	0.783	0.878	0.818	0.767	0.709	0.792	0.737	0.678	0.618
Glycine + Serine	2.296	2.164	2.026	1.893	2.090	1.955	1.828	1.694	1.876	1.747	1.611	1.475

* Amino acid composition calculated based on ingredients analysed

Results and Discussion

The effect of supplementation of L-threonine by lowering dietary crude protein (CP) levels on the mean body weight of commercial broilers from day one to sixth week of age on weekly cumulative basis were significantly influenced among the various treatment groups (Table-5). The findings of the birds with the supplementation of L- threonine showed significantly reduced BW at 2 and 3 percent unit reduced CP diet (T_3 and T_4) on the cumulative weekly basis. Further, BW on the weekly cumulative basis in 3 percent unit reduced CP diet with L–threonine supplementation (T_4) showed lower BW (Table 5). The BWG results of low protein diets are on par with Jahaniyan (2012) [8] he concluded that with threonine supplementation in broiler diets one could not reduce dietary crude protein level by 3 percent units to the standard recommendation which lowers the growth performance.

The threonine addition significantly improved the body weight gain (BWG) at the end of the first week to end of the sixth week of age on the cumulative basis at 1 percent unit reduced CP diet group and it was non-significant with control diet-fed broilers (T_1). The results indicate that supplementation of L–threonine in improving growth performance of broilers fed low protein diets had a positive effect but was limited to 1 percent unit CP reduction to the standard recommendations. Similar results were reported by Aftab (2006) [1], Aletor *et al*. (2000) [3], Webel *et al.* (1996) [19], Waldroup *et al.* (2005) [18] and Khan *et al*. (2006) [9].

The BW results are also on par with the findings of Ahmed (2014) [2] and Bade *et al*. (2014) [5] who opined that reduction of CP by 1 percent unit and supplementation of L- threonine at different levels did not affect growth performance rather helped in gaining similar BW as that high protein control diet. However, these results are in disagreement with the findings of Kid and Kerr (1997) [11-12] and Dozier *et al*. (2000) [7] who reported that no improvement in performance was observed in broilers fed diets supplemented crystalline threonine. These controversial reports may be affected by several causes like protein content of experimental diet digestibility of amino acid, the phase of the experiment and environmental factors.

Overall survivability percentage of birds under different treatments during 42 days of experimental period among the different treatments showed a good survivability percentage of the birds and did not differ significantly are presented in Tables 6. Supplementation of L-threonine to low CP diets had no negative influence on survivability. Standard management conditions with proper vaccination schedule followed during the experimental period also helped to reduce the mortality percentage of the birds. The results are on par with the findings of Ahmed, (2014) [2], Anand (2015) [4] Kid *et al*., (2004b) [15], Mehri *et al*., (2010) [16] and Waldroup (2005) [18].

Table 5: Weekly cumulative body weight (g/bird) of commercial broilers as influenced by dietary supplementation of L-threonine by reducing the levels of crude protein

Treatment	Crude protein reduction (%)	Weekly body weight (g)					
		I	II	III	IV	V	VI
T_1	Control	163.85^a	456.95^a	845.93^a	1327.46^a	1839.23^a	2345.26^a
T_2	1.0	165.49^a	454.33^a	839.67^a	1323.63^a	1821.46^a	2337.92^a
T_3	2.0	155.18^b	431.57^b	802.34^b	1217.86^b	1676.34^b	2151.09^b
T_4	3.0	150.21^b	404.54^c	742.24^c	1111.75^c	1550.23^c	2005.92^c
S. Em. ±		2.84	5.55	9.62	28.69	22.86	16.59
C.D. at 5%		8.38	16.38	28.37	84.64	67.43	48.95
F value		6.49*	19.26*	24.49*	12.75*	35.24*	96.57*

Note: The pairs with different superscripts are significant at 5%

Table 6: Survivability of commercial broilers at the end of experiment on cumulative basis (42 days) as influenced by dietary supplementation of L-threonine by reducing the levels of crude protein

Treatment	Crude protein reduction (%)	Mortality percentage	Survivability percentage
T_1	Control	1.67	98.33 [a]
T_2	1.0	1.67	98.33 [a]
T_3	2.0	1.67	98.33 [a]
T_4	3.0	2.5	97.50 [a]
S. Em. ±		-	-
C.D. at 5%		-	-

Note: The pairs with different superscripts are significant at 5%.
NS: Non-significant.

References

1. Aftab U, Ashraf M, Jiang Z. Low protein diets for broilers. World's Poultry Science Journal. 2006; 62:688-698.
2. Ahmed T. Effect of supplementation of L-threonine on the performance of commercial broilers. Master's degree thesis. KVAFSU, Bidar, 2014.
3. Aletor VA, Hamid II, Niess E, Pfeffer E. Low protein amino acid supplemented diets in broiler chickens: Effects on performance, carcass characteristics, whole-body composition and efficiencies of nutrient utilisation. J. Sci. Food Agric. 2000; 80:547-554.
4. Anand Manegar G. Effect of dietary supplementation of L-threonine and L- tryptophan by reducing levels of crude protein on growth performance and carcass characteristics of commercial broilers PhD thesis. KVAFSU, Bidar, 2015.
5. Bade RN, Ghodake, Deshmukh. Effect of threonine supplementation to diets with redueed crude protein in commercial broiler. Indian J. Poult, Sci. 2014; 49(3):250-254.
6. Baker DH. Utilization of precursors for L-amino acids.Amino acids in farm Animal Nutrition. J.P.F. D' Mello, ed. CAB Intl., Wallingford, UK, 1994.
7. Dozier Iii WA, Moran Jr ET, Kidd MT. Threonine requirement of broiler males from 42 to 56 days in a summer environment. J. App. Poult. Res. 2000; 9:496-500
8. Jahaniyan R. Wpc 2012-Salvador-Bahia-Brazil-5-9 August. World's Poultry Science Journal, Supplement 1, Expanded abstract-poster presentation, 2012.
9. Khan AR, Nawaz H, Andzahoor I. Effect of different levels of digestible threonine on growth performance of broiler chicks. J. Anim. Pl. Sci. 2006; 16(1-2).
10. Kidd MT, Kerr BJ, Fireman JD, Boling SD. Growth and carcass characteristics of broiler fed low protein, threonine supplemented diets. J. Appl. Poult. Res. 1996; 5(2):180-190.
11. Kidd MT, Kerr BJ, Anthony NB. Dietary interaction between Lysine and Threonine in Broilers. Poult. Sci. 1997; 76:608-614.
12. Kidd MT, Kerr BJ. Threonine responses in commercial broilers at 30-42 days. J. App. poult. Res. 1997; 6(4):362-367.
13. Kidd MT, Lerner SP, Allard JP, Rao SK, Halley TT. Threonine needs of finishing broilers, Growth, Carcass and economic response. J.Appl. Poult. Res. 1999; 8:160-169.
14. Kidd MT. Nutritional considerations concerning threonine in broilers. World's Poult. Sci. J. 2000; 56:139-144.
15. Kidd MT, Corzo A, Hoehler D, Kerr BJ, Barber J, Brantons SL. Threonine needs of broiler chickens with different growth rates. Poult. Sci. 2004b; 83:1368-1375.
16. Mehri M, Nassiri, Moghaddam H, Kermanshahi H, Danesh, Mesgaran M. Digestible threonine needs of straight run broiler during the growing period. J. Anim. Vet. Adv. 2010; 9(16):2190-2193.
17. NRC. Feeding Standards of Poultry.8threv.ed.National Academy Press, Washington, DC.PRABHAKARAN, R. Proc. XXIX National Symposium of IPSACON held at PDP, Hyderabad during, 1994-2012.
18. Waldroup PW, Jiang Q, Fritts CA. Effects of supplementing broiler diets low in crude protein with essential and nonessential amino acids. Int. J.Poult. Sci. 2005; 4(6):425-431.
19. Webel DM, Fernandez SR, Parsons CM, Baker DH. digestible threonine requirement of broiler chickens during the period three to six and six to eight weeks post hatching. Poult. Sci. 1996; 75:1253-1257.