



Influence of L-Threonine in Reduced Dietary Crude Protein Levels on Growth and Economic Indices in Broilers

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ABSTRACT

The present study was aimed to investigate the effect of reduced dietary crude protein (CP) supplemented with L-threonine on economic feasibility of in commercial broiler diets. A total of 480 broiler chicks were 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. The dietary CP was reduced by 1, 2 and 3 per cent unit to the standard recommendation in other 3 treatments. The diets with reduced CP level were supplemented with synthetic threonine. From the study, it was found that the economic indices *viz.*, cost of production per bird, cost of production per kilogram live body weight, net return per bird, net return per kilogram live body weight, performance index score (PIS) and economic index score (EIS) were significantly influenced by the supplementation of L-threonine in reduced dietary CP levels. The lowest cost of production per bird was recorded in birds fed with 3per cent crude protein reduced diet, where as the lower cost of production per kilogram live body weight was recorded in birds fed with control and 1 per cent crude protein reduced diets. Net returns per bird, net returns per kg live weight,PIS and EIS were better in birds fed with control and 1 per cent crude protein reduced diets. Up to one percent unit crude protein could be lowered at all growing phases of commercial broiler birds safely as it was economical.

Key Words: Body weight, Broilers, Crude Protein, Economic Indices. Threonine.

INTRODUCTION

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. Maize and soybean meal are the key feed ingredients. High crude protein diets for broilers results in amino acids excess and elevated nitrogen excretion. 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). In corn – soya based feedstuff for poultry, threonine is the third limiting amino acid for broilers and it becomes more limiting as crude protein decreases (Kidd, 2000). 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).

There is additional deminition in crude protein with the addition of L-threonine, comparable to that of lysine as most of the threonine in broiler rations is from soybean and meat meal. Fundamentally, marginal deficiencies of the less limiting amino acids (those beyond the need of L-threonine) in broiler rations result in decreased ration cost and reduced bird performance. In practice, however, the marginal decrease in bird performance is usually undetected, whereas reduced ration cost directly impacts the economic outcome. Recent research has delineated good estimates of L-threonine requirements in different growing stages of broilers. Although the threonine requirement is established

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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 bird's diets by lowering crude protein on growth performance and economic feasibility of L-threonine supplemented groups.

MATERIALS AND METHODS

One 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. 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). 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 was met as per the NRC (1994) 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). Body weights of birds were recorded at the end of each week during the experimental period. The cost incurred in formulating the pre-starter, starter and finisher phase diets of the experiment were calculated based on the market price of the

different ingredients used in the rations. The cost of production included cost incurred for day old chick, feed cost, brooding, vaccination, medication, disinfection, litter material, labour, transportation, rearing and miscellaneous costs in all the treatments. Gross return and net return were calculated based on the market price of the chicken. Performance index score (PIS) and economics index score (EIS) were calculated. 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.

RESULTS AND DISCUSSION

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 one percent unit reduced CP diet group and was non-significant with control diet-fed broilers (T_1) (Table 2). 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 one percent unit CP reduction to the standard recommendations. Similar results were reported by Aftab (2006), Aletoret *et al* (2000), Webel *et al* (1996), Waldroup *et al* (2005) and Khan *et al* (2006).

Economic indices *viz.*, cost of production per bird, cost of production per kilogram body weight, net return per bird, net return per kilogram live body weight, performance index score (PIS) and economic index score (EIS) were significantly influenced by the supplementation of L-threonine in reduced dietary CP levels and are presented in the Table 3.

The reduced CP diets at 1, 2 and 3 per cent unit units with the supplementation of L-threonine (T_2 , T_3 and T_4) showed a significant reduction in the cost of production per bird as compared to the control diet birds (T_1). The cost of production per bird in the present study was due to the reduction of crude protein in the diet which costs higher than any other nutrient. It was attributed to reduced feed cost due

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Table 1. Experimental diets formulated for different growth phases of broilers.

Experimental diet	Pre-Starter (1 – 14 d)		Starter (15 – 28 d)		Finisher (29 – 52 d)	
	CP %	Threonine %	CP %	Threonine %	CP %	Threonine %
T ₁	23.0	Basal level	21.0	Basal level	19.0	Basal level
T ₂	22.0	0.046	20.0	0.051	18.0	0.040
T ₃	21.0	0.094	19.0	0.095	17.0	0.095
T ₄	20.0	0.145	18.0	0.140	16.0	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 ration.

to the reduction of soya bean meal in the diet and supplementation of L-threonine to balance amino acid at a cheaper cost.

The cost of production per kg did not differ significantly between one per cent unit CP reduced diet fed birds (T₂) and control diet-fed birds (T₁). It was attributed to reduced feed cost due to the reduction of soybean meal in the diet and supplementation of L-threonine to balance amino acid at a cheaper cost in one per cent unit CP reduced diet. However, in 2 and 3 per cent unit reduced CP diet with L-threonine supplementation (T₃ and T₄). Cost of production per kg was higher than that of control diet-fed birds (T₁). It was due to the poor feed conversion ratio and lower body weight gain occurred in higher CP reduction diets (T₃ and T₄). This indicated that supplementation of L-threonine

was not beneficial when the dietary CP reduced beyond one per cent unit in the diet of commercial broilers.

Statistical analysis showed no significant difference between control diet-fed birds (T₁), and one per cent unit reduced CP diet with L-threonine supplemented birds (T₂) even there was Rs. 2.34, more net return per bird in T₂ than that of control diet-fed birds (T₁). It may be due to higher body weight gain, lesser feed consumption and better FCR in L-threonine supplemented birds. However, in 2 and 3 per cent unit reduced CP diets with L-threonine supplementation (T₃ and T₄) lower net return per bird was observed than in control birds which indicates net return will be affected if crude protein content in the diet decreased beyond 2 per cent unit.

Table 2. Weekly cumulative body weight (g/bird) of commercial broilers as influenced by dietary supplementation of L-threonine.

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*

Table 3. Economic feasibility of commercial broilers as influenced by dietary supplementation of L-threonine by reducing the levels of crude protein.

Treatment	CP reduction (% units)	Cost of production (Rs)		*Net return (Rs)		Index score	
		Per bird	Per kg live weight	Per bird	Per kg live weight	PIS	EIS
T ₁	Control	148.94 ^a	63.52 ^c	90.28 ^a	38.48 ^a	324.10 ^a	12.06 ^a
T ₂	1.0	145.85 ^b	62.41 ^c	92.62 ^a	39.59 ^a	322.50 ^a	12.34 ^a
T ₃	2.0	141.16 ^c	65.65 ^b	78.25 ^b	36.35 ^b	278.75 ^b	10.94 ^b
T ₄	3.0	135.37 ^d	67.49 ^a	69.24 ^c	34.51 ^c	246.79 ^c	9.99 ^c
S.Em. ±		0.18	0.45	1.64	0.45	6.01	0.23
C.D. at 5%		0.53	1.34	4.83	1.34	17.73	0.68

Note: Pairs with different superscripts are significant at 5%; PIS: Performance index score; EIS: Economic index score

Results showed no significant differences between one per cent unit reduced CP diet with L-threonine supplemented birds (T₂) and control diet birds in the net return per kg. Further, one per cent unit reduction of CP increased in net returns of Rs 1.11 per kg compared to control (T₁). Which indicates that L-threonine supplementation beneficial at one per cent unit reduced crude protein levels in the commercial broilers. However, reducing crude protein at 2 and 3 per cent unit with L-threonine supplemented birds (T₃ and T₄) showed significantly lower net return compared to control diet birds. The present finding of the cost of production and net returns indicate that one per cent unit CP reduction with L-threonine supplementation was beneficial than the standard recommended levels of crude protein in the commercial broiler diets. The results were in agreement with Bade *et al* (2014).

Both PIS and EIS were significantly influenced by the various treatments. Statistical analysis revealed similar PIS and EIS values in T₂ (one per cent unit CP reduced diet with L-threonine) and control (T₁) but both PIS and EIS values in 2 and 3 per cent unit CP reduced diets were significantly lower than that of the control diet (T₁). The better PIS and EIS in L-threonine supplemented in one

per cent reduced CP treatment birds were mainly attributed to better body weight gain, superior feed conversion ratio as well as good liveability percentage.

CONCLUSION

Crude protein in commercial broiler rations could be decreased by one percent unit with inclusion of L threonine without deviating the body weight gain. Feed consumption and feed to weight gain are not affected in commercial broilers up to one percent unit decrease in CP levels with supplementation of L- threonine. Production charges per bird were less in decreased crude protein rations but higher production outlay per kg. Net profit /bird and kg were similar in control as well as in one percent unit CP reduced with L-threonine supplementation ration. Up to one percent unit protein could be lowered at all growing phases of commercial broilers safely as it was economical.

*Higher net return in all treatments is attributed to the highest market price at the time of culling (Sold @) Rs 102 per kg live weight).

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