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ORIGINAL ARTICLE

The Effects of different levels of L- threonine on Growth Performance and Carcass Traits of broiler Chickens during Phase growth

Asgar Alizadeh Mazraeh, Habib Aghdam Shahryar*, Ramin Salamat Doust Nobar, Abolfazl Gorbani
Department of Animal Science, Shabestar branch, Islamic Azad University, 53815-159 Shabestar, Iran
***Corresponding author:** H_a_shahriar@yahoo.com

ABSTRACT
This study was conducted to evaluate the effects of different levels of L- threonine on growth performance and carcass traits of broiler chickens during phase growth. 320 made broiler chickens were fed either a control diet or supplemented with different levels of L- threonine 110, 120, and 130% above NRC recommendations. On the 1st day of experiment, broilers on based complete randomized design were divided to four treatments with four replicates per treatment and 20 broilers per replicate. Weight and feed intake were measured for each experimental unit from 1 to 10 days of age, and then weight gain and food efficiency were calculated. Furthermore, carcass traits (weights of carcass, breast, leg, liver, heart, and gizzard) were assessed. Weight gains and feed conversion ratio significantly improved in broilers fed threonine compared to the control broilers, but there were no significant difference in the feed intake. Moreover, Carcass weights and relative weights of breast and leg significantly increased in broilers fed threonine compared to the control broilers whereas, liver, heart and gizzard weights were not significantly altered. The results of the study indicated that, positive beneficial effects of threonine on weight gains, feed conversion ratio and development of the carcass of broiler chickens.
***Key words**: L- threonine, performance, carcass, broiler*

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INTRODUCTION

The essential amino acid, threonine (Thr), is the third most limiting amino acid, especially in a low crude protein diet [1, 2]. Threonine is used in important metabolic processes such as protein synthesis and uric acid formation. Poultry cannot synthesize threonine making it a nutritionally essential amino acid. Poultry can utilize only L-threonine [1], making it metabolically expensive. Threonine has also been shown to hinder methionine influx and stimulate lysine influx into the epithelial cells of the intestinal lumen [3]. Until recently, research including threonine as a supplemental amino acid has been vague or included with the effects of other amino acids.

Also, threonine is the amino acid that will become first-limiting in practical broiler diets once Lys and Met needs are met. On the other hand, carbon skeletons from the catabolism of L-threonine generate pyruvate for energy or glucose production and glycine for metabolic needs (e.g., synthesis of protein, creatine, serine, uric acid, bile salts, and glutathione [4, 5]. Past threonine research has focused on egg production, hen weight, internal contents of the egg, and feed consumption in diets of laying hens and broler breeder hens. There is a lack of evidence concerning the effect of supplemental threonine in broiler chickens diets on the growth performance and carcass traits.

The Nutritional Requirement Compendium (NRC) requirement for threonine is 0.74% of the diet, which is an estimate due to the lack of experimental data (NRC 1994) [6]. There is some evidence that essential amino acids levels in the feed higher than NRC specifications needed to achieve optimal growth performance, immune competence and disease resistance [7, 8]. Thus a level of 0.74% Thr will serve as control in this research. The primary objective of this research is to evaluate the impact of increased levels of dietary threonine on the growth performance and carcass traits of broiler chickens during phase growth.

MATERIALS AND METHODS

Three hundred and twenty made broiler chickens, on based complete randomized design were divided to four treatments with four replicates per treatment and 20 broilers per replicate. Broilers were fed either a control diet or supplemented with different levels of L- threonine 110, 120, and 130% above NRC recommendations. Feed and water were provided *ad libitum.* Environmental conditions of housing were constant during the trial: temperature of 18 ±1°C, relative humidity (RH) of 60%. The lighting schedule was maintained at 23 hours of daylight and 1 hour of darkness throughout the studies. Experimental diets contained threonine supplied by synthetic 98% feed quality L-threonine.

In each pen, bird body weight and food intake were recorded on days 0 and 10 of age and thereafter mean body weight gain, food intake, and food conversion ratio were calculated for each pen (replicate) between 0 and 10 days. Body weight gain was calculated and expressed as grams per bird. Food intake (g of food intake/bird) over the entire grow-out period was calculated by totalling food consumption in each time interval between each bird sampling. Food conversion ratio (g of food intake /g of body weight gain) was calculated by dividing total food intake by total weight gain in each pen.

On the 10nd day, eight birds per treatment were randomly taken to determine carcass traits. Chicks were fasted for approximately 12 h and then individually weighed, slaughtered, feathered and eviscerated. The weight of carcass parts (breast and legs) and organs of birds (heart, liver, and gizzard) were recorded. So, the percentage of carcass, parts of carcass and organs of birds (% of live body weight) were calculated.

The pen of birds was considered the experimental unit for all analyses. All data were analyzed by the GLM procedure of SAS [9]. Interactions were tested, and in their absence, main effects are displayed in tables ($P \leq 0.05$). Differences among means were separated with repeated Tukey's multiple range tests by the LSMEANS procedure of SAS.

RESULTS AND DISCUSSION

Weight gains and feed conversion ratio significantly improved in broilers fed threonine compared to the control broilers, but there were no significant difference in the feed intake (Table 2). Ishibashi *et al.* [10] reported improved feed intake, and feed efficiency with increasing threonine levels (0.31% - 0.61%). Incrementally increasing the level of dietary threonine from 0.35% to 0.58% in a typical layer diet yielded increased bird weight [11]. Koelkebeck *et al.,* [12] fed laying hens a commercial corn – soy diet with the addition of 1% supplemental threonine and reported significantly lower feed consumption compared to the control diet. Also, Schutte [2] reported that increasing the supply of one amino acid improves performance only if no other amino acid is limiting. Performance of hens receiving higher levels of threonine may have been hindered when other amino acid levels were not increased as well. Threonine has been shown to hinder methionine influx and stimulate lysine influx into the epithelial cells of the intestinal lumen [3] thus the higher levels of threonine may have altered the metabolic balance of methionine and lysine. Shan *et al.,* [13] reported that Dietary supplementation of threonine increased body weight gain and feed consumption and improved feed conversion ratio.

Table 2. Performance of broiler chickens fed diets containing threonine

Treatment	0 to 10		
	BWG[1]	FI[1]	FCR[1]
Control	171.7[c]	249.1	1.450[a]
[2]Thr 110%	179.3[a]	248.1	1.383[c]
Thr 120%	181.4[a]	248.4	1.367[c]
Thr 130%	175.5[b]	248.2	1.413[b]
P-Value	0.0001	0.611	0.0001
SEM	0.749	0.631	0.505

[a–c] Averages in a column with different superscript letters are significantly different [1]BWG: body weight gain (g/bird); FI: Food intake (g/bird); FCR: Food Conversion ratio (FI/BWG).
[2]Thr= Threonine

Table 3. The effect of dietary threonine on carcass yield, breast, leg, liver, heart and gizzard of broiler chickens on day 10 of age

Treatments	Carcass[1] (%)	Breast[1] (%)	Leg[1] (%)	Liver[1] (%)	Heart[1] (%)	Gizzard[1] (%)
Control	54.48[b]	17.83[b]	16.51[c]	3.240	0.618	1.512
Thr 110%	54.84[a]	18.11[a]	16.97[b]	3.335	0.590	1.575
Thr 120%	55.06[a]	18.25[a]	17.11[a]	3.297	0.577	1.710
Thr 130%	54.96[a]	18.14[a]	17.04[ab]	3.407	0.600	1.645
P-Value	0.005	0.029	0.0001	0.800	0.998	0.988
SEM	0.094	0.085	0.043	0.121	0.171	0.419

[a–c] Averages in a column with different superscript letters are significantly different
[1]percentages of live weight (%).

Moreover, Carcass weights and relative weights of breast and leg significantly increased in broilers fed threonine compared to the control broilers whereas, liver, heart and gizzard weights were not significantly altered (Table 3). An increase in whole carcass and boneless-skinless breast meat absolute weights were observed when dietary Thr was increased in the diet [14]. Kidd and Kerr [15] reported that the 21-42 day NRC threonine requirement of 0.74% of diet is too high. In contrary, Dozier *et al.* [16] indicated that threonine supplementation of the diet did not affect body weight gain; while Lehmann *et al*. [17] indicated that different threonine levels (0.82-0.88-0.94-1.00-1.06-1.12%) improved body weight gain.

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