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The impact of supplemental L-threonine in broiler breeder molting hen diets on egg production, egg weight, and hatching traits

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ABSTRACT

The impacts of supplemental L-threonine in broiler breeder molting hen diets were evaluated. 600 hens were obtained from (Cobb-500) broiler breeder strain at 60 weeks of age. All hens were collected from the same breeder flock and weighed on a balance with 10 g precision. At 60 weeks of age, hens based on a completely randomized design were divided into 5 treatments with 4 replicates per treatment and 30 hens and 3 roosters per replicate. Control hens were fed a corn-soybean commercial broiler breeder molting diet containing 0.48% threonine (Thr). Experimental diets containing, basal diet with 0.52, 0.57, 0.62, and 0.67% Thr were fed. Egg samples were analyzed for egg weight, egg production and hatching traits in newly-hatched chickens. The results of the study indicate that, egg production increased with increasing dietary threonine levels up to 0.67% Thr in the diet. But, the weight of eggs was significantly lower than control. Dietary L-threonine supplementation didn't show any significant effect on hatchability of broiler breeder molting hens from 60 to 63 weeks of age. Weight of newly-hatched chickens was significantly lower when supplemental L-threonine in broiler breeder molting hen diets from 60 to 63 weeks of age were received than control group. These data clearly indicate a potential important impact on egg production by increasing dietary threonine nutrition of a broiler breeder molting hen.

Key words: L-threonine, egg production, egg weight, hatching traits, broiler breeder molting hen.

INTRODUCTION

All nutrients needed for embryogenesis are provided by the hen by the time the fertile egg is laid [1]. If nutritional deficiencies occur during the formation of the egg, it can have significant repercussions on the developing embryo [2]. Hen diets are composed mainly of corn and soy, which contain low levels of L- threonine [3]. Therefore, eggs contain little or no L- threonine [4].

The essential amino acid, threonine (Thr), is used in important metabolic processes such as protein synthesis and uric acid formation. Threonine is the third most limiting amino acid, especially in a low crude protein diet [5, 6]. Poultry cannot synthesize threonine making it a nutritionally essential amino acid. Poultry can utilize only L-threonine [5], 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 [7]. The Nutritional Requirement Compendium (NRC) requirement for threonine is 0.48% of the diet, which is an estimate due to the lack of experimental data (NRC 1994) [8]. Thus a level of 0.48% Thr will serve as control in this research. The primary objective of this research is to evaluate the impact of increased levels of dietary L-threonine on egg production, egg weight, and hatching traits.

MATERIALS AND METHODS

600 hens were obtained from (Cobb-500) broiler breeder strain at 60 weeks of age. All hens were collected from the same breeder flock and weighed on a balance with 10 g precision. At 60 weeks of age, hens based on a completely randomized design were divided into 5 treatments with 4 replicates per treatment and 30 hens and 3 roosters per replicate. Control hens were fed a corn-soybean commercial broiler breeder molting diet containing 0.48% threonine (Thr). Experimental diets containing, basal diet with 0.52, 0.57, 0.62, and 0.67% Thr were fed. Hens were dieted from 60 to 63 weeks of age and provided with a standard broiler breeder molting ration (National Research Council, 1994) (table 1) [8]. Each treatment group and hen was identified by the neck tag and recorded. All hens and treatments were randomly assigned to 1 of 20 pens. Each pen was bedded with soft pine wood shavings and equipped with automatic drinkers, and manual self-feeders. Food and water were available ad libitum. The lighting schedule was maintained at 17 hours of daylight and 7 hours of darkness throughout the studies. Food and water were available ad libitum. Supplemental threonine was supplied by synthetic 98% feed quality L-Threonine from Dgvsa® Co. All animal experimentation was conducted in accordance with the regulations of Islamic Azad University, Animal Ethics Committee. Egg samples were analyzed for egg weight, egg production and hatching traits in newly-hatched chicks. Upon hatch, the hatchability and weight of newly-hatched chicks were measured. The weight of newly-hatched chickens was determined by weighing all chicks hatched one by one. Hatchability was calculated by considering the ratio of chickens hatched to the live chicken's embryo after the treatment and expressed as a percentage of fertilized eggs. Results were analysed by ANOVA using the GLM procedure of SAS software (SAS institute, 2001) [9]. Differences between treatments were compared by the Duncan's multiple range tests following ANOVA, and values were considered statistically different at $P < 0.05$ [10]. When data were percentages they were transformed by arc sin square root.

RESULTS AND DISCUSSION

Based on the results of present study, the supplemental L-threonine in broiler breeder molting hen diets can be an effective tool to increase the egg production, but the supplemental L-threonine caused significant decrease of the egg weight and weight of newly-hatched chickens. Moreover, dietary L-threonine supplementation didn't show any significant effect on hatchability of eggs from broiler breeder molting hens from 60 to 63 weeks of age. It has previously been shown that the graduating the level of dietary threonine from 0.35% to 0.58% in a typical layer diet increased egg production without affecting egg weight [11]. [12] fed laying hens a commercial corn–soy diet with the addition of 1% supplemental threonine and reported significantly improved hen day egg production, egg weight.

Also, Past research has primarily focused on dietary essential amino acids methionine and lysine. [13] reported that methionine fed at a level of 507 mg/HD positively affected egg weight and albumen and yolk solids when compared to Nutritional Requirement Compendium (NRC) requirements for the amino acid in normal layer diets. Similar results were reported by Prochaska et al. [14] who added lysine to a normal sorghum-soybean diet at a level of 1,613 mg/HD. But in present research, the weight of eggs was significantly lower than control. Ishibashi et al. [15]studied a flock of 2000 Single Comb White Leghorns (Dekalb XL Link) and demonstrated that egg weight was not affected by the dietary treatments. The influence of dietary threonine on egg weight observed in this experiment disagrees with the results of Shafer et al. (1998), Prochaska et al. (1996) and Ishibashi et al. (1998).

Table1. Ingredient percentages and calculated analysis of broiler breeder molting hen diet

Item	Diet
Ingredient (%)	
Corn	69.58
Soybean meal(44% CP)	17.81
Dicalcium phosphate	1.68
Oyster sell-ground	6.74
Salt	0.52
Sodium bicarbonate	3
Vitamin premix[1]	0.3
Trace mineral premix[2]	0.3
DL-Met	0.07
Calculated analysis	
ME (kcal/kg)	2688
CP (%)	14.1
Ca (%)	3.2
Available P (%)	0.4
Met (%)	0.303
Met + cystine (%)	0.542
Lys (%)	0.678
Thr (%)	0.48

[1]Vitamin premix provided the following per kilogram of diet: vitamin A, 11,013 IU; vitamin D3, 3,525 IU; vitamin E, 33 IU; vitamin K, 2.75 mg; riboflavin, 7.7 mg; pantothenic acid, 17.6 mg; niacin, 55.1 mg; choline, 478 mg; vitamin B12, 0.028 mg; pyridoxine, 5.0 mg; thiamine, 2.2 mg; folic acid, 1.1 mg; biotin, 0.22 mg.
[2]Trace mineral premix provided the following per kilogram of diet: manganese, 64 mg; zinc, 75 mg; iron, 40 mg; copper, 10 mg; iodine, 1.85 mg; and selenium, 0.3 mg.

Table 2. The effect of supplemental L-threonine on egg production, egg weight of broiler breeder molting hen

Treatments	Egg production (g)	Egg weight (g)
Control	74.41[b]	77.97[a]
0.52% (Thr)*	76.21[a]	76.78[b]
0.57% (Thr)	76.03[a]	77.03[b]
0.62% (Thr)	76.70[a]	75.56[c]
0.67% (Thr)	77.40[a]	75.83[c]
P-Value	0.0105	0.0002
SEM	0.50	0.28

Different letters (a, b, c, d or e) show significant difference.
** Thr = Threonine*

Table 3. The effect of supplemental L-threonine on hatchability, weight of newly-hatched chickens of broiler breeder molting hen

Treatments	Hatchability (%)	Weight of newly-hatched chickens (g)
Control	76.25	52.24[a]
0.52% (Thr)	74.50	51.44[b]
0.57% (Thr)	77.75	51.61[b]
0.62% (Thr)	72.50	50.62[c]
0.67% (Thr)	75.00	50.80[c]
P-Value	0.3284	0.0002
SEM	1.74	0.19

Different letters (a, b, c, d or e) show significant difference.

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