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# Threonine Requirement of Laying Japanese Quails

[1]Sibel Canogullari, [1]Mikail Baylan and [2]Tugay Ayasan
[1]Samandag Vocational School, Mustafa Kemal University, Samandag, Hatay, Turkey
[2]Cukurova Agricultural Research Institute, Adana, Turkey

**Abstract:** In order to determine the threonine requirement of laying Japanese quails, one experiment was conducted using laying performance as parameters. In the study, a total of 40 female Japanese quails at 8 weeks of age were used. The quails were divided into four groups randomly. Experimental treatments consisted of four concentrations of total threonine using diets that ranged from 0.74-1.04% in progressive increments of 0.10%. Feed and water were supplied *ad libitum* and light was provided 16 h (from 8.00-24.00) each day. Laying performance was determined daily by measuring feed intake, feed conversion efficiency (feed intake/egg weight), egg production (number and weight). The experimental period lasted 9 weeks. Increasing threonine level in the diets increased feed conversion efficiency, total egg production (g/bird/63 days), egg weight (g/bird/day) and number of eggs (bird/63 days). However, there were no significant differences among the groups (p>0.05). About 1.04% threonine level in diet increased egg production 9.79% and number of eggs 9.30% compared with the basal diet (0.74% threonine). The results suggest that the current NRC recommendation of 0.74% threonine for laying quails is not adequate to support comparable laying performance.

**Key words:** Japanese quail, threonine, egg yield parameters, *ad libitum*, feed conversion, egg production

## INTRODUCTION

Japanese quail are used for commercial specialty meat and egg production and also valued research animals. Consequently, the nutrient requirements of Japanese quail have been documanted to a greater extent than have those of other game bird species (Ayasan and Okan, 2006).

There are only two available reports that studied the threonine requirement of Japanese quails. The NRC (1994) suggest that quails fed diets containing 2900 kcal $kg^{-1}$ of diet should receive a total dietary threonine level of 0.74% of diet. Parlat *et al.* (2003) were performed to determine the effects on threonine addition to diets containing high protein on performance traits of laying Japanese quail. Researches found that threonine supplementation to diets containing high protein did not affect performance criteria except egg production and egg weight. Researches suggested that the laying quails may have threonine requirements not greater than those generally recommended (0.74%) by NRC (1994). Baylan *et al.* (2006) found that threonine supplementation to the diet did not affect growth performance and edible carcass parts (p>0.05), assuming that birds can make metabolic adaptation to current dietary threonine supplementations.

Studies on threonine in poultry revealed contradictory results. Positive effects on egg production, egg weight and feed conversion ratio of laying hens were observed when threonine was added to layer diets (Martinez-Amezcua *et al.*, 1999). In some studies, positive influences of supplemental threonine on egg production, egg weight, egg mass and feed intake were observed at the levels of 0.53% of laying hens. However, body weights were not significantly different among hens that received diets containing 0.45-0.53% threonine (Faria *et al.*, 2002). Ishibashi *et al.* (1998) found that dietary threonine exceeded the requirement level, egg mass and feed conversion ratio decreased with increasing dietary threonine levels. Zollitsch *et al.* (1993) did not observe improvements in feed conversion ratio resulting from increased threonine. Sohail *et al.* (2002) reported that laying hens reported to the inclusion or removal of supplemental threonine, lysine, isoleucine, tryptophan and total sulfur amino acid within 1-2 weeks.

It is apparent that sufficient data are not available to establish a reliable estimate of the threonine requirement of the laying Japanese quails. Therefore, the present study was conducted to evaluate the threonine requirement of laying quails.

**Corresponding Author:** Sibel Canogullari, Samandag Vocational School, Mustafa Kemal University, 31780 Samandag, Hatay, Turkey

## MATERIALS AND METHODS

Forty laying Japanese quails, approximately 8 weeks of age, were used for the experiment. At the beginning, quails were weighed and distributed in laying cages (16×26×25 cm) individually. The quails were divided into four dietary groups, ten quails each. The composition of basal diet is given in Table 1. The diets were formulated isocaloric and isonitrogenous and to meet or exceed the nutrient requirements for laying quails (NRC, 1994). Experimental treatments consisted of four concentrations of total threonine using diets that ranged from 0.74-1.04% in progressive increments of 0.10%. About 0.74% threonine level was accepted as a basal diet. Because NRC (1994) suggest that quails fed diets containing 2900 kcal $kg^{-1}$ of diet should receive a total dietary threonine level of 0.74% of diet.

The house was provided with programmable lighting and ventilation. Feed and water were provided for *ad libitum* consumption. The experiment was conducted for 9 weeks.

Laying performance was determined daily by measuring feed intake, feed conversion efficiency, egg production (number and weight). Eggs were collected and weighed daily. Egg production (%), cumulative egg weight per bird were calculated for all of the experiment. The obtained data regarding laying performance was subjected to analysis of variance using GLM procedure of SPSS (1999). The significant means were ranked using Duncan's Multiple Range Test.

Table 1: Ingredients and chemical composition of experimental diet

| Ingredients | (%) | Nutrient contents (calculated) | (%) |
|---|---|---|---|
| Corn | 55.46 | Dry matter | 89.24 |
| Soybean meal | 15.96 | ME (kcal $kg^{-1}$) | 2800.00 |
| Full fat soybean | 8.14 | Crude protein | 20.00 |
| Sunflower meal | 6.25 | Crude fiber | 4.00 |
| Corn gluten meal | 1.60 | Crude ash | 9.83 |
| Meat-bone meal | 3.34 | Threonine | 0.74 |
| Poultry offal meal | 4.01 | Methionine+Cystine | 0.77 |
| Sodium bicarbonate | 0.12 | Lysine | 1.00 |
| DL-methionine | 0.12 | Methionine | 0.45 |
| L-lysine | 0.01 | Arginine | 1.35 |
| Vitamin premix* | 0.10 | Ca | 2.50 |
| Mineral premix** | 0.10 | Available P | 0.35 |
| Salt | 0.01 | Sodium | 0.15 |
| Limestone | 4.75 | Potasium | 0.74 |
| Total | 100.00 | Klor | 0.14 |
| | | Linoleik acid | 2.00 |
| | | Tryptofan | 0.20 |

*Each kg of vitamin premix contains 6000000 IU Vitamin A; 800000 IU Vitamin $D_3$; 14000 mg Vitamin E; 1600 mg Vitamin $K_3$; 1250 mg Vitamin $B_1$; 2800 mg Vitamin $B_2$; 8000 mg Niacin; 4000 mg Ca-D-Pantothenate; 2000 mg Vitamin $B_6$; 6 mg Vitamin B12; 400 mg Folic acid; 18 mg D-Biotin; 20000 mg Vitamin C; 50000 mg Choline chloride, **Each kg of mineral premix contains 80000 mg Mangan; 60000 mg Iron; 60000 mg Zinc; 5000 mg Copper; 200 mg Cobalt; 1000 mg Iod; 150 mg Selenium

## RESULTS AND DISCUSSION

The results obtained in this study are presented in Table 2. The results showed that threonine supplementation to the diet had no significant ($p>0.05$) effects on feed intake, egg production, egg weight, number of eggs obtained in 63 days and body weights. However, threonine supplementation tended to improve feed conversion efficiency but not significant ($p>0.05$).

Quail given diet containing 0.94% threonine supplemented group, attained greater cumulative feed intake than the another groups numerically but not statistically significant ($p>0.05$). Increasing the dietary threonine content from 0.74-0.94% of diet improved feed intake. This numerical increase in feed intake can be explained that threonine may have appetitive effect on feed intake. The results of present studies are in line with the results of Parlat *et al.* (2003) who reported that the laying quails fed on rations containing different threonine levels had no significant difference in feed intake between different groups. In contrast to our results, Martinez-Amezcua *et al.*, 1999) reported that increasing diatary threonine levels increased feed intake ($p<0.01$). Body weights were not significantly different among quails that received diets containing 0.74-1.04% threonine. Similarly, Parlat *et al.* (2003) suggested that 0.90-1.10% threonine supplementation had no effect on body weights of quails.

In the current research, increasing dietary threonine did not increase feed conversion efficiency. The average feed conversion efficiency values for laying Japanese quails in different threonine supplemented groups were 3.55, 3.18, 3.34 and 3.13 per bird, respectively. About 1.04% threonine supplemented group showed the best feed conversion efficiency i.e., 3.13 per bird while, 0.74% threonine supplemented group showed the poorest feed conversion efficiency i.e., 3.55 per bird. Feed conversion efficiency was not affected by threonine supplementation. In aggreement with Parlat *et al.* (2003), threonine supplementation to diets containing high protein did not affect feed conversion efficiency.

Egg production (%) increased as a result of threonine supplementation especially 1.04% by laying quails. Egg production in groups (%) were found 86.59, 91.70, 94.60 and 95.07%. No significant difference was observed between all groups ($p>0.05$). In contrast with Faria *et al.* (2002) and Parlat *et al.* (2003), the addition of threonine to diets was affected on egg production.

Egg weight increased from 12.72 g when the diet containing 0.74% threonine to 13.17 g for the diet containing 0.84% threonine but not significantly ($p>0.05$). This result is consisted with previous experiment of

Table 2: The effect of threonine amino acid supplementation on performance of laying japanese quails

| Parameters | Dietary threonine level (%) 0.74 | 0.84 | 0.94 | 1.04 | SED |
|---|---|---|---|---|---|
| Initial body weight (g) | 316.20 | 312.50 | 314.10 | 313.90 | 3.669 |
| Final body weight (g) | 344.28 | 341.38 | 347.00 | 359.88 | 5.468 |
| Feed Intake (FI:g/bird/63 days) | 2361.32 | 2418.98 | 2615.74 | 2417.17 | 52.220 |
| Feed conversion efficiency (FI/TEP) | 3.55 | 3.18 | 3.34 | 3.13 | 0.09 |
| Total Egg Prod (TEP; g/bird/63 days) | 683.09 | 724.09 | 785.16 | 782.02 | 22.276 |
| Egg production (%) | 86.59 | 91.70 | 94.60 | 95.07 | 1.779 |
| Egg weight (g/bird/day) | 12.72 | 13.17 | 13.16 | 13.04 | 0.179 |
| Number of eggs (bird/63 days) | 54.80 | 58.40 | 59.60 | 59.90 | 1.074 |

Ishibashi *et al*. (1998) who observed not to improve egg weight with the supplementation of threonine to the diet. In contrast with Parlat *et al*. (2003) found that there were significant differences among the experimental groups for egg weight ($p<0.05$).

Dietary threonine had no effect on body weights. In studies have reported that threonine amino acid (Parlat *et al*., 2003) did not affected the body weights in laying quails. This is in contrast to the results of Faria *et al*. (2002) where threonine amino acid supplementation affected in body weights.

Results from this study agree with those of Penz *et al*. (1991), who found that higher levels of threonine are needed to improve feed conversion efficiency. In addition to improvements in feed conversion efficiency, benefits in egg production and egg weight were noted in this experiment. Both egg production and egg weight were improved by threonine levels up to 0.74% of that recommended by the NRC (1994). Another important observation is that feed intake did not differ among treatments. Quails may be unable to compensate for threonine deficiency by increasing feed intake, a conclusion that agrees with research of Keshavarz and Jackson (1992). Our results suggest that the current NRC (1994) recommendation of 0.74% threonine for laying quails is not adequate to support comparable laying performance.

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