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EFFECT OF GRADED LEVELS OF THREONINE ON GIMMIZAH LAYER HENS PERFORMANCE.

By

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Abstract: *This experiment was designed to study the effect of increasing dietary threonine (Thr) levels on the production performance of Gimmizah layer hens. Ninety-six Gimmizah laying hens (40 wks of age) were weighed and randomly housed in individual cages and allotted for six dietary treatment groups of 16 hens each. The experiment continued for 8 weeks. Threonine was added by 0.22 g/kg to its content of the basal diet to obtain 6 graded levels of 5.19, 5.41, 5.63, 5.85, 6.07 and 6.29 g Thr /kg diet.*

All the experimental levels of Thr had no significant effect on egg production and feed consumption. Egg weight, egg mass and feed conversion had improved significantly with increasing dietary Thr level up to 6.07 g/kg diet and then reversed with increasing Thr level. Birds fed diet containing 6.07 g Thr/kg during the same mentioned period (40-48 wks of age) recorded the highest egg weight (61.52g); egg mass (37.75 g/hen/day) and the best feed conversion (3.52). The results indicated that Thr concentration equal to 802 mg/h/day was adequate for improving layer performance. According to the input-output analysis, increasing dietary Thr in layer diet increased the economical efficiency (EE) and relative economic efficiency (REE). Moreover, the best records of EE and REE were observed for group of layers fed diet containing 6.07 g/kg Thr.

INTRODUCTION

Practically, methionine is the first limiting amino acid in poultry diets followed by lysine. Also, Threonine (Thr) may often become limiting amino acid (Fernandez *et al*., 1994; Kidd and Kerr, 1996 and Schutt and Joung, 1999). Threonine is involved in important metabolic processes e.g. uric acid formation and protein synthesis as reported by Bender (1985) and Ballévre *et al.* (1991), besides, its catabolism generates many important products such as glycine, acetyl COA and pyruvate (Bender, 1985). Therefore it is necessary to determine the Thr requirement for laying hens.

Keshavarz (1986) showed that reduction in protein level (16g of protein/day) during the peak stage reduced egg production and egg weight. Egg production, egg weight and feed conversion ratio were improved as Thr was increased above that of NRC (1994) recommendation (Martinez *et al*., 1999). Beorlegui and Gonzalez (1991) suggested that the Thr needs for hens during egg production are as high as 650 mg/day. Zollitsch *et al*. (1993) observed improving in egg productivity in laying hens fed diets containing 14% crude protein and supplemented with Thr and arginine, while feed conversion ratio did not realize any improvement. Ishibashi *et al*. (1998) reported that feed intake and daily egg mass had increased as Thr increased. On the other hand, Ojeda *et al*. (1981) evaluated Thr levels (0.4, 0.5 and 0.6 % of diet) in laying hens at the beginning of peak production and found no effect on egg production.

This investigation was designed to study the effect of graded levels of Thr on Gimmizah layer hens performance.

MATERIALS AND METHODS

The current study was conducted at El-Sabahia Poultry Research Station, Animal Production Research Institute, Agricultural Research Center.

Ninety-six Gimmizah laying hens (40 wks of age) were weighed and randomly housed in individual cages and allotted for six dietary treatment groups of 16 hens each. Birds were maintained under commonly 15 h light: 9 h dark cycle throughout the experimental period. Samples of yellow corn and soybean meal were analyzed for it is crude protein and amino acids content at Digussa AG, Germany (Table 1). The basal diet was formulated using yellow corn, wheat bran, gluten feed meal, soybean meal and nigella seed meal, with a protein content of 14.42 CP %, 2800 ME Kcal/kg, a total Thr content of 5.19 g/kg diet (Table 2). Threonine was added in 5 graded levels of 0.22 g/kg to a basal diet content to obtain 6 experimental Thr levels were 5.19, 5.41, 5.63, 5.84, 6.07 and 6.29 g/kg diet, respectively. Feed and water were offered for *ad- libitium* consumption. Individual egg production traits and feed consumption were recorded throughout 8 weeks as the peak of egg production (40-44 and 45-48 wks of age).

Economical efficiency (EE) and relative economic efficiency (REE) of the experimental diets were calculated according to input-output analysis at the end of the experiment.

All results were statistically analyzed by General Linear Models (GLM), one way analysis of variance, using SAS software (SAS Institute, 1989). Differences among means were separated using Duncan's multiple range test (Duncan, 1955).

Table (1) Crude protein and amino acid Profile of yellow corn, soybean meal, nigella seed meal, wheat bran and corn gluten feed.

Parameters	Yellow Corn*	Soybean meal*	Nigella seed meal**	Wheat bran***	Corn gluten feed***
Crude protein	8.21	43.58	32.00	15.40	22.00
Methionine	0.15	0.59	1.59	0.23	0.45
Cystine	0.18	0.66	1.12	0.32	0.51
Methionine+ Cystine	0.33	1.24	2.71	0.55	0.96
Lysine	0.25	2.62	1.39	0.61	0.63
Threonine	0.28	1.35	1.14	0.50	0.89
Tryptophan	0.06	0.60	0.48	0.23	0.10
Arginine	0.39	3.10	0.66	1.02	1.01
Isoleocine	0.26	1.97	1.16	0.47	0.65
Leucine	0.95	3.30	1.42	0.96	1.89
Valine	0.37	2.10	1.11	0.70	0.05

* Prediction With NIR-Spectroscopy - Degussa AG (Analytisches Labor – FA-AT), Methionine+Cystine estimated with separate calibration equation. Figures standardized to a dry matter content of 88%.
**Khalifah (1995) ***Based on NRC (1994)

Table (2): Composition and the nutritive value of the basal diet.

Ingredients	%	Energy content and nutrient content	
Yellow Corn (8.21% CP)	51.50	ME (kcal/kg)	2800
Soybean meal (43.58% CP)	11.10	Crude protein (% calculated)	14.42
Wheat bran	1.80	Ca %	3.27
Gluten feed (22.0% CP)	15.50	P % (available)	0.40
Nigella seed meal (32% CP)	5.00	Fiber (%)	4.02
Vegetable oil	3.90	Ether extract (%)	3.27
Dicalcium phosphate	1.55	*Amino acid content (%calculated)*	
Limestone	8.50	Methionine	0.435
Premix*	0.30	Methionine + Cystine	0.862
Dl-Methionine	0.14	Lysine	0.686
L-Lysine Hcl	0.10	Argenine	0.753
NaCl	0.40	Threonine	0.519
Sand	0.21		

* Composition of premix in 3 kg is : Vit A 10,000,000 IU, Vit D_3 2,000,000; Vit E 10,000 mg, Vit K_3 1,000 mg, Vit B_1 1,000 mg, Vit B_2 4,000 mg, Vit B_6 1,500 mg, Vit B_{12} 10 mg; Niacin 20,000 mg; Pantotenic acid 10,000 mg, Folic acid 1,000 mg, Biotin 50 mg, Choline chloride 500, 000 mg, Cu 3,000 mg, Iodine 300 mg, Fe 30,000 mg; Mn 40,000 mg, Zn 45,000 mg, Selenium 100 mg.

Table (3) Means of Gimmizah layer performance traits as affected by graded levels of threonine during the experimental period

Thr in diet g/kg diet	Feed Consumption g/hen/d			Threonine intake mg/h/d			Egg Production %			Egg weight g			Egg mass g/hen/day			Feed Conversion g feed/g egg mass		
	Age weeks																	
	40-44	45-48	40-48	40-44	45-48	40-48	40-44	45-48	40-48	40-44	45-48	40-48	40-44	45-48	40-48	40-44	45-48	40-48
5.19	128.5	135.7	132.1	667c	704c	686d	61.61	56.25	58.93	54.20bc	55.03b	54.61bc	33.32b	30.82b	32.09ab	3.88ab	4.41	4.13ab
5.41	130.2	133.6	131.9	704bc	723c	714c	61.61	56.25	58.93	50.79c	53.64b	52.21c	31.39b	30.18b	30.82b	4.26a	4.49	4.37a
5.63	128.8	137.1	132.9	725b	772b	748b	67.86	59.93	63.40	56.44ab	55.36b	55.90bc	38.25a	32.50ab	35.43ab	3.38b	4.31	3.80ab
5.85	123.3	133.4	128.4	721b	780b	751b	63.39	57.14	60.27	57.13ab	56.97b	57.05ab	36.14ab	32.07ab	34.09ab	3.43b	4.31	3.78ab
6.07	127.0	136.5	131.7	771a	829a	799a	60.71	61.61	61.61	60.07a	62.97a	61.52a	36.46ab	38.75a	37.57a	3.55ab	3.53	3.52b
6.29	124.0	133.4	128.7	780a	839a	810a	61.61	58.04	59.82	58.79ab	57.81b	58.30ab	36.21ab	33.61ab	34.88ab	3.43b	4.07	3.71ab
SEM	1.01	0.69	0.69	9.56	10.10	9.80	1.32	1.81	1.32	0.85	0.85	0.79	0.89	1.08	0.80	0.14	0.11	0.10
Sign.	NS	NS	NS	**	**	**	NS	NS	NS	**	**	**	**	**	**	*	NS	**

Means within the same column with different superscript are significantly different.
NS = Not Significant * Significantly at 0.05 ** Significantly at 0.01

RESULTS AND DISCUSSION

Results presented in Table 3 indicated that graded levels of Thr in Gimmizah layer diets had no significant effect on the amount of feed consumption throughout the experimental periods(40-44, 45-48 and 40-48 weeks), and it is ranged from 123.3 to 130.2, 133.4 to 137.1 and 128.7 to 132.9 g/hen/day, respectively. The lowest amount of feed consumption was recorded for the birds fed 5.85 and 6.29 g/kg Thr throughout the experimental periods. Regarding feed consumption with levels of dietary Thr, Ishibashi *et al*., (1998) reported that feed intake was increased and then decreased linearly as Thr increased.

Threonine intake was significantly (P≤ 0.01) increased by increasing the levels of Thr in layer diets throughout the experimental periods (40-44, 45-48 and 40-48 weeks). Incorporation of Thr in layer diets at high levels of 6.07 and 6.29 g/kg diet increased the amount of Thr intake per hen per day. Beorlegui and Gonzalez (1991) suggested that the Thr needs for hens for egg production are as high as 650 mg/day.

Moreover, dietary supplemented Thr had no significant effect on egg production percentage throughout the experimental periods (40-44, 45-48 and 40-48 weeks of age). In addition to that, the best egg production percentage was recorded by the birds fed 5.63 g/kg throughout the experimental periods (40-45 and 40-48 weeks of age).

Increasing the concentration of Thr in layer diets has significant effect (P≤0.01) on the average of egg weight and egg mass throughout the experimental periods (40-44, 45-48 and 40-48 weeks). Generally, the birds fed diet containing 6.07 g Thr/kg had the best egg weight throughout the experimental periods (40-44, 45-48 and 40-48 weeks) and it recorded 60.07, 62.97 and 61.52 g, respectively as egg weight. Moreover, the same level of Thr supplementation (6.07 g Thr/kg) had the best value of egg mass during the period of (40-48 weeks of age). Therefore, it could be concluded that using the concentration of 6.07 g Thr /kg in the layer diet could be useful for improving egg mass and egg production during the laying cycle. Ishibashi *et al*., (1998) and Martinez *et al*., (1999) reported that egg weight and egg mass were improved as Thr was increased in layer diets.

Feed conversion ratio had been significantly (P≤0.05) affected by graded levels of Thr in layer diets throughout the first period (40-44 weeks of age). Also, feed conversion ratio had been significantly (P≤0.01) affected

during the whole experimental period (40-48 weeks of age). Generally, increasing Thr levels in the layer diets improve the feed conversion ratio. The best feed conversation ratio (3.52) had been recorded for the level of 6.07 g/kg diet through the whole experimental period (40-48 weeks of age).

These results are in harmony with those reported by Martinez *et al*. (1999) and Barkley and Wallis (2001) who reported that increasing Thr concentration of the diet improved feed conversion ratio. However, Zollitsch *et al*. (1993) observed that feed conversion ratio of laying hens fed diet containing 14 % crude protein and supplemented with Thr did not improve.

The economic efficiency (EE) and the relative economic efficiency (RFE) of different formulated diets are shown in Table 4. The results indicated that increasing the level of Thr in Gimmizah layer diets increase the net return, EE and RFE. Incorporation Thr in the diet at the level of 6.07 g/kg was superior for maximized the net return, EE and RFE than any level of dietary Thr. The net return, EE and REE for this group were 4.84 L.E, 0.442 and 178.4%, respectively. That result was a reflection for increasing the percentage of egg production (61.61 %) and the egg mass (37.88 g/hen/day) which increasing the total egg mass (2.104 kg/hen) and total egg price (15.78LE).

Table (4): Economic evaluation of Gimmizah layer as affected by graded levels of threonine during the whole experimental period (40-48 weeks of age)

Thr in diet .g/kg diet	Egg mass kg/hen (40-48)	Egg price1 (L.E)	Total feed consumption (40-48) kg	Feed cost 2 (L.E)	Total cost 3 (L.E)	Net return 4	EE 5	REE6
5.19	1.797	13.48	7.39	1.461	10.80	2.68	0.248	100.0
5.41	1.726	12.95	7.39	1.466	10.83	2.12	0.196	78.9
5.63	1.948	14.88	7.45	1.472	10.96	3.92	0.358	144.2
5.85	1.909	14.32	7.19	1.477	10.62	3.70	0.398	140.5
6.07	2.104	15.78	7.38	1.483	10.94	4.84	0.442	178.4
6.29	1.953	14.65	7.03	1.488	10.96	4.19	0.401	161.5

1-Price of kg egg = 7.50 L.E
2-Feed cost = Price of kg feed (1.46 LE) + Price of Thr. (Price of Thr. = Aprox. 20 L.E/kg)
3-Total cost = Total feed intake x Feed cost
4-Net return = Egg price – Total cost
5-Economic Efficiency = Net return / Total cost
6-Relative Economic Efficiency (REE)

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الملخص العربى
تأثير المستويات المتدرجة من الثريونين على الآداء الأنتاجى لدجاجات الجميزة البياضة

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صممت هذه التجربة لدراسة تأثير زيادة مستويات الحمض الامينى الثريونين بالعلف على الآداء الأنتاجى لدجاجات الجميزة خلال فترة إنتاج البيض. وزنت ووزعت عشوائيا عدد ٩٦ دجاجة جميزة فى أقفاص فرديه ثم قسمت الى ٦ معاملات بكل منها ١٦ دجاجه (عمر ٤٠ أسبوع) واستمرت التجربة لمدة ٨ أسابيع، تم أضافه الثريونين بمعدل ٠,٢٢ جم/كجم لما هو موجود بالعلف ليتكون ٦ مستويات هى٥,١٩ ، ٥,٤١، ٥,٦٣، ٥,٨٥، ٦,٠٧ و ٦,٢٩ جم/كجم علف بالترتيب.

كل التركيزات المختبرة من الثريونين لم يكن لها اى تأثير معنوى على كل من إنتاج البيض،استهلاك العلف. تحسن كل من وزن البيض وكتله البيض ومعدل تحويل العلف معنويا مع زيادة تركيزات الثريونين فى العلف حتى تركيز ٦,٠٧ جم/كجم خلال الفترة الكلية للتجربة ثم حدوث انخفاض فى تلك الصفات مع زيادة التركيز. الطيور المغذاة على ٦,٠٧ جم/كجم علف ثريونين خلال نفس المدة سجلت أعلى وزن بيض (٦١,٥٢ جم)؛ كتله بيض (٣٧,٧٥ جم/دجاجه/يوم) واحسن كفاءة تحويلية (٣,٥٢). وقد أوضحت النتائج ان التركيز ٨٠٢ مجم/دجاجه/يوم من الثريونين مناسب لتحسين الأداء الإنتاجى للدجاجات. بناء على تحليل المدخلات والمخرجات تبين ان زيادة الثريونين فى العلف يزيد من الكفاءة الاقتصادية والكفاءة النسبية الاقتصادية وكانت افضل النتائج قد لوحظت فى مجموعه الطيور المغذاة على علف يحتوى ٦,٠٧ جم/كجم ثريونين .