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THE INFLUENCE OF CASEIN SUPPLEMENTATION WITH OR WITHOUT VITAMIN C ON PRODUCTIVE PERFORMANCE AND EGG QUALITY OF FAYOUMI HENS

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Abstract : *A total number of 225 Fayoumi hens 34 weeks old were used in this experiment to study the effect of supplementing layer diet with 0.2% casein (C) with or without 0.05% vitamin C (vit .C) in drinking water on the performance and egg quality. The experiment continued for 90 days. Birds were randomly divided into three groups; each group contained 3 replicates of 25 each. Birds in 1st group were served as a control and fed a basal diet are shown in Table (1), birds in group 2 were fed a basal diet supplemented with Casein at level of 0.2%. Birds of the third group were fed a basal diet supplemented with casein at level of 0.2% plus 0.05% vit. C in drink water. Egg number, egg weight, feed consumption and egg quality traits were evaluated. Feed conversion and economic efficiency were also calculated. Results obtained showed that:*

1-Addition of 0.2% Casein with or without Vit .C improved all productive traits , economic efficiency , albumen index , egg shape index and increased egg components (shell , albumen and yolk) percentage as compared with those of the control group .

2- Addition of 0.02% casein and 0.05% Vit.C gave higher values for most productive traits, egg quality and egg components percentage as compared with those supplemented with 0.2% casein only.

In general, results obtained revealed that supplementing Fayoumi layers diet by 0.2% Casein with 0.05% Vit.C in drinking water improved most of productive traits, egg quality, economic efficiency and egg contents percent as compared with those of the other treatments.

INTRODUCTION

Casein is a major constituent of milk which comprises about 80% of the total protein in milk (Manson, 1978). Results of using casein in food chickens by (Mykkamen and Wasserman, 1980) indicated that the ability to stimulate calcium absorption from the intestine may operate independently of vitamin D metabolism. Vander Meer (1983) and Vander Meer et.al. (1985) suggested that the proportion of amino acid phosphorylated in a protein (i – e ., amino acids of casein are highly phosphorylated) had effects on bile acid reabsorption . Allotta et.al. (1985) hypothesized that the highly phosphorylated amino acid absorption, especially zinc and copper had an effect on cholesterol metabolism. El-Husseiny et. al., (2000) reported that when supplemented broiler ration with 0.02% iodocasein the performance was improved. However a littile studies are available in this respect for laying hens.

Ascorbic acid is an indispensable micronutrient required to maintain the physiological processes of certain animals including poultry (McDwell, 1989). Vitamin C alleviates the negative effects of stress such as heat stress-related depression in poultry (McDowell, 1989 and Kutlua and Forbes, 1993). Metwaly (2005) found that birds fed the highest level of vitamin C had a good quality of egg and its shell. The beneficial effect of vitamin C may to be due to the reduction in heat stress and can sequent improvement in absorption of calcium. Attia et. al., (1997) found that supplementating layer diets with ascorbic acid improved the productive performance of local strain layers exposed to heat stress. Ascorbic acid synthesized in avian kidneys has been demonstrated to improve disease resistance in birds by optimizing the functions of the immune system (Wu et. al., 2000 and Lohakare. et. al., 2005).Orban et. al ., (1993) reported that supplementing diet with ascorbic acid resulted to plasma ionic calcium significantly increased .Abo-El-Ella (1999) reported that the high level of ascorbic acid supplementation gave a good results whereas two opposite was true with economically efficient . It may be due to the role of ascorbic acid in food metabolism and increase the food utilization especially its effect in calcium metabolism and its absorption.

The present study was conducted to evaluate the effect of casein supplementation with or without vitamin C on the performance and egg quality of Fayoumi hens.

MATERIALS AND METHODS

This study was carried out at the Poultry Research Unit , Animal production department , Faculty of Agriculture , Al – Azhar University , Assuit branch , Egypt . The study aimed to evaluate the effect of casein supplementation with or without vitamin C (Vit . C) on the performance and egg quality of Fayoumi hens .

Birds and management:

Total number of225Fayoumi hens 34 weeks old reared on floor in open side house under the same managerial conditions .Birds were randomly allotted to three groups. Each group divided into three replicates ,each replicate contain 25hens.Birds in 1stgroup fed on basal diet (unsupplemented) which served as a control .The composition and calculated analysis of the basal diet are shown in Table(1)while ,birds of the second group fed dietary casein at level of 0.2%. The third group received the same diet of the second group plus0.05%Vit.C in drinking water. All the experimental diets were isonitrogenous(17.36%CP)and isocaloric(2832kcal ME/Kg diet).All birds maintained under the same natural environmental conditions of upper Egypt .Artificial light was used beside normal daylight to provide 16 hours a day photoperiod.Feed and water were provided ad Libitum.The experimental period was extended to90days during the period of November,December and January

Performance traits:

Egg production (number and weight) was recorded daily per replicate. Within each replicate weekly feed intake was determined and feed conversion (feed: egg) was then calculated.

Egg and shell quality:

At the end of experimental period , six eggs were collected from each treatment to examine egg and shell quality measurements .Egg dimension (length and width) were measured in mm to calculate egg shape index according to Romanoff and Romanoff (1949) using the following equation : Egg shape index = egg width (mm) / egg length (mm) x 100 . Yolk and albumen index were calculated according to Funk et. al., (1958) as Yolk and albumen height divided by Yolk and albumen diameter, respectively. The weight of yolk was estimated after the separation of albumen while, albumen weight was calculated by subtracting the weight of yolk and shell from the egg weight. The shell without membrane was

weighed and measured its thickness by micrometer. Albumen, yolk and shell percentages were also calculated.

Economic efficiency:

Economical efficiency of egg production was calculated from input-output analysis which was calculated according to the prices of the experimental diets and egg produced during the year of 2008. The values of economical efficiency was calculated as follows:-

$$\text{Economic efficiency (EE)} = \frac{\text{Net revenue (LE)}}{\text{Total feed cost (LE)}}$$

Statistical analysis:

Data were statistically analyzed according to SAS (1996). Significant differences among individual measure were analyzed by Duncans multiple range tests (Duncans, 1955). Pooled standard error for each trait was also calculated.

RESULTS AND DISCUSSION

Productive Performance:

Results in Table (2) shows that the addition of casein to Fayoumi diets with or without Vit.C in drinking water had a significant effect ($P \leq 0.05$) on all performance parameters as compared with the control group. Hens received diets of 0.2% casein and 0.05% Vit .C in drinking water had best values of egg number, egg mass and feed conversion ratio. While, The opposite was true with egg weight, which was the significantly lowest value. However no significant was found between treatments of casein and that of casein plus Vit.C.

These findings are in agreement with those reported by Essa and Madion (2009) who found that most performance traits were improved when diet Fayoumi laying hens was supplemented with casein. They related this influence to improve calcium and protein utilization by feeding casein. Vander Meer, (1983), Vander Meer et. al., (1985) and Allotta et. al., (1985) have hypothesized that the highly phospharylated amino acid of casein interfere with trace mineral absorption especially zinc and copper. Pardue et. al., (1984), Zapata and Gernat, (1995), Attia et. al., (1997) reported that supplementing diet with ascorbic acid improved the productive performance. Also, El-Genndi et. al., (1999) reported that pullets fed Vit.C had the highest feed consumption, egg mass and egg weight when compared

with control group . It may be due to the role of Vit .C in activating thyroid gland which influence the feed intake (El – Fiky 1998).

Variation in average feed conversion due to treatments applied may be attributed to Vit .C supplementation on the rate of production and the amount of feed consumed. The beneficial effects of vit .C on feed conversion may be due to that Vit .C helps to control the increase in body temperature and plasma corticosterone concentration. It also protects the immune system (Roma, et. al., 2002).

Egg and shell quality traits:

Data in Table (3) shows that the supplementation casein to the fayoumi layers diet and vit. C in drinking water had insignificant ($P < 0.05$) effect on all egg and shell quality traits except albumen index when compared with those of the control group . Also, casein supplementation without Vit.C had an insignificant effect on egg shape and albumen index. While hens feed diet supplemented with 0.2% casein only had significantly decrease on yolk index and shell thickness. Diet supplemented with 0.2% casein and 0.05% vit. C had significant effect on all egg and shell quality traits accepted egg shape index as compared with hens supplemented with 0.2% casein only. In this respect, Essa and Madian (2009) who reported that supplementing diets with casein improved albumen index. They related this influence to improve protein utilization by feeding casein. Chen and Nockless (1973) and Asker (1977) found that shell thickness was significantly improved by supplementing the laying hens diet with ascorbic acid. Obran et. al., (1993) reported that supplementing deit with ascorbic acid resulted to significantly increase plasma ionic calcium. It may be due to the role of ascorbic acid in food metabolism and increase the food utilization especially its effect in calcium metabolism and absorption. Metwaly (2005) found that fed diet with Vit . C had a good quality of shell thickness and egg yolk when compared with control group.

Zapata and Gernat, (1995) found an improvement in shell quality was found as supplementing diet with Vit.C. Abdel Hamid et. al ., (1995) reported that the positive effects of Vit.C supplementation on egg quality confirmed the physiological functions of minerals , amino acids and poly saccharides metabolism as well as the adrenal cortex, pituitary , ovary and liver as target organs .

Results in Table (4) shows that the addition of casein to Fayoumi diets without Vit.C in drinking water had significantly improved albumen percentage as compared with that of the control group. While, the opposite

was true with yolk percentage which had a significantly decreased. However, casein plus Vit.C had not a critical effect on this respect. Addition of 0.2% casein and 0.05% Vit. C insignificantly increased shell and Yolk percent while; albumen percent significantly decreased when compared with hens received 0.02% casein only. These findings agree with those reported by Essa and Madian (2009). El – Gendi et. al., (1999) found that eggs were characterized significantly higher ($P < 0.05$) absolute and relative weights of albumen, shell and yolk by Vit. C supplementation. Also, Metwally (2005) found that hens fed Vit. C had a good quality of yolk and shell weight when compared with control group.

Economic efficiency:

Results of economical efficiency (E.E) and relative economical efficiency (R.E.E) estimated for the different treatments during the experiment are shown in Table (5). According to the input-output , the best R.E.E were recorded by hens fed 0.2% casein and 0.05% Vit.C followed by hens fed diet of 0.2% casein only compared with those fed on a basal diet . These results indicated that hens supplemented with casein only or casein and Vit.C were more economical over that of the control group. This improvement could be due to improve the feed conversion ratio and increase egg production. In general it can be concluded that the incorporating 0.2% casein into diet plus 0.05% Vit.C in drinking water gave the best economical efficiency.

Table (1): Composition and calculated analysis of the experimental basal diet.

Ingredients	%
Yellow corn	68
Soybean meal (44%)	14.5
Layer concentrate [(a)]	10.0
Limestone	7.25
Layer premix [(b)]	0.25
Total	100
Calculated analysis [(c)]	
Metabolizable energy (Kcal / Kg diet)	2832
Crude protein %	17.36
Calcium %	3.76
Available p. %	0.45
Lysine %	0.86
Methionine %	0.37
Methionine + Cystine %	0.64

a) Layer concentrate contains : crude protein 50% , crude fiber 2% , fat 4.28% , Ca 6% , P 2.85% , Methionine 1.38% , Methionine + Cystine 2.03% Laysine 2.72% , Nacl 2.67% and 2300 Kcal ME / Kg .

b) Each 2.5 Kg of layer premix contains : Vit A 10.000.000 I.U, Vit D 2.250.000 I.U, Vit K 1 g , Vit B_1 1g , Vit B_2 4g , Vit B_6 1.5g Vit B_{12} 10 mg, Pantothenic acid 10g, Niacine 20g , Zinc 45 mg, Cupper 3g, cobalt 100 mg , Iodine 300mg, Selenium 100 mg, Folic acid 1 g , Biotin 500 mg , Choline chloride 500 mg , manganese 40 g and CaCo3 to 2500 mg .

c) According to NRC (1994) .

Table (2): Effect of supplementing casein (C) with or without vitamin C (Vit.C) on the productive performance of Fayoumi hens .

Item	Month	Treatments		
		T1 (control)	**T2 (0.2% C)**	**T3 (0.05% vit . C)**
Egg number / hen / month	1	12.50 ± 0.21 b	14.60 ± 0.35 a	15.24 ± 0.24 a
	2	11.34 ± 0.20 c	13.30 ± 0.32 b	14.88 ± 0.31 a
	3	11.92 ± 0.24 b	13.95 ± 0.18 a	14.52 ± 0.38 a
	Overall mean	11.92± 0.33 c	13.95 ± 0.38 b	14.88 ± 0.19 a
Egg weight (gm)	1	46.80 ± 0.12 a	46.30 ± 0.26 a	44.65 ± 0.36 b
	2	46.18 ± 0.15 a	46.70 ± 0.21 a	45.70 ± 0.26 b
	3	46.0 ± 0.40 a	46.52 ± 0.17 a	45.00 ± 0.21 b
	Overall mean	45.99 ± 0.47 b	46.51 ± 0.12 a	45.12 ± 0.21 c
Egg mess/gm/hen/month	1	585.0 ± 8.7 b	676.0± 13.0 a	680.7 ± 21.3 a
	2	512.34 ± 16.7 b	615.11 ± 35.0 a	680.0 ± 30.6 a
	3	548.32 ± 14.8 b	648.95 ± 15.31 a	653.0 ± 20.4 a
	Overall mean	548.6 ± 47.0 b	646.7 ± 21.3 a	671.2 ± 13.1 a
Feed consumption gm/ hen / month	1	3280 ± 21.0 c	3466 ± 41.0 b	3560 ± 20.8 a
	2	3340 ± 23.0 c	3650 ± 29.0 a	3500 ± 20.8 b
	3	3300 ± 20.0 b	3400 ± 12.0 a	3420 ± 25.2 a
	Overall mean	3307 ± 18.0 b	3505 ± 74.0 a	3493.3 ± 23.2 a
Feed conversion ratio , kg Feed consumed / kg eggs produced	1	5.61 ± 0.06 a	5.13 ± 0.09 b	5.23± 0.07 b
	2	6.52 ± 0.28 a	5.93 ± 0.14 b	5.16 ± 0.17 c
	3	6.02 ± 0.09 a	5.24 ± 0.12 b	5.24 ± 0.03 b
	Overall mean	6.05 ± 0.26 a	5.41 ± 0.13 b	5.21 ± 0.05 b

a,b,c Means in the same raw having the same superscripte are not significant ($P \leq 0.05$) .

Table (3) : Effect of feeding of casein and vitamin C on egg and shell quality of Fayoumi Laying hens .

Measurements / Treatments	Egg shape index (ESI)	Yolk index (YI)	Albumen index (AI)	Shell thickness (SH.TH)
T1 (control)	73.46± 0.98 a	44.13 ± 0.60 a	6.82 ± 0.33 b	0.409 ± 0.01 a
T2 (Casein)	71.97 ± 0.51 a	41.97 ± 0.59 b	6.91 ± 0.21 b	0.358 ± 0.009 b
T3 (Casein+vit.C)	72.93 ± 0.46 a	43.73 ± 0.46 a	7.65 ± 0.23 a	0.418 ± 0.004 a

a, b Means in the same column having the same superscript are not significant at ($P < 0.05$) .

Table (4) : Effect of feeding of casein and vitamin C on egg contents of Fayoumi Laying hens .

Measurements / Treatments	Shell %	Albumen %	Yolk %
T1 (control)	11.37 ± 0.10 a	55.38 ± 0.30 b	33.26 ± 0.37 a
T2 (Casein)	11.46 ± 0.11 a	56.10 ± 0.21 a	32.44 ± 0.15 b
T3 (Casein + vit.C)	11.62 ± 0.05 a	55.04 ± 0.17 b	33.34 ± 0.18 a

a , b Means in the same column having the same superscript are not significant at ($P < 0.05$) .

Table (5) : Effect of supplementing casein with or without vitamin C on the economic efficiency of Fayoumi hens

(According to price at 2008) .

Treatments / Items	**T1 (control)**	**T2 (0.2% C)**	**T3 (0.2% C +0.05% vit.C)**
- Feed Consumption / hen (k g)	3.307	3.505	3.493
- Price / K g diet (L . E)	1.700	1.760	1.775
- Feed cost / hen (L . E)	5.62	6.17	6.20
-Egg mass / hen (kg)	0.549	0.647	0.671
- Price of Kg egg mass	12.00	12.00	12.00
- Total revenue / hen (L .E)	6.59	7.76	8.05
- Net revenue / hen (L . E)	0.97	1.59	1.85
- Economical efficiency (E. E)*	0.17	0.26	0.30
- Relative economical efficiency (R . E. E)* *	100	154	176

*Economical efficiency (E. E) = net revenue / feed cost .

**Relative economic efficiency (R. E.E) = $\frac{\text{E. E. of treatments}}{\text{E. E. of control}}$

L. E = Egyptian lover

Price of kg egg mass = 12 L . E

Price of Kg Casein = 30 L. E

Price of kg Vit.C = 15 L . E

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الملخص العربى

تأثير التغذية على الكازين مع أو بدون فيتامين ج على الأداء الانتاجى وصفات جودة البيضة للدجاج الفيومى

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أجريت هذه الدراسة على عدد (٢٢٥) دجاجة فيومى عند عمر ٣٤ أسبوع ولمدة ٩٠ يوم وذلك لدراسة تأثير إضافة ٠.٢% كازين فى العليقة مع أو بدون إضافة ٠.٠٥% فيتامين ج فى ماء الشرب على الأداء وصفات جودة البيضة. وقد تم تقسيم الدجاج عشوائياً إلى ٣ مجموعات بكل مجموعة ٣ مكررات بكل منها ٢٥ دجاجة وغذيت المجموعة الأولى على عليقة أساسية (مقارنة) تحتوى على ١٧.٣٦% بروتين خام و٢٨٣٢ كيلو كالورى طاقة ممثلة لكل كجم علف و ٣.٤٦% كالسيوم ، ٠.٤٥% فوسفور متاح فى حين غذيت المجموعة الثانية على العليقة الأساسية مضافاً إليها ٠.٢% كازين وغذيت المجموعة الثالثة على العليقة الأساسية مضافاً إليها كل من ٠.٢% كازين و٠.٠٥% فيتامين ج فى ماء الشرب وقد درست صفات إنتاج البيض الغذاء المستهلك وكفاءة التحويل الغذئى وصفات جودة البيضة وكانت النتائج كالتالى :

١-إضافة ٠.٢% كازين مع أو بدون إضافة ٠.٠٥% فيتامين ج أدى إلى تحسن فى جميع الصفات الإنتاجية وكفاءة التحويل الغذائى والكفاءة الاقتصادية ومعامل الألبيومين ودليل شكل البيضة وزيادة النسب المئوية لمكونات البيض بالمقارنة بمجموعة الكنترول .

٢-إضافة كل من٠.٢% كازين للعليقة مع٠.٠٥% فيتامين ج فى ماء الشرب أعطى قيم أعلى لمعظم الصفات الإنتاجية وصفات جودة البيضة عن المعاملة التى أضيف لها ٠.٢% كازين فقط.

وعموماً يمكن التوصية بالتغذية على علائق تحتوى على كل من ٠.٢% كازين و ٠.٠٥% فيتامين ج فى ماء الشرب حيث أدى ذلك إلى تحسن فى معظم الصفات الإنتاجية وصفات جودة البيضة والكفاءة الاقتصادية.