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EFFECTS OF VITAMIN E SUPPLEMENTED DIET ON EGG PRODUCTION PARAMETERS AND A-TOCHOPHEROL DEPOSITION IN THE YOLK

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Abstract

The transfer of vitamin E from high level supplemented diets in egg yolk, effect on egg production and age was investigated. Hisex Brown, molted laying hens, assigned in three groups were used in the experiment. Two, 80 weeks old, hens were accommodated in each cage. The hens were fed basal diet, containing 45 IU vitamin E kg^{-1} (group 1), basal diet supplemented 150 IU vitamin E kg^{-1} (group 2) and basal diet supplemented 300 IU vitamin E kg^{-1} (group 3). The egg production, egg weight and albumen weight were significantly higher in the experimental groups, but the egg yolk has similar weight in all three groups. The content of vitamin E in the yolk was measured. The concentration of vitamin E in 100 g yolk in group 1, 2 and 3 was 12.78 IU, 21.34 IU and 42.28 IU, respectively. The transfer of vitamin E was significantly higher in the experimental groups ($p<0.01$).

Key words: *egg quality, egg production, vitamin E.*

INTRODUCTION

Vitamin E is one of the most powerful antioxidants which supplemented into animal feed improve productive performance, immunological status, quality of egg and also increase the amount of the vitamin E into the egg yolk (Sunder et al., 1997; Flachowsky, 2000; Melluzi, 2000; Grobas, 2002). Chickens, however, cannot synthesize vitamin E; therefore, vitamin E requirements must be met from dietary sources (Chan and Decker, 1994). The recommended vitamin E concentration in diet of laying hens is from 0.05 to 0.08 ppm in correlation of the daily feed intake (NRC, 1994). These investigations using vitamin E in the diet of chicken are carried out with relatively young hens in the first faze of laying. Working with older hens after artificial molting (80 weeks and older) where the immune and antioxidative system could be colapsed is extremely rare. Because old and molted layers become very common in our region, our feeding trial was carried out with molted layers to investigate the effect of large amount vitamin E supplementations on its transfer in the yolk and egg structure.

MATERIALS AND METHODS

The current experiment was conducted with 30 molted laying hens (hybrid Hisex Brown), divided in three groups, 10 in each, and accommodated 2 per cage. The birds were housed in standard poultry house. The experimental molted hens where aged 80 weeks on the beginning of the experiment.. Vitamin E was added in the basal diet (group 1) as a-tocopheryl acetate (45 IU vitamin E/kg) and supplemented with 150 IU/kg (group 2) and 300 IU/kg (group 3). The composition of the basal diet is presented in Table 1.
The hens were fed with 120g feed per day/hen. (in the feeder for 2 hens was added 240g feed daily). The possibility for every bird was to consume in average of 5.4 IU vitamin E per day (group 1), 23.4 IU (group 2) and 41.4 IU (group 3). The experiment was lasting 45 days. The number of produced eggs was monitored every day. The egg structure parameters (egg weight, white weight, yolk weight and eggshell weight) was measured on 6 eggs 3 times during the experiment (every 15^{th} day) on balance with 0.1 g accuracy. The egg samples were prepared by mixing 6 yolks, in fresh condition, homogenized and then saponified with stirring

in an alcoholic solution of potassium hydroxide.

Table 1. Composition of the basal diet

Ingredient	%
Maize	54.72
Soybean meal	22.50
Sunflower meal (28%)	5.00
Maize gluten	2.00
Sunflower oil, crude	2.88
Synthetic methionine	0.07
Choline chloride (60%)	0.11
Potassium carbonate	0.31
Sodium bi carbonate	0.40
Bentonal	0.30
Mono calcium phosphate	1.25
Calcium carbonate	9.79
Salt	0.17
Premix	0.50
Total	100.00
ME, Kcal/kg	2750
Crude protein,%	17.8
Lysine,%	0.91
Methionine,%	0.36
Methionine + cistine,%	0.69
Threonine,%	0.63
Triptophane,%	0.19
Arginine,%	1.12
Calcium,%	4.00
Phosphorus, total,%	0.62
Phosphorus, available,%	0.37
Potassium,%	0.82
Sodium,%	0.21
Chlorine,%	0.17
Electrolyte balance, mEq/kg	249
a-tocopheryl acetate, IU/kg	45

The analytes were then extracted with hexane and washed with water. The organic faze was removed by evaporation and the residue was dissolved in methanol, filtered and then injected into the chromatographic system. The mobile phase used was a 2.5 m*M* acetic acid-sodium acetate buffer. The flow rate was 1.0 ml/min. The High Performance Liquid Chromatography (HPLC) system used for analysis was Perkin Elmer. The results were expressed in mg/100 g yolk, and in one yolk. Data were tested for significance using the analysis of variance, the F-test (Snedecor and Cochran, 1989).

RESULTS AND DISCUSSIONS

The effect of the supplemented vitamin E in feed of Hisex Brown hens on the egg structure parameters are presented in Table 2.

Table 2. Effects of supplementing vitamin E in feed on egg structure parameters

Specification	Group 1 Basal Feed (BF) 45 IU Vit E kg^{-1}	Group 2 BF + 150 IU Vit E kg^{-1}	Group 3 BF + 300 IU Vit E kg^{-1}
Egg production, %	82.00	78.00	84.00
Egg weight,g	67.01±3.41[a]	71.37±3.61[b]	71.53±6.29[b]
Egg white weight, g	39.67±3.33[a]	42.61±2.92[b]	43.59±4.27[b]
Egg yolk weight, g	19.23±2.28	19.82±1.31	19.30±2.27
Egg shell weight, g	8.10±0.61[a]	8.93±0.67[b]	8.63±1.10[b]
Egg white, %	59.17±3.49	59.65±2.37	60.93±2.21
Egg yolk, %	28.75±3.42	27.83±2.25	27.02±2.34
Egg shell, %	12.08±0.66	12.51±0.66	12.06±0.88

Values sre means ± S.D. n = 16 eggs in each group

[a,b] - Values in the same row with no common superscript differ significantly ($p< 0.05$)

The average egg weight of the experimental hens was 67.01±3.41, 71.37±3.61 and 71.53±6.29 in the order of the groups, respectively. There are significant differences of the increasing of egg weight in relation with the increasing amount of supplemented vitamin E in the experimental feed ($p< 0.05$). These results are opposite with the results reported by Kirunda et al., 2001. The reported results by Chung et al., 2005, indicate that combined vitamin C and E in the diets of the broiler breeders significantly improved egg quality parameters such as egg weight but during the heat stress period. There are not reported results from the trials carried out with the molted hens to show the effect of diet supplemented with vitamin E on the egg quality parameters. Egg white weight was significantly higher in the groups of hens fed with larger amount of supplemented vitamin E in feed compared with the experimental group fed with basal feed (39.67 ± 3.33, 42.61 ± 2.92 and 43.59 ± 4.27; $p< 0.05$). The weight of egg yolk was similar values in all experimental groups. The egg shell weight was 8.10 ± 0.61; 8.93 ± 0.67 and 8.63 ± 1.10 in group 1, 2 and 3, respectively ($p<0.05$). These results are presented in Figure 1.

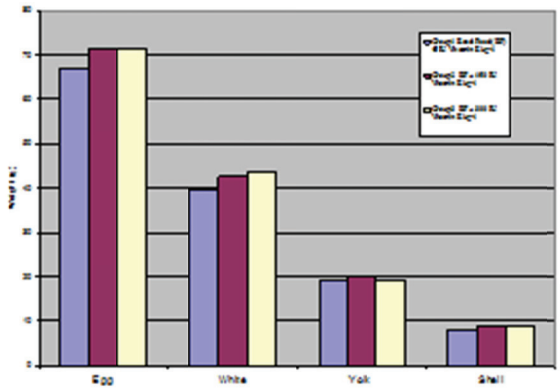

Figure 1. Effects of large amount of supplementing vitamin E in feed on egg structure parameters

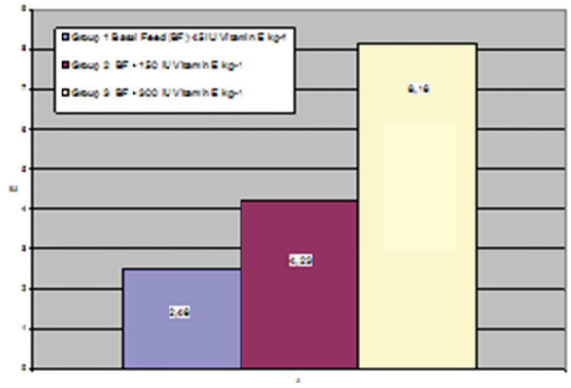

Figure 2. Vitamin E cocentration in one average egg yolk, mg

The concentration of vitamin E in egg yolks increased linearly with dietary vitamin E concentration, an effect which has been reported by several other authors (Sunder and Flachowsky, 2001; Franchini, 2002; Skrivan, 2010) Vitamin E content in egg yolk of the experimental eggs is presented in Table 3 and Figure 2.

Table 3. a-tocopherol deposition in egg's yolk from hens fed with large amount vitamin E supplemented diet

Specification	Group 1 Basal Feed (BF) 45 IU Vit E kg^{-1}	Group 2 BF + 150 IU Vit E kg^{-1}	Group 3 BF + 300 IU Vit E kg^{-1}
Daily consumption of vitamin E, IU	5.4	23.4	41.4
Egg production,%	82.00	89.33	90.00
Vitamin E content in 100 g egg yolk, IU	12.78 ± 3.67^{A}	21.34 ± 3.49^{B}	42.28 ± 9.27^{C}
Vitamin E content in one yolk, mg	2.46 ± 0.93^{A}	4.23 ± 0.49^{B}	8.16 ± 1.65^{C}

$^{A-C}$ - Values in the same row with no common superscript differ significantly ($p< 0.01$)

The transfer of vitamin E in the yolk was 45.55% of the consumed vitamin E in the feed of the control group. Transfer of the vitamin E in the egg yolk in the experimental groups feed with 150 and 300 IU supplemented vitamin E was 18.08% and 19.71% of the consumed vitamin E, respectively. This different transfer of vitamin E in the yolks might be related to the mechanisms of absorption and transport of vitamin E to the egg yolk.

CONCLUSIONS

Based on the obtain results from the experiment to observe the effects of large amount of supplemented vitamin E in the feed on its transfer and egg structure can be concluded that large amount of vitamin E in layers diets affected production of significant larger egg weight ($p<0.05$), egg white weight ($p<0.05$) and egg shell weight ($p<0.05$). Larger amount of supplemented vitamin E improved not only the egg production of laying hens, but improved its transfer in the egg yolk and produced enriched eggs with vitamin E ($p<0.01$).

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