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Effect of dietary supplemented semi-refined sunflower oil with vitamin E on egg quality of laying hens

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Abstract

The aim of this experiment was to evaluate the effects of supplemented semi-refined vegetable oil (with or without vitamin E supplement) on egg characterizes. A factorial experiment (3×2) including 3 levels of semi-refined oil (2, 4 or 6%) and 2 levels of vitamin E (150 or 750 mg/kg diet) based on completely randomized design was performed with 212 laying hens (Hy-line W36) from 62w to 74w of age. Egg physical traits were estimated for eggs produced by layng hens fed experimental diets. Evaluated data during experimental period showed that utilization of semi-refined oil with vitamin E didn't have considerable effect on egg characterizes (egg shell weight, shell thickness and specific weight), with exception of haugh unit ($p<0.05$). Supplementation of 4 or 6% semi-refined oil caused highest haugh unit in produced eggs. Results obtained by supplemented 4% were more significant (haugh unit: 90.85). Supplementation of Vitamin E didn't has any considerable effect on egg characterizes; egg shell weight, shell thickness, specific weight, haugh unit. In overall, supplementation of semi-refined vegetable oil (with or without vitamin E supplement) didn't have any considerable effect on egg physical traits.

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Introduction

Given the economical demands of broiler farm, specially feed ingredient cost, cheaper high energy and protein sources are favorable selects, when corn is major proportion of diet. The alternative energy sources such as Sunflower oil production wastes (Alizadeh *et al.,* 2012) and restaurants waste oil (Karamouz *et al.,* 2010) are used in experimental studies with successful results.

Regardless to vegetable oil benefits for broilers, unfortunately they are susceptible for oxidation reaction. Free radicals cuts "H" from "CH" group of fatty acids carbon chain and cause pro-oxidation reaction (Mori *et al.,* 1992). Anti-oxidant agents such as vitamin E (Açıkgöz *et al.,* 2011) must be presented in high oil included diets to prevention of occurrence oxidative damages arise from unsaturated fatty acids oxidation.

Bozkurt *et al*., (2008), reported that supplementation of 1.5 percent oil in corn-soybean based diet may improve egg production rate, egg weight, hatchability, hatching weight chicks of oil fed breeders, without any negative effect on breeder body weight and hatching quality of eggs. Optimum level of oil in laying hen diet with attention to cumulative egg production and performance may be is 10 percent that was suggested with Grobas *et al*., (2001). In other side, use of oxidized (Anjum *et al*., 2004; Karamouz *et al.,* 2010) or semi-refined oils (Moraes *et al*., 2009) is a new trend in poultry nutrition research works for possible economic efficiency with lowering feed cost and energy obtaining via cheaper sources. It was documented that oxidation of oil hadn't negative effect on its ME levels for poultry (Hussein and Kratzer, 1982), but in other hand oxidized oils may be hazardous for birds and can lowers feed efficiency and body weight (Anjum *et al*., 2004). With attention to high cost of refined vegetable oil and successful results with dietary supplementation of semi-refined rice oil for broilers (Moraes *et al*., 2009), and our observations on efficiency of semi-refined vegetable oil for laying hens performance, aim of this study was to investigate the effects of dietary supplemented semi-refined sunflower oil (as common dietary oils in poultry nutrition) with vitamin E (as anti-oxidant agent) on egg characterizes in laying hens.

Materials and methods

Experimental design

This study was conducted as 3×2 factorial experiment with three level of semi-refined sunflower oil (2, 4 and 6 percent) and two vitamin E level (150 and 750 mg/kg) in six treatments (include three replicates: 12 bird) and totally 212 Hy-line (W36) strain from 62 to 74 weeks in completely randomized design. Before onset, eggs were selected from average weight of eggs produced by each experimental group.

Diet formulation

Diets were formulated according nutrient requirements of laying hens presented in NRC (1994); ME: 2750 Kcal/Kg, CP: 13.75% by UFFDA software (8). Experimental rations were including;

Group1: supplementation of 2% semi-refined sunflower oil with 75 mg Vitamin E, Group2: supplementation of 2% semi-refined sunflower oil with 150 mg Vitamin E, Group3: supplementation of 4% semi-refined sunflower oil with 75 mg Vitamin E, Group4: supplementation of 4% semi-refined sunflower oil with 150 mg Vitamin E, Group5: supplementation of 6% semi-refined sunflower oil with 75 mg Vitamin E, and Group6: supplementation of 2% semi-refined sunflower oil with 150 mg Vitamin E (Table1).

Assays and Data collection

Four eggs from each replicate were weighted and special weigh was determined via salty water method. Next, eggs were broken and haugh unit was measured in conducted albumen. The standard haugh meter (CE-300) was applied for determination of yolk haugh. Egg shells were dried in room temperature and after 48h, egg shell weights were weighted (0.01 accuracy) and

egg shell diameter was assayed by micrometer (0.001 mm) in three different points of egg shell, means of these three points was announced as a shell diameter for experimental groups. The weight of per cm egg shell was considered as egg shell strength. Egg shell surface area was estimated using Cortis and Willson method.

Table 1. Feed ingredients and ration composition of experimental layer hen diets. Environmental conditions such as lighting program (16 hours light: 8 hours darkness) were similar for all groups.

Feed ingredients %	Treatments					
	1	2	3	4	5	6
Corn	47.67	47.67	40.23	40.23	34	34
Wheat	18.11	18.11	19.81	19.81	20.01	20.01
Soybean oil	15.73	15.73	16.83	16.83	18	18
Wheat bran	5	5	5	5	5	5
Semi-refined sunflower oil	2	2	4	4	6	6
Vitamin E	75	150	75	150	75	150
sand	2	2	4	4	6	6
oyster shell	7.24	7.24	7.36	7.36	7.06	7.06
Bone meal	1.49	1.49	1.52	1.52	1.55	1.55
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Vitamin supplement[1]	0.25	0.25	0.25	0.25	0.25	0.25
Mineral supplement	0.25	0.25	0.25	0.25	0.25	0.25
Meatbolizable energy (ME)(kcal/kg)	2750	2750	2750	2750	2750	2750
Crude protein (CP) %	13.75	13.75	13.75	13.75	13.75	13.75
Calcium %	3.27	3.27	3.22	3.22	3.22	3.22
Available phosphorus %	0.3	0.3	0.3	0.3	0.3	0.3
Sodium %	0.14	0.14	0.14	0.14	0.14	0.14
Lysine %	0.63	0.63	0.65	0.65	0.67	0.67
Metyonine + systein %	0.52	0.52	0.52	0.52	0.52	0.52
Theronin %	0.55	0.55	0.55	0.55	0.55	0.55
Tryptophan %	0.18	0.18	0.18	0.18	0.18	0.18

1- per kg vitamin supplement include 8500000 IU vitamin A, 2500000 IU Vitamin D_3, 11000 IU Vitamin E, 2200 mg Vitamin K_3, 1477 mg Vitamin B_1, 4000 mg Vitamin B_2, 7840 mg Vitamin B_3, 34650 mg Vitamin B5, 2464 mg Vitamin B6, 110 mg Vitamin B9, 10 mg Vitamin B12, 400000 mg coline chloride.

2-per kg mineral supplement include 74400 mg Mg, 75000 mg Fe, 64.675 mg Zn, 6000 mg Cu, 876 mg iodine, 200 mg selenium.

Obtained data were analyzed by SAS software Ver. 9.1 and Duncan multiple range test were done for detection of significant differences at 0.05 %.

Results and Discussion

Dietary utilization of different levels of semi-refined oil had considerable effect on haugh unit ($P<0.05$), that with inclusion of 4% oil we had highest haugh unit. There was no any significant difference between 4 or 6 % semi-refined oil or supplementation of vitamin E (or combination of oil+Vit. E) for haugh unit measure. In other words, inclusion of Vitamin E hadn't any considerable effect on egg quality traits (Table2).

Table2. Effects of different levels of semi-refined sunflower oil and vitamin E on some of egg quality measures in laying hens

Table 2. Effects of different levels of semi-refined sunflower oil and vitamin E on some of egg quality measures in laying hens

Supplements (mg/dl)	Specific weight (mg/cm3)	Egg shell weight (g)	Haugh unit	Egg shell thickness (mm)	Weight of per g of egg shell (mg/ cm3)
2% semi-refined sunflower oil	1.083	5.59	85.76[b]	0.39	0.78
4% semi-refined sunflower oil	1.083	5.54	90. 85[a]	0.35	0.78
6% semi-refined sunflower oil	1.082	5.68	87.86[ab]	0.38	0.78
SEM	0.008	0.074	1.20	0.39	0.01
75 mg/kg Vitamin E	1.082	5.60	89.48	0.38	0.77
150 mg/kg Vitamin E	1.083	5.60	86.83	0.37	0.78
SEM	0.0007	0.061	0.98	0.84	0.008
2% semi-refined sunflower oil × 75 mg/kg Vitamin E	1.082	5.63	86.70	0.35	0.77
2% semi-refined sunflower oil × 150 mg/kg Vitamin E	1.084	5.55	84.82	0.35	0.79
4% semi-refined sunflower oil × 75 mg/kg Vitamin E	1.082	5.47	91.39	0.35	0.76
4% semi-refined sunflower oil × 150 mg/kg Vitamin E	1.084	5.61	90.31	0.35	0.79
6% semi-refined sunflower oil × 75 mg/kg Vitamin E	1.082	5.71	90.35	0.35	0.79
6% semi-refined sunflower oil × 150 mg/kg Vitamin E	1.082	5.65	85.37	0.41	0.77
SEM	0.001	0.11	4.23	0.86	*0.014*

**different letters (a and b) show significant difference, p<0.05.*

In Ahadi *et al.,* (2010) study highest haugh unit was resulted by addition of 2% soybean oil and 2% canola oil to laying hens diets. Almost vegetable oils had potential for optimizing haugh unit of eggs (Florou-Paneri *et al.*, 2005). Al-Daraji *et al.*, (2011), in a comparative study between animal and vegetable oils, had shown that sunflower oil didn't have considerable effect on egg quality of Japanese quail, but corn oil (as vegetable oil) and fish oil (as animal oil) had considerable effects on egg quality characterizes. In agreement to Al-Daraji *et al.*, (2011) report in quails and Florou-Paneri *et al.,* (2005) in hens, in present study, addition of semi-refined sunflower oil, with exception to haugh unit, didn't have any significant effect on other egg physical traits.

In a past study conducted by Kirunda *et al.*, (2001), the egg weight, emulsification capacity, yolk color, yolk index, and yolk viscosity were not improved by vitamin E supplementation for layers subjected to heat stress. In this regard, Yardibi and Turkay, (2008) demonstrated that there was no evidence of a beneficial effect of dietary vitamin E on egg production during heat stress within the dietary range.

Also in a similar study conducted in normal temperature (without heat stress)(Biswas *et al.,* 2010) reported that the egg quality traits in terms of albumin weight, yolk weight, shell thickness, albumin index and yolk index did not differ significantly following vitamin E supplementation. Present findings for effect of vitamin E on egg quality are in agreement with Kirunda *et al.*, (2001) and Yardibi and Turkay, (2008), and Biswas *et al.,* (2010). In other hand, combination of vitamin E with semi-refined oil couldn't affect egg quality. So, it was concluded that dietary supplementation of semi-refined vegetable oil (with or without vitamin E) haven't any considerable effect on egg physical characterizes.

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