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The effects of dietary supplemented semi-refined sunflower oil with vitamin E on egg production performance of laying hens

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ABSTRACT

The aim of this study was to investigation on effects of dietary supplemented semi-refined sunflower oil with vitamin E (as anti-oxidant agent) on egg production performance in laying hens. This study was conducted as 3×2 factorial experiment with three levels (2, 4 and 6 percents semi-refined sunflower oil) and two vitamin E levels (75 and 150 mg/kg) in six treatments (include three replicates and 12 bird in each replicate) in completely randomized design. In this experiment 212 laying hens Hy-line (W36) strain were evaluated from 62 to 74 weeks. Maximum of egg production percent (67.27), egg mass (40.89g) and of the best feed conversion ratio (FCR: 2.47) were observed in groups fed 6% semi-refined sunflower oil supplemented ration. Supplementation of 150mg/kg vitamin E caused the highest egg production (64.15%). As interactive effects; maximum amounts of egg production (73.82%), egg mass (44.68g) and the best FCR (2.25) were resulted by 6% semi-refined oil and 150mg/kg vitamin E. It is concluded that dietary supplementation of 6% semi-refined sunflower oil in combination with 150 mg/kg vitamin E is an efficient choice for optimizing egg production performance.

Key words: laying hen, performance, semi-refined oil, vitamin E.

INTRODUCTION

Because of their higher amount of metabolisable energy (ME), dietary fats and oils are good selection for energy obtaining in poultry feeds. Animal fats have structural long-chain and higher number of saturated fatty acids that commonly have lower digestibility and absorption rate and also lower ME in comparison with vegetable oils [1]. Broilers especially in term of starter

feeding, can digest vegetable oils (because of their high unsaturated fatty acid content) better than animal fat such as tallow [2, 3]. 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 [4]. Anti-oxidant agents such as vitamin E [5] or selenium [6] must be presented in high oil included diets to prevention of occurrence oxidative damages arise from unsaturated fatty acids oxidation.

Bozkurt et al., [7], 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. But higher amounts of dietary supplemented oils may cause liver dysfunctions or related syndromes [8]. Maximum 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., [9]. In other side, use of oxidized [10, 11] or semi-refined oils [12] is a new trend in poultry nutrition research works for possible economic efficiency with lowering feed cost and energy obtaining via cheaper sources. It is documented that oxidation of oil did not have negative effect on its ME levels for poultry [13], but in other hand oxidized oils may be hazardous for birds and can lowers feed efficiency and body weight [10]. With attention to high cost of refined vegetable oil and successful results with dietary supplementation of semi-refined rice oil for broilers [12], aim of this study was to investigation on effects of dietary supplemented semi-refined sunflower oil (as common dietary oils in poultry nutrition) with vitamin E (as anti-oxidant agent) on egg production performance 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, egg production records of hens were determined for identification of their egg production number. During 12 weeks of experiment, feed intake, egg production, egg weight, egg mass and FCR were recorded.

-Diet formulation

Diets were formulated according nutrient requirements of laying hens presented in NRC [14]; ME: 2750 Kcal/Kg, CP: 13.75% by UFFDA software. Experimental rations were including;

Group1: supplementation 2% of semi-refined sunflower oil with 75 mg Vitamin E, Group2: supplementation 2% of semi-refined sunflower oil with 150 mg Vitamin E, Group3: supplementation 4% of semi-refined sunflower oil with 75 mg Vitamin E, Group4: supplementation 4% of semi-refined sunflower oil with 150 mg Vitamin E, Group5: supplementation 6% of semi-refined sunflower oil with 75 mg Vitamin E, and Group6: supplementation 2% of semi-refined sunflower oil with 150 mg Vitamin E, and Group6: supplementation 2% of semi-refined sunflower oil with 150 mg Vitamin E, and Group6: supplementation 2% of semi-refined sunflower oil with 150 mg Vitamin E, and Group6: supplementation 2% of semi-refined sunflower oil with 150 mg Vitamin E [table1].

Environmental conditions such as lighting program (16 hours light: 8 hours darkness) were similar for all groups.

Feed ingredients	Treatments						
	1	2	3		5	6	
/0	1	47.67	3	4	24	24	
Corn	47.67	4/.6/	40.23	40.23	34	34	
Wheat	18.11	18.11	19.81	19.81	20.01	20.01	
Soybean meal	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	
Inert (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 premix ¹	0.25	0.25	0.25	0.25	0.25	0.25	
Mineral premix	0.25	0.25	0.25	0.25	0.25	0.25	
Calculated nutrients							
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	

 Table 1. Feed ingredients and ration composition of experimental layer hen diets

1- per kg vitamin supplement include 8500000 IU vitamin A, 2500000 IU Vitamin D₃, 11000 IU Vitamin E, 2200 mg Vitamin K₃, 1477 mg Vitamin B₁, 4000 mg Vitamin B₂, 7840 mg Vitamin B₃, 34650 mg Vitamin B5, 2464 mg Vitamin B6, 110 mg Vitamin B9, 10 mg Vitamin B12, 400000 mg choline 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.

-Assays and Data collection

Egg production was determined as cumulative egg production and feed consumption and FCR were estimated weekly. 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

Maximum egg production percent (67.27), egg mass (40.89g) and the best FCR (2.47) were observed in groups fed 6% semi-refined sunflower oil supplemented ration. Supplementation of 150 mg/kg vitamin E caused the highest egg production (64.15%). As interactive effects; maximum egg production (73.82%), egg mass (44.68g) and better FCR (2.25) were resulted by 6% semi-refined oil and 150 mg/kg vitamin E. Findings for effects of dietary supplemented semi-refined oil with vitamin E on egg production performance and egg characterizes were presented as table2.

Oil sources because of their high energy content, palatability, effects on intake feed, lower heat production, and vitamin contented have suitable effects on hen performance [15] that performance efficiency with 6 percent semi-refined oil supplementation in present study [table 2] may be because of this reason. It is reported that supplementation of 5 percent dietary poultry fat

without ME change, can cause egg size increase for breeder flock [7]. Moraes et al., [12] in comparison of rice bran semi-refined oil with soybean oil, suggested that rice bran semi-refined oil can use in poultry diet for obtain similar performance and carcass quality, as a good replacement for soybean oil. About vitamin E, addition of 250 mg/kg vitamin ration caused body weight rise, egg production and FCR of laying hens exposed to 6° environmental temperature, that similar effect with similar doses was observed in broilers, too [16].

of laying tiens											
supplements	Egg	Production rate	Cumulative egg Feed		Feed conversion						
	weight (g)	(%)	production (g)	consumption (g)	ratio (FCR)						
2% semi-refined sunflower oil	60.70	53.65 ^b	32.53 ^b	99.81	3.11 ^a						
4% semi-refined sunflower oil	60.50	58.62 ^b	35.29 ^b	101.02	2.89 ^a						
6% semi-refined sunflower oil	60.82	67.27 ^a	40.89 ^a	100	2.47 ^b						
SEM	0.20	1.37	1.37	1	0.14						
75 mg/kg Vitamin E	60.84	57.54 ^b	34.88	100.6	2.90						
150 mg/kg Vitamin E	60.50	64.15 ^a	37.59	99.94	2.75						
SEM	0.16	1.72	1.11	0.81	0.11						
2% semi-refined sunflower oil \times 75	60.90	54.74 ^b	33 35 ^b	100.42	3 01 ^a						
mg/kg Vitamin E	00.90			100.12							
2% semi-refined sunflower oil \times	60.51	52.53 ^b	31.71 ^b	99.2	3.21 ^a						
150 mg/kg Vitamin E	00.01	02.00			0.21						
4% semi-refined sunflower oil \times 75	60.54	57.14 ^b	34.2 ^b	101.68	2.99 ^a						
mg/kg Vitamin E											
4% semi-refined sunflower oil \times	60.46	60.10 ^b	36.39 ^b	100.35	2.79 ^a						
150 mg/kg Vitamin E					,						
6% semi-refined sunflower oil \times 75	61.1	60.72^{ab}	37.1 ^{ab}	99.70	2.69^{ab}						
mg/kg Vitamin E	0111		0,11		>						
6% semi-refined sunflower oil \times	60.55	73.82^{a}	44 68 ^a	100.28	2.25 ^b						
150 mg/kg Vitamin E	/kg Vitamin E			100.20	0						
SEM	0.28	2.98	1.93	1.40	0.19						

Table 2. Effects of different levels of semi-refined sunflower oil and vitamin E on egg production performance of laving bons

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

Aghdam Shahryar [17] reported that supplementation of saturated or unsaturated fatty acids in various dosages in combination with vitamin E did not have any considerable effect on broiler breeder's performance. In present study according to table 2, supplementation of 6 percent semi-refined sunflower oil caused significant FCR improvement and better egg production performance that were in agreement with Kucuk et al., [16] in layers and Moreas et al ., [12] in broilers conducted with semi-refined oil. But our observation for performance improvement in considerable specially for groups fed diets include 6 percent semi-refined oil with 150 mg/kg vitamin E, where it couldn't visible in Aghdam Shahryar [17] with various level of dietary oil. It seems that current combination "6% sunflower oil and 150 mg/kg vitamin E" is more efficient, especially this uncommon dietary oil source (semi-refined) is available with lower cost.

Finally it is concluded that dietary supplementation of 6 percent semi-refined sunflower oil in combination with 150 mg/kg vitamin E is an efficient choice, where the ration cost is lower and is suitable for farm economy without oxidative-related negative effect on production performance of laying hens.

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