Effect of Se and oils on laying hens productivity, egg quality parameters and content of Se

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Abstract

In this study, effects of using different oil sources, organic and inorganic Se and vitamin E on laying hens productivity, egg quality parameters, Se and vitamin E accumulation. A total of 40 laying hens which were 22 weeks old were assigned to four treatment groups and fed with the experimental diets for 8 weeks. The trial was set up as a randomized complete block design with 2x2 factorial arrangement: 2 added oils (sunflower S and linseed L) and 2 sources of Se+ vit. E (organic O and inorganic I) and then four dietary treatments were used SO (sunflower oil+organic Se and vit.E), LO (linseed oil+organic Se+vit.E), SI (sunflower oil+inorganic Se+vit.E), LI (linseed oil+inorganic Se+vit.E). The laying hens were fed with compound feed 125 g per day. Daily were calculated and weighed all the eggs, every 14 days weighed and calculated feed conversion ratio, egg production intensity and egg numbers dynamics. The egg quality parameters were established by multifunctional automatic egg characteristics analyzer „Egg Multi-Tester EMT-5200“, hardness of eggshell – by „Egg Shell Force Gauge MODEL–II“ device, and thickness of eggshell – by electronic micrometer „MITUTOYO“. Se and vitamin E concentration in egg yolk were determined by atomic absorption spectrometry, AOAC Official Method 975.43 method. The egg yolk colour intensity increased 33 and 21 % ($P<0.05$) in SI and LI compared to the SO and LO treatments group. Se concentration in egg yolk decreased 25 and 12 % ($P<0.05$) in SO and LO compared to the SI and LI groups. a-tocopherol increased 10 ($P<0.05$) in SI, and decreased 12% ($P<0.05$) LI compared to the SO and LO respectively. When analysed y-tocopherol concentration it's increased 25 in SI compared to the SO ($P<0.05$). The results of this study clearly demonstrate that inorganic Se and different oils had effect on vitamin E accumulation but had negative effect on Se concentration in egg yolk.

Keywords: oils, Se, eqq quality

Introduction

Feed additives have been widely used to increase the performance of animals and are now used in poultry feeding practices extensively (KHAN et al., 2007) not only to stimulate the growth and feed efficiency but to improve health and performance of birds (FADLALLA et al., 2010; ABOUELFETOUH & MOUSSA, 2012; GOPI et al., 2014). Selenium (Se) is an essential trace mineral that is important for growth as a component of poultry nutrition (SELLE at al., 2013; HABIBIAN et al., 2016). Se supplementation to animal feeds enhances the immune status of the animal and the ability of the immune system to respond to disease challenges (TAYEB & QADER, 2012). Vitamin E is a fat-soluble vitamin as well as an effective antioxidant that can protect cells from oxidative damage (BAUTISTA-ORTEGA & RUIZ-FERIA, 2010; XIAO et al., 2011; LITTA et al., 2014). Numerous nutritional and physiological studies have shown that vitamin E supplementation is beneficial for growth performance in various animal models (COLNAGO et al., 1984; GAO et al., 2010).

The aim of this study was to investigate the different oils (sunflower and linseed) and organic/inorganic selenium effect on laying hens productivity, egg qualitative parameters and concentration of selenium and vitamin E.

Material and methods

A feeding trial was conducted on 40 *Lohman Brown* laying hens, which were 22 weeks old were assigned to four treatment groups and fed with the experimental diets for 8 weeks. The trial was set up as a randomized complete block design with 2x2 factorial arrangement: 2 added oils (sunflower S and linseed L) and 2 sources of Se+ vit. E (organic O and inorganic I) and then four dietary treatments were used SO (sunflower oil+organic Se and vit.E), LO (linseed oil+organic Se+vit.E), SI (sunflower oil+inorganic Se+vit.E), LI (linseed oil+inorganic Se+vit.E). The laying hens were fed with compound feed 125 g per day. Daily were calculated and weighed all the eggs, every 14 days weighed and calculated feed conversion ratio, egg production intensity and egg numbers dynamics. Egg weight, albumen high, Haugh unit, intensity of egg yolk color are established by multifunctional automatic egg characteristics analyzer „Egg Multi-Tester EMT-5200", hardness of eggshell – by „Egg Shell Force Gauge MODEL–II" device, and thickness of eggshell – by electronic micrometer „MITUTOYO".

Content of Se in the eggs and compound feed were determined by AA spectrometry (Thermo SCIENTIFIC ice 3000 series, Thermo Fisher Scientific, UK).

Vitamin E concentration were determined in accordance with the EN 12822 (2000) by HPLC (Shimadzu, Varian ProStar).

Statistical Analysis. The results of the experiment were analysed using the 1-way ANOVA test, and significant differences between groups were determined by Duncan's multiple range test. Statistica 8.0. for Windows™ software was used. Differences were considered significant at $P<0.05$.

Results and discussions

The data of laying hens productivity is presented in Table 1. No statistically significant effect was observed on productive performance of laying hens at all period of trial ($P>0.05$). It has been reported that dietary supplementation by vitamin E and selenium did have not significant effect on stimulate the egg production of laying hens (MOHITI ASLI et al., 2010; OSMAN et al., 2010).

Table 1. Effect of sunflower, linseed oils and organic and inorganic selenium, on laying hens productivity (in all trial period)

Parameter	Group			
	I control (SO)	II control (LO)	I experimental (SI)	II experimental (LI)
Total feed consumption ratio per 1 kg of egg mass, kg	2.19±0.09	2.17±0.15	2.22±0.08	2.08±0.10
Average of egg weight, g	58.25±0.99	58.57±1.18	58.55±1.04	57.88±1.21
Intensity of egg laying, %	88.76±6.86	91.87±4.07	91.98±4.70	91.35±3.63

Qualitative research results of eggs of laying hens of 22-29 weeks of age are presented in Table 2. The egg weight in I experimental group increased 3 % ($P>0.05$), in II experemental group decreased by 2 % ($P>0.05$) compared to the control group. Same tendency were get when analysed eggshell strength – I (SI) group increased 9 % ($P>0.05$), II (LI) group – decreased 6 % ($P>0.05$). Hough unit in I (SI) group decreased by 7 % ($P>0.05$), in II (LI) group- increased by 1 % ($P>0.05$) compared to control group. Statistically significant results were get just in egg yolk colour intensity – in I (SI) group it increased 13 % ($P<0.05$) compared to control group (SO). For the rest egg

qualitative parameters used organic and inorganic selenium and different oils had no statiscally significant effect.

Table 2. Effect of sunflower, linseed oils and organic/inorganic selenium on the egg quality parameters (per all period)

Parameters	Group			
	I control (SO)	II control (LO)	I experimental (SI)	II experimental (LI)
Egg weight, g	60.99±4.97	63.12±1.09	62.66±5.44	61.90±5.03
Eggshell hardness, kg/m²	3.691±1.01	4.001±0.82	4.012±0.99	3.772±0.78
Albumen height, mm	7.30±2.02	7.14±2.24	6.73±2.50	7.25±2.63
Haugh unit	82.49±16.78	80.95±18.00	77.05±21.27	81.60±19.21
Yolk color intensity, point	2.09±0.51	2.78±0.68	2.36±0.49*	2.61±0.62
Eggshell weight, g	5.534±0.62	5.862±0.81	5.790±0.75	5.613±0.72
Eggshell thickness, mm	0.36±0.04	0.36±0.05	0.37±0.04	0.35±0.04

*- data statistically significant at P<0.05

It was further reported that yolk-Se concentration significantly increased due to organic and inorganic selenium supplementation and the greatest increase was observed by the group fed diet supplemented with organic selenium (LEESON et al. 2008; ATTIA et al. 2010). Moreover, BRIENS et al. (2013) stated that the different absorption manner between organic and inorganic selenium sources led to the different digestibility rates, with the inorganic source having a poorer digestibility than the organic form.

Table 3. Effect of sunflower, linseed oils and organic/inorganic selenium on accumulation of selenium and tocopherols in the egg yolks

Parameter	Group			
	I control (SO)	II control (LO)	I experimental (SI)	II experimental (LI)
Selenium, µg/gSM	1.347±0.101	1.203±0.098	1.013±0.080*	1.058±0.118*
α-tocopherol, mg/kg	265.63±14.39	205.71±6.10	291.66±47.79	180.18±19.48*
γ-tocopherol, mg/kg	14.74±0.88	66.90±6.13	18.35±0.62*	59.86±7.33

*- data statistically significant at P<0.05

Our results are agree with these authours, because concentration of Se in experimental groups decreased 25 and 12% (P<0.05) compared to the control group. α-tocopherol in I (SI) group increased by 10 % (P>0.05), but in II (LI) group decreased 13 % (P<0.05) compared to the control group. When analysed data of β-tocopherol – determined same tendency in I (SI) group increased by 24 % (P<0.05), in II (LI) decreased by 11 % (P>0.05) compared to the control group.

Conclusions

The results of this study clearly demonstrate that inorganic Se and different oils had effect on vitamin E accumulation but had negative effect on Se concentration in egg yolk.

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