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The influence of layers feed supplementation with organic selenium on the eggs quality and selenium content in the egg

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Abstract

The effect of addition of different levels of organic Selenium in laying hens' diets for a period of 13 weeks was studied in this research. For this purpose, 400 layers of hybrid Lohman Brown, aged 39 weeks were equally divided into four groups. The first group, which was used a control one (C) was fed with the standard feed formula, while the feed used for the other three groups was supplemented with Organic Selenium (Se) - Sel-Plex®, Alltech, inc., respectively 0.2 (Experiment 1 - E1), 0.3 (Experiment 2 - E2) and 0.4 ppm (Experiment 3 - E3). The egg production was monitored on daily basis, while the egg quality and content of Se in eggs was measured at the end of the week six and thirteen. Layers' performances, total egg weight, the egg white weight, shell weight and shell thickness were not affected by the level of feed supplementation with organic selenium. At the end of the experiment, a significant improvement ($P \leq 0.05$) of the yolk's weight was observed, at the group E2 and E3, respectively supplemented with 0.3 and 0.4 ppm Organic Selenium, compared with the control group. The addition of Selenium in the layers' feed significantly increased its concentration in both the yolk and the white of the egg in the two measurements performed. Results of this study showed that the addition of Organic Se in layers diet increased its content in the eggs.

Key words: Laying hen, Selenium, egg quality, feed

Introduction

Selenium is a very important nutrient. Selenium can be added to poultry feed portion as organic selenium and inorganic selenium. Supplementation of selenium in poultry feed is depending on its bio-geo-dynamics, respectively the low level of its suitability in soil-plant relationship. In many studies it was reported that the supplementation of organic selenium showed a significant effect compared with inorganic selenium regarding the increase of selenium content in egg [2, 10], and has improved the quality of eggs [14].

The results of many studies have shown that supplementation of poultry diet with different levels of selenium has no effect on egg production [2, 9]. Adding selenium concentration in feed has contributed to the increase of its content in eggs [4, 6, 12].

Some authors [11] have studied that the addition of organic selenium in poultry diets significantly increased content of selenium in the edible parts of the egg and contributed positively to the egg freshness parameters.

The purpose of this study was to determine the effect of dietary supplementation of layers with different levels of organic Selenium Sel-Plex – Alltech in egg quality and selenium content in egg.

Material and methods

The study was conducted on a commercial farm egg production in Podujevo for a period of 13 weeks. Based on the principle of comparative analogy of body condition, age, egg production were formed 4 groups of 100 hens aged 39 weeks. Chickens were of the Lohman Brown hybrid for egg production, of the age of 19 weeks regarding productivity. Throughout the experiment chickens were kept in the same house, in a 4 tier cage, with 5 hens per cage, in equal environmental, treatment and service conditions.

Throughout the study period, the composition of the diet was the same for all groups (the difference was in levels of selenium): for the control (C) the basal diet contained a trace mineral premix that provided no supplemental Se, in the three experimental groups the diet was supplemented with 0.2 ppm (Experiment 1 - E1), 0.3 ppm (Experiment 2 - E2) and 0.4 ppm (Experiment 3 - E3) of organic Se, Sel-Plex®, Alltech, inc. The feed was prepared in the feed factory, near poultry farm.

Table 1. Composition and calculated analysis of basal diet

Ingredients	**(%)**
Yellow corn	60
Soybean meal 48%	20
Sunflower meal	10
Limestone	7.7
Vitamin and mineral premix	1.0
Sodium chloride	0.3
Di-calcium phosphate	1.0
Total	100
Calculated analysis	
Metabolizable energy (kcal/kg)	2732.50
Crude protein (%)	17.70
Crude fiber (%)	3.20
Crude fat (%)	2.67
Calcium (%)	3.33
Available phosphorus (%)	0.38
Lysine (%)	0.75
Methionine (%)	0.34
Cystine (%)	0.29

The study was divided into two phases: the first phase was completed in six weeks, and the second in the thirteenth week, which marked the end of the experiment. Each week was monitored number of eggs and calculated the egg production (%). At the end of the experiment, by randomly selected 10 eggs/group in order to determine both internal and external qualitative parameters. It was determined the weight of the egg, the weight of the white, yolk weight, the shell weight and the shell thickness, index format. At the end of each stage (after 6 weeks and 13 weeks respectively) we have analyzed the content of selenium in the white and the yolk of eggs. For this purpose, from each group were analyzed in total five eggs. Determination of Selenium under conditions mentioned above was conducted in the laboratory NSH Agrovet, Kosovo, which is accredited according to ISO 17025-2006. Preparation and reading of the samples was carried out according to standard methods: BS EN 13804:2002; 13805:2002; 13806:2002; 13656:2002; 13657:2002. Extraction of samples was conducted in the procedure with Microwave Pressure Digestion (speed-wave MWS-3^{+}, Berghof), Application Report, V 5.0. However, reading the selenium content in egg samples was conducted with inductively coupled plasma optical emission spectrometry (ICP-OES), 2100 DV, Perkin Elmer.

The obtained experimental results were processed and analyses statistically with ANOVA and descriptive analysis, whereas for comparisons was used t-test.

Results and discussion

At the end of each stage it was analyzed and evaluated the effect of supplementation with three levels of selenium (0.2, 0.3 and 0.4 ppm) in poultry diets in the production and quality of eggs. Results are presented below in the table 2 and 3.

Table 2. The effect of different levels of selenium in the egg production and quality of eggs at the end of the first phase

Parameters	**Control**	**Experiment 1**	**Experiment 2**	**Experiment 3**
Egg production (%)	83.9 ±8.6	83.9 ± 6.9	84.9±10.0	85.6±7.0
Egg weight (g)	59.82±3.98	60.64±1.51	61.09±3.47	61.92±5.04
Egg mass (kg)	50.18	50.88	51.87	53.00
The white egg weight (g)	37.08±2.65	37.58±1.12	37.77±2.68	37.89±4.88
The yolk weight (g)	14.92±1.66	14.95±1.05	15.04±0.62	15.15±0.91
The shell weight (g)	7.75±0.61	7.82±0.60	7.95±0.97	8.02±1.02
Shell thickness (mm)	0.58±0.03	0.58±0.04	0.59±0.04	0.59±0.01

The higher percentage of egg production was confirmed in E3: 2% higher than in Control and E1 and 0.8% higher than in E2 (but there are no statistically significant differences). Our results for egg production agree with those of authors [1, 2, 9], who reported no differences in egg production when hens were fed a basal diet supplemented with Selenium. In accordance with our results, Chinsrari *et al*. [3], have not found any significant effect of additions of Selenium yeast.

It seems that the egg weight increased with increasing the level of Selenium supplemented in diet. So, the hens of E3 produced eggs with 3.5% weight higher than in Control, 2.1% higher than in E1 and 1.4% higher than in E2. However, differences between groups regarding egg weight were not proved to be statistically significant to the probability of $P \leq 0.05$.

Table 2. The effect of different levels of selenium in the egg production and quality of eggs at the end of the second phase

Parameters	**Control**	**Experiment 1**	**Experiment 2**	**Experiment 3**
Egg production (%)	78.9±9.30	78±8.39	78±8.03	78.8±8.41
Egg weight (g)	62.00±5.15	62.28±5.34	63.67±4.27	64.92±4.96
Egg mass (kg)	48.92	48.57	49.66	51.16
The white weight (g)	38.92±3.14	39.10±4.29	39.87±3.96	40.89±3.94
The yolk weight (g)	15.11±0.61	15.37±1.18	15.81±1.05	15.91±1.32
The shell weight (g)	8.18±0.93	8.22±0.31	8.45±0.68	8.69±0.78
Shell thickness (mm)	0.58±0.03	0.59±0.03	0.59±0.03	0.60±0.02

The same phenomenon is also observed for the mass of the eggs (Table 1). The superiority of E3 compared to control regarding egg mass was 5.6%, compared to E1 was 4.2% and compared to E2 was 2.2%. It was also noted a trend for higher weight of the egg white, the yellow, the shell and shell thickness and shell of the hens group that was supplemented with 0.4 ppm selenium in feed compared to the other three groups.

After seven weeks of the experiment it was shown a significant decline on egg production (%) in all groups (hens are 52 weeks of age). It was noted that there was not statistically significant differences between groups regarding fertility. The group that was supplemented with 0.4 ppm selenium has produced the highest egg mass (4.56% higher than in C, 5.33% higher than in E1 and 3.02% higher than in E2). This group showed the trend to greater weight of the egg, the white, the shell and thickness of the shell for P = 0.05 (t-Test: Two-Sample Assuming Equal Variances). According to some authors [5, 7, 8, 13], (supplementation of the selenium and vitamin E in feed diet did not influenced in the performance and in egg weights.

Increasing the dose of 0.3 and 0.4 ppm of selenium resulted in the increasing of the yolk weight. In the second phase it was confirmed only differences between K: E2.

In the table 3 we have presented the results of analysis for the content of the selenium in yolk and white of egg at the end of each phase.

Table 3. Selenium content in egg (mg/kg)

The experimental phases	Indicators	Control	Experiment 1	Experiment 2	Experiment 3
Phase I	Se in the yolk	8.24±0.05	9.44±0.04	11.24±0.04	13.50±0.05
	Se in the white	1.84±0.04	2.04±0.04	2.30±0.02	2.48±0.02
Phase II	Se in the yolk	12.18±0.03	14.02±0.06	14.73±0.04	15.75±0.03
	Se in the white	1.92±0.02	2.19±0.02	2.29±0.03	2.52±0.04

It seems clearly, that in both phases the supplementation of selenium doses has significantly affected the content of the selenium in the yolk and the white of the egg. Differences statistically are

proven for the probability of P≤0.05. According to [8], the introduction of the selenium in hens feed has led to an increase of its concentration in the egg. Also, in other studies it is cited that by supplementing the selenium to the poultry feed it was reached to increase its level in eggs [5, 10].

Also it was observed a significant increase in the selenium content in the yolk and the white of the egg in the second phase compared to the first one. So, the prolonged use of organic selenium in poultry feed has contributed in production of the eggs rich with selenium.

Conclusions

- With the increase of the selenium doses in poultry feed rations there were shown trends for improvement of the weight and eggs mass, the weight of the white, the shell and shell thickness.
- Supplementation of layers diet with organic Selenium with 0.3 and 0.4 ppm, produced eggs with higher weight of the yolk compared with the layers that received the base diet and with 0.2 ppm selenium.
- Content of the Selenium in the yolk and the white of the egg has been increased progressively with increasing Selenium content in feed (0.2-0.4 ppm).

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