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Effect Of Supplementation Of Broilers Diets With Different Levels Of Organic Selenium In The Quality Of Carcasses And Its Concentration In Meat And Blood

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***Abstract*—This study was carried out to determine the effect of adding different levels of organic selenium to the quality of carcass of broilers as well as its contents in muscle, blood and faeces. For this purpose, 1200 broiler chickens of hybrid ROSS 708 were used, divided into 4 groups. The probationary period lasted 35 days and was divided into two phases. The same diet was used for all groups, but while in the control group was not used the Selenium (Se) supplement, the other three experimental groups were supplemented as follows: Experiment 1, was supplemented in the first phase with 0.4 ppm while in the second with 0.8 ppm Se, experiment 2, in the first phase with 0.4 ppm and then at 1ppm, while experiment 3 diet was supplemented with 1ppm organic Se, for the whole period. Evaluation of the content of Se in meat, blood and faeces was concluded at the end of the first and second phase of the experiment. The results of our study showed that the different levels of selenium did not show a significant impact on live weight, slaughter weight, and broiler pure meat. Supplementation with 1ppm organic selenium since the beginning of growth influenced the weight gain of chest muscle (P <0.05). Increasing the selenium dose from 0.0-1.0 ppm in food influenced the enrichment of meat with selenium, increasing its content in the blood and faeces.**

Keywords—Broiler, organic selenium, slaughter traits, meat, blood

INTRODUCTION

Selenium is an important mineral with oxidizing properties or animals. Se is defined as an essential supplement in the diet and it affects the improvement of health status and performance of broilers and in the quality of meat for consumption Haug A., Greatorex S.E., Bernhoft A., Wold JP, Hetland H, Christophersen OA, Sogn. (2007); Yoon I. W Erner T.M Butler J.M (2007). In the last 25 years there have been many achievements regarding the feeding of Se in the poultry.

Restriction on the use of inorganic Se is related to interactions with other minerals and vitamins, with low efficiency to be transformed to meat and eggs and inability to collect and keep its reserves in the organism. Thus, a large amount of consumed Se in the inorganic form is eliminated from the body by fecal and urine. Surai, P.F., Fisinin V.I. (2014).

It is known that in industrial growth chickens face different stresses. Selenium as part of various selenoproteins can help to provide antioxidant protection and to prevent tissue damage.

Selenium is widely used in poultry feeding, especially in commercial poultry flocks, characterized by a high production of eggs and a high intensity of their growth. But these genetic improvements have their own cost, because chickens (broilers) are quite sensitive to different stresses.

It has been studied that the main advantage of organic selenium in animal and poultry production is related to the ability to deposit its stocks in the organism in the form of selenomethionine. These reserves are particularly important in stress conditions when demand for Se grows, while decreases food consumption Surai (2006); Fisinin, V.I., Papazyan, T.T., Surai, P.T., (2008); Surai, P.F., Taylor-Pickard, J (Eds.), (2008); De Meester, F., Zibadi,S., Ross Watson, D. (Eds.), (2010); P. P. Surai (2010). So, organic selenium has a protective role when the organism passes into stress condition. Absorbing organic Se can reach up to 80 % Reilly (1996).

Many studies confirm the idea that selenium accumulated in tissues in the form of selenomethionine may be suitable for the synthesis of selenoprotein Alfthan, G., Xu, G.L., Tan, W.H., Aro, A., Wu, J., Yang, Y.X., Liang, W.S., Xue, W.L., Kong, L.H., (2000); Pappas, A.C., Acamovic, T., Sparks, N.H.C., Surai, P.F., McDevitt, R.M. (2005); P. Surai (2006)

Worldwide, in animal and poultry farms, it has become a common practice selenium supplement of food meals. Organic Se is the natural form of selenium that should be included in animal diets. However, until recently the form of animal food rations has been with inorganic Se, mainly selenits or selenats, due to the low price.

Through this study we intend to determine and compare the effects of using different levels of organic Se in the qualities of carcass, in the Se concentration in the blood, muscle and excrements of broilers.

MATERIAL AND METHOD

The study on the impact of the action of organic Se added to broiler food in the performance and quality of meat was accomplished by conducting an experiment on a broiler farm in Podujevo. The experiment was carried out with 1 day chicks of the Ross 708 hybrid for a 35 day period. Chickens subjected to the experiment were kept under the same breeding and nutritional conditions and for them was applied the growth technology according to the standards of the technical guide of the broilers.

The chickens used for the experiment had nearly the same weight and were in good health condition. The concentration of heads was 18 chickens / m^2. The same lighting regime was applied for all groups during 24 hours, keeping under control the intensity of light under the technological card. Gas heating was provided and optimum ventilation.

4 experiment groups of 300 single day chickens of the Ross 708 hybrid were set up according to the following scheme:

Table 1. Experiment Scheme with Se use (ppm)

Age to days	Control	Exp. 1 (E1)	Exp. 2 (E2)	Exp. 3 (E3)
FI 1-21	-	0.4	0.4	1.0
FII 22-42	-	0.8	1.0	1.0

The experiment took place in two phases:

The first phase lasted 1-21 days. In the control group was not used supplemented Se. In Experiments 1 and 2, was added 0.4 ppm Se, while in Experiment 3 was added 1.0 ppm Se.

The second phase lasted from the age of 21 to 35 days (until the end of the growth at the time of delivery to the slaughterhouse). Control group continued to consume food without selenium supplement. In E1 it was passed with 0.8 ppm dose, with E2 at 1.0 ppm dose, while E3 continued with 1.0 ppm Se.

The structure of the food ration used and the analysis of its chemical composition for both phases of growth is presented in the following table:

Table 2. Growth rate for birds according to the phases used in the farm

Components	Day 1-21	Day 22-35
Corn	55	60
Soybeans	39	34
Oil	3	3
Carbonate	1.5	1.5
Premix	1.5 (Clinacox)	1.5 (Sacox)
The nutrient levels		
Metabolized energy (kkal/kg)	2980	3130
Crude protein	22.50	20
Fats	5.60	6.90
Fiber gross	2.70	3.20
Ash	5.60	5
Calcium	0.90	0.78
Phosphorus	0.70	0.60
Soda	0.18	0.15
Methionine	0.65	0.55
Lysine	1.40	1.22

The chickens were weighed at the beginning of the experiment, and laterg week after week. Weekly weighing was performed at the same hour in the morning before eating food at 5% of the number of heads (15 heads).

Pure Meat. was calculated at the end of the experiment, where each group were analyzed 10 chickens per group for the following indicators: live weight, slaughtered weight, pure meat, white meat, red meat, skin and bones. Chickens were used, from which blood samples were taken.

The content of Se in plasma, in tissue and in faces of broilers

a)The content of Se in white meat at the age of 21 and 35 days

b)Content of Se in chest and thighs, at 21 and 35 days

c)The content of that in plasma at the age of 21 and 35 days.

d)The content of Se in faeces at the age of 21 and 35 days

Blood samples were taken at the end of the first phase and at the end of the experiment. The blood samples were taken in the wing veins, 10 individuals for each group.

The manure samples (faces) were taken at the end of the first phase (21 days) and at the end of the experiment (day 35) for each set of experiments.

Determining the Content of Se in the food samples, meat, blood plasma and faces at broilers

All the samples of the materials mentioned were mineralized according to the selected standard program with MW^{3+} (microwave oven) production Berghof, Germany. The program is based on selection of temperature, pressure and duration according to

nitrogen resolution phases in the presence of nitric acid (HNO_3) and hydrogen peroxide (H_2O_2). The mineralized samples were subject to measurement for the content of Se in ICP-OES, produced by Perkin-Elmer, USA, under specified working conditions (wavelength) selected for Se element which in these conditions is detected up to 4 ppb.

Determination of the content of Se under the aforementioned conditions was carried out in the laboratory of SOE Agrovet, Kosovo, which is accredited according to ISO 17025–2006. For the realization of this study, adequate and standard methods, mainly ISO, EN, EPA, AOAC, etc. were used to achieve the most reliable results.

The experiment data were elaborated up statistically with ANOVA method, descriptive analysis and tTes was used comparisons.

RESULTS AND DISCUSSION

Meat yield (pure meat cut, ratio of main parts)

Table 3. Meat yield on slaughter performance (g)

Groups	C	E 1	E 2	E 3
Live weight	1398.55± 220.72	1440.7± 203.66	1460.95± 152.53	1471.45±144.38
Weight slaughtered	1013± 191.98	1077± 130.03	1106± 123.97	1124± 107.38
Meat prices (%)	72.4	74.8	75.7	76.4
White meat	236± 68.98	262± 45.44	271.4 ± 82.26	289 ± 26.99
Red meat	242± 69.24	265.2± 28.67	280.2± 67.41	301.8± 53.84
Skin	95.6± 12.28	103.4± 21.32	104.2 ± 12.31	108.6 ±15.19
Bones	397.4± 7.78	404± 57.78	415.4± 38.11	420.6± 40.03

As for live weight and slaughter weight differences are statistically unproven for P <0.05. So the different levels of Se in the food diet of broilers did not affect the body weight. Spears JW, Grimes J., Lloyd K., Ward TL. (2003) also reported nonsignificant differences over the live weight of birds, whose diets were supplemented with different levels of selenium. According to Guoshun Chen, Jinfeng W, Chong Li (2013), the productive performance of broilers did not significantly improve when their diet was supplemented with 0.3, 0.5, 1.0 or 2.0 ppm organic selenium.

The differences of values for weight of the white meat are verified between K:E3, E1:E3. So increasing the dose of Se in food has affected the weight gain of white meat.

For the skin, differences are verified between K and E3 for P <0.05. Pure meat has improved with the addition of the selenium dose from 0.4-1.0 ppm in the portion (with 5.5, 2.1 and 0.9 % respectively to K, E1 and E2).

Table 4. Indicators after slaughter (%)

Groups	Slaughtered Weight	White meat	Red meat	Skin	Bones
Control	1013 ± 191.98	23.30	23.89	9.44	39.23
Experiment 1	1077 ± 130.03	24.33	24.62	9.60	37.51
Experiment 2	1106 ± 123.97	24.54	25.33	9.42	37.56
Experiment 3	1124 ± 107.38	25.71	26.85	9.66	37.42

By increasing the dose of Se from 0.0-1.0 ppm increases progressively the percentage of pectoral muscles to the carcass. The same thing is seen in the thigh muscles.

Choct. M, Naylor A.J., Reinke. N. (2004) and Payne R.L., Southern L.L (2005) reported significant improvements in the radius of the pure meat, weight of muscle chest and thighs when organic Se was used. According to Jokić Ž, Pavlovski Z., Mitrović S., Đermanović V. (2009) the mean values of the indicators after slaughter were close to the chickens of all groups with not significant differences.

Chemical parameters in the quality of meat (Selenium) in white and red meat, in blood and faeces.

At the end of each phase, the content of selenium in the meat was analyzed in the laboratory.

Table 5. The content of selenium in meat (ppm)

Phase	Type of meat	Control	Exp. 1	Exp. 2	Exp. 3
1	White meat	0.123± 0.001	0.297± 0.012	0.297± 0.012	0,419 ± 0.013
	Red meat	0.123± 0.001	0.317± 0.018	0.317± 0.018	0,454 ± 0.027
2	White meat	0.122± 0.002	0.407± 0.010	0,499± 0.020	0,669 ± 0.012
	Red meat	0.123± 0.001	0.442± 0.020	0,542± 0.035	0,663 ± 0.042

At the end of the first phase (after 3 weeks) it is recorded a deposit growth of Se in white meat and red meat with the addition of the level of supplementation in the diet of chickens (P <0.05). Differences are not verified only between E1 and E2 (since the addition of Se was the same - 0.4 ppm). At the end of the experiment (35 days) the increase of Se supplement in food (from 0.0-1.0) has significantly contributed to its deposition in pectoral muscles and thighs, so it impacted the enrichment of meat with selenium.

Even under Guoshun Chen, Jinfeng W, Chong Li (2013) the Se supplement in diet was accompanied even with increased deposition in chest muscles. Zelenka. J, Fajmonova E., (2005) concluded that the

concentration of Se in the organism increases with age advancement. Similar results were also achieved in this study.

Table 6. The effect of different levels of Selenium in its deposition in the blood (mg/L)

Phase	Control	Exp.1	Exp. 2	Exp. 3
1	0.190 ±0.026	0.236±0.008	0.236 ±0.008	0.291 ±0.006
2	0,194 ±0.028	0.283±0.007	0.300 ±0.010	0.336 ±0.015

Increasing of Se level in food in the first phase has had an impact on its deposition in the blood. Only groups that received the same dose of Se (0.4 ppm) did not statistically differ (for P <0.05). At the end of the growth it can be concluded that with the increase of Se in the diet is progressively increased its deposition in the blood (with significant difference). Our results are similar to the study of Yoon I. W Erner T.M Butler J.M (2007)**.**

Selenomethionine as the most useful organic form in the poultry industry is easily absorbed by erythrocytes through an active mechanism similar to that of methionine. In contrast to similar inorganic Se, like sodium selenite, which is absorbed by simple diffusion.

Table.7 The effect of different levels of Selenius on diet in its elimination in faces (ppm)

Phase	Control	Exp. 1	Exp.2	Exp. 3
1	0.185 ±0.006	0,294 ±0.003	0.295±0.003	0,561 ±0.022
2	0.189 ±0.013	0.480 ±0.015	0.634 ±0.010	0,711 ±0.023

At the end of the first phase it was ascertained that the higher the Se dosage was in food, the greater was the Se amount eliminated with fecals. Again, since groups E1 and E2 have received the same dose of Se, even the amount eliminated from them has been with insignificant differences. At the end of the experiment, a progressive increase of Se amount eliminated by groups (0.0-1.0 ppm Se) was observed with significant differences (for P <0.05).

CONCLUSIONS

Based on the results obtained we can conclude:

Supplementation of diet of broilers with different levels of organic Se (0.0-1.0) did not affect the live weight.

Supplement with 1ppm organic selenium from the beginning of growth has affected the weight gain of chest muscles. Addition of Se supplement in food (from 0.4-1.0) has significantly contributed to its deposition in the pectoris muscles and thighs. With the increase of the level of Se in the diet, it is progressively increased its deposition in the blood (with significant difference). Adding selenium in diet has affected its increasing in faeces.

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