Bulgarian Journal of Agricultural Science, 24 (No 3) 2018, 480–483
Agricultural Academy

PRODUCTIVITY OF RABBITS AND BALANCE OF SELENIUM IN THEIR BODY BY FEEDING DIFFERENT DOSES OF SELENIUM

TETYANA L. SYVYK[1]; LEONID S. DYACHENKO[2]; OLENA M. TYTARIOVA[2*]; OLHA P. SHULKO[3]; OLEG P. OSIPENKO[4]; LIUDMYLA V. PIROVA[1]; VITA V. BILKEVYCH[5]

[1]*Bila Tserkva National Agrarian University, Department of Technology of Milk and Meat Production, Faculty of Biological Technology, 09111 Bila Tserkva, Ukraine*

[2]*Bila Tserkva National Agrarian University, Department of Technology of Feed, Feed Additives and Animal Feeding, Faculty of Biological Technology, 09111 Bila Tserkva, Ukraine*

[3]*Bila Tserkva National Agrarian University, Department of Ecology and Biotechnology, Faculty of Ecology, 09111 Bila Tserkva, Ukraine*

[4]*Bila Tserkva National Agrarian University, Department of Food Technologies and Technologies of Processing of Livestock Products, Faculty of Biological Technology, 09111 Bila Tserkva, Ukraine*

[5]*Bila Tserkva National Agrarian University, Department of Production of Poultry and Pig Production, Faculty of Biological Technology, 09111 Bila Tserkva, Ukraine*

Abstract

Syvyk, T.L., L.S. Dyachenko, O.M. Tytariova, O.P. Shulko, O.P. Osipenko, L.V. Pirova and V.V. Bilkevych, 2018. Productivity of rabbits and balance of selenium in their body by feeding different doses of selenium. *Bulg. J. Agric. Sci.*, 24 (3): 480–483

It is impossible to achieve a high level of rabbits' productivity, maintaining their health and reproductive capacity, without the presence of Selenium. Vegetable fodders, which are traditionally the main component of their rations, contain an insufficient amount of this microelement. Conflicting results of experiments conducted in the world, led to further study of this issue and conducting of scientific and economic experiments to establish optimal dose of Selenium for rabbits which are farmed for meat. During the experiment the average daily live weight of rabbits was investigated, as well as the digestion of Selenium in their body and content of Selenium in the blood. Thus, we have found that the optimal dose of Selenium in the fodder mixture for young rabbits is 0.2 mg / kg of dry matter.

Key words: rabbits; selenium; sodium selenite; digestion; assimilation

Introduction

Selenium is a vitally important microelement. According to modern notions, its biological role is primarily determined by antioxidant, immunomodulating, antivirus properties. Selenium is involved in cellular respiration, oxidation of fatty acids, synthesis of steroids, and coenzyme A (Surai, 2006). Its lack in animal rations negatively affects their health and economic indicators. However, because of the high toxicity of this element, its amount in feed is strictly regulated in most countries of the world. In particular, AAFCO (The *Association of American Feed Control Officials, 2013),* regulates the content of Selenium in fodder mix for chickens, swine, turkeys, sheep, cattle and ducks at a level not exceeding 0.3 mg / kg. In the European Union countries (Commission Directive, 1986) the maximum allowable level of Selenium in the fodder mix is 0.5 mg / kg.

**Corresponding author:* olenakosyanenko@gmail.com

In the most countries of the world, its amount in the fodder is significantly lower than the need of animals. This is proved by a number of different studies (Surai, 2006). Therefore, for normal animals' growth, production and reproduction, additional introduction of Selenium into the diet is required. Typically, the optimal dose of Selenium, which provides the highest productivity of animals, is in the range of 0.2-0.4 mg / kg

About the importance of Selenium rationing in feeding of cattle (Mehdi and Dufrasne, 2016), pigs (Mahan et al., 1999; Mateo et al., 2007), sheep (Robson and Plant, 2016), horses (Stowe, 2015) and poultry (Chen et al., 2013, 2014; Surai and Fisinin, 2014; Suchy et al., 2014) a large number of scientific articles have been published.

However, the study of this issue in rabbit breeding was not large. Thus, a group of Greek scientists (Papadomichelakis et al., 2017) conducted a study to determine the effects of various doses of Selenium in the organic compound on the productivity and quality of rabbit products, although the doses used in this experiment were very broad – 0.1; 0.5 and 2.5 mg / kg feed. Czech scientists (Dokoupilova et al., 2007) compared the productivity of rabbits and the quality of their products at doses of Selenium 0.12 and 0.5 mg / kg feed. At the same time, a certain negative tendency towards the growth of animals that consumed an elevated dose of this microelement has been marked.

So, the contradictory results of studies by different scientists have led us to study the problem of the Selenium dosage in the feeding of rabbits in a narrower range.

Materials and Methods

For conducting of scientific and economic experiment 5 groups of rabbits with 15 heads in each were formed. Animals were selected taking into account the race (the breed is silver), age (45 days), live weight, gender and origin. The animals were kept in individual cages with round-the-clock access to water and feed. For rabbits feeding full-fodder feeds were used, the nutrition of which met the established requirements (Maertes et al., 2004). Sodium selenite was chosen as the source of Selenium. The scheme of the experiment is shown in Table 1.

During the experiment, the following indices were investigated: average daily gain of live weight, feed increment costs, balance of Selenium in the body of rabbits and its content in rabbits' blood at the age of 120 days.

Animals were weighed on electronic weighing machines PWII-2 to control the dynamics of live weight and determine average daily increments.

The content of Selenium in fodder (AOAC Official Method 996.16, Selenium in Feeds and Premixes, 2000), blood (Method for performing measurements of the mass concentration of chemical elements in blood plasma by X-ray fluorescence method, 2007) and discharge products (Methodological guidance on atomic absorption determination methods of toxic elements in food products and food resources, 1992) were determined in the laboratory of the Scientific and Technical Center "Viria-ltd" by the method of spectral analysis using an X-ray fluorescence analyzer "ElvaX-med".

Results and Discussion

Feeding young rabbits with various Selenium levels have substantially influenced their growth rate (Figure 1).

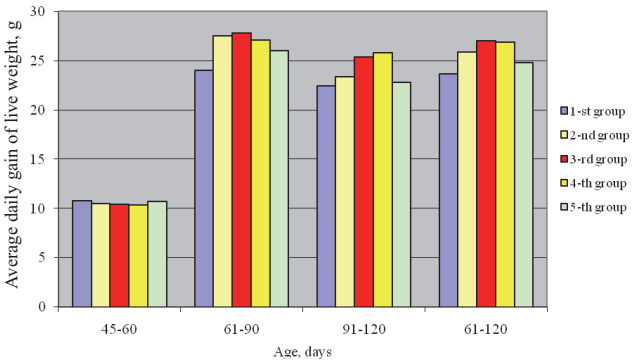

Fig. 1. Average daily gain of live weight of rabbits during 45-120 days of experiment, g

Table 1
***In-vivo* experiment with rabbits, fed with sodium selenite**

Groups of animals	Feeding terms and conditions	
	Comparative term (15 days)	Basic term (60 days)
1 – control group	Basic diet (BD), balanced as per specified norms	BD (with Selenium content rate of 0.08 mg/kg of dry matter)
2 – experimental group	BD	BD + sodium selenite (with Selenium content rate of 0.1 mg/kg of dry matter)
3 – experimental group	BD	BD + sodium selenite (with Selenium content rate of 0.2 mg/kg of dry matter)
4 – experimental group	BD	BD + sodium selenite (with Selenium content rate of 0.3 mg/kg of dry matter)
5 – experimental group	BD	BD + sodium selenite (with Selenium content rate of 0.4 mg/kg of dry matter)

Table 2

Balance of Selenium in the body of young rabbits, mg, $\bar{\bar{O}} \pm S_{\bar{o}}$ (n = 3)

Indicators	Group				
	control	experimental			
	1	2	3	4	5
Consumed with feed	0.010± 0.0002	0.013± 0.0004**	0.027± 0.0006***	0.039± 0.0020**	0.051± 0.0015**
Secreted with excrements	0.003± 0.0002	0.004± 0.0001	0.011± 0.0007**	0.020± 0.0002***	0.028± 0.0006***
Secreted with urine	0.007± 0.0002	0.006± 0.0003	0.007± 0.0004	0.008± 0.0004	0.010± 0.0002***
Assimilated	–	0.003± 0.0001***	0.009± 0.0013*	0.011± 0.0014*	0.014± 0.0012**
Assimilated, % of the amount consumed	–	25.02± 0.072 **	33.98± 4.616**	28.95± 2.162***	26’.80± 1.538***

Note: hereinafter *P < 0. 05; **P < 0. 01; ***P < 0.001 as compared with the control group

Table 3

Feed consumed for growing and feeding rabbits

Indices	Group				
	control	experimental			
	1	2	3	4	5
Feed consumption per 1 kg of live weight increase, kg	5.67	5.45	5.29	5.30	5.53
relatively to control, %	–	96.1	93.3	93.5	97.5

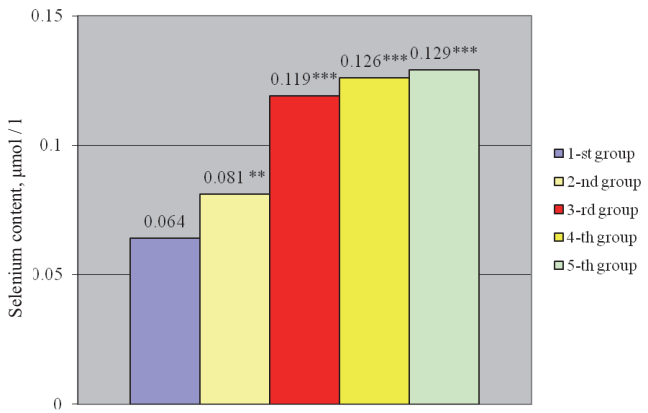

Fig. 2. Selenium content in the blood of rabbits at the age of 120 days, µmol / l

During the whole basic period of the experiment, the average daily increments of rabbits in the 2, 3, 4 and 5 experimental groups exceeded the control group analogues, respectively, by 9.7 (P<0.05), 14.4 (P <0.01), 14.0 (P <0.05) and 5.1 %.

Selenium consumed by rabbits was assimilated differently by animals of different groups (Table 2). The share of assimilation of this trace element was the greatest in rabbits, which had the content of Selenium in the diet of 0.2 mg / kg of dry matter.

It is worth to pay attention to the fact that increasing of the Selenium concentration in the diet increases the amount of assimilated microelements, although the percentage of its assimilation thus decreases.

Blood analysis of experimental animals confirmed the results of metabolic experiments (Figure 2).

As the concentration of Selenium in feed increased, its content in the blood of rabbits also increased. The difference between this indicator among control and experimental animals was statistically significant.

The expenditure of feed for growth is a significant indicator for determining of the economic efficiency of feed additives use. Thus, rabbits of all experimental groups consumed less feed per 1 kg of live weight increase than the control animals (Table 3).

Conclusions

The best doses of Selenium for rabbits are 0.2 mg/kg of dry matter. It is this dose of Selenium to be considered optimal for young rabbits for fattening. However, it should be noted that the animals showed similar productivity and conversion of feed, the Selenium content in the mixed fodder was 0.3 mg / kg. Increasing of the Selenium dose in rabbits’ diet to 0.4 mg / kg of dry substance is not reasonable as it causes a decrease of animal productivity.

References

AOAC, 2000. Official Method 996.16. Selenium in Feeds and Premixes. *AOAC International*.

Chen, G., J. Wu and C. Li, 2013. The effect of different Selenium levels on production performance and biochemical parameters of broilers. *Italian Journal of Animal Science*, **12:** 486-491.

Chen, G., J. Wu and C. Li, 2014. Effect of different Selenium sources on production performance and biochemical parameters of broilers. *J. Anim. Physiol. Anim. Nutr.,* **98:** 747-754.

Commission Directive, 1986. Amending the Annexes to Council Directive 70/524/EEC concerning additives in feeding stuffs. *Official Journal of the European Communities*, 28 July, 20- 8-86. 233:16-18.

Dokoupilová, A., M. Marounek, V. Skřivanová and P. Březina, 2007. Selenium content in tissues and meat quality in rabbits fed selenium yeast. *Czech J. Anim. Sci.*, **52** (6): 165-169.

Maertens, L., J.M. Perez, M. Villamide, C. Cervera, T. Gidenne and G. Xiccato, 2004. Nutritive value of raw materials for rabbits: EGRAN tables 2004. *World Rabbits Sci.,* **10:** 157-166.

Mahan, D.C., T.R. Cline and B. Richert, 1999. Effects of dietary levels of selenium enriched yeast and sodium selenite as Selenium sources fed to growing-finishing pigs on performance, tissue Selenium, serum glutathione peroxidase activity, carcass characteristics and loin quality. *J. Anim. Sci.*, **77:** 2172-2179.

Mateo, R.D., J.E. Spallholz, R. Elder, I. Yoon and S.W. Kim. 2007. Efficacy of dietary Selenium sources on growth and carcass characteristics of growing-finishing pigs fed diets containing high endogenous Selenium. *J. Anim. Sci.*, **85:** 1177- 1183.

Mehdi, Y. and I. Dufrasne, 2016. Selenium in Cattle: A Review, *Molecules*. **21:** 545, doi:10.3390/molecules21040545.

Papadomichelakis, G., E. Zoidis, A.C. Pappas, K.C. Mountzouris and K. Fegeros, 2017. Effects of increasing dietary organic Selenium levels on meat fatty acid composition and oxidative stability in growing rabbits. *Meat Science*, **131:** 132-138.

Robson, S. and J. Plant, 2016. Selenium Deficiency in Sheep. *NSW Department of Primary Industries*, September.

Stowe, H.D., 2015. Selenium supplementation for horse feed. *Kentucky Equine Research*, **4:** 97-103.

Suchý, P., E. Straková and I. Herzig, 2014. Selenium in poultry nutrition: a review. *Czech J. Anim. Sci.*, **59** (11): 495-503

Surai, P.F., 2006. Selenium in Nutrition and Health. *Nottingham University Press*; Nottingham, UK.

The Association of American Feed Control Officials, 2013. Food and Drug Administration, HHS. 21 CFR Ch. I (4–1–09 Edition), pp. 556-557.

Surai, P.F. and Fisinin VI, 2014. Selenium in poultry breeder nutrition. *Animal Feed Science and Technology*, **191:** 1-15.

Methodical instructions on atomic-adsorption methods for the determination of toxic elements in food products and food raw materials (Metodicheskiye ukazaniya po atomno-absorbtsionnykh metodov opredeleniya toksichnykh elementov v pishchevykh produktakh i pishchevom syr'ye) – № 01-19/47-11, 25.12. 1992.

The technique of definition of chemical elements content of blood plasma by a roentgen -fluorescent method (MPM № 081\12-0468-07 dated 12.10.2007, certified by the Ukrainian state SPC of Standardization, Metrology and Certification UkrCMC) (Metodika vypolneniya izmereniy massovoy kontsentratsii khimicheskikh elementov v plazme krovi rentgenofluorestsentnym metodom (MVI № 081\12-0468-07, 12.10.2007, attestovana Ukrainskim gosudarstvennym NPTS standartizatsii, metrologii i sertifikatsii UkrTSSM)

Received November, 2, 2017; accepted for printing May, 17, 2018