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Effects of Selenium Preparation on Morphological and Biochemical Parameters of Quail Meat

Ksenia Nikolaevna Bachinina[1], Sergey Nikolaevich Povetkin[2*], Alexander Nikolaevich Simonov[3], Sergey Viktorovich Pushkin[2], Anastasiya Alexandrovna Blinova[2], Ekaterina Dmitrievna Sukhanova[2], Igor Spartakovich Baklanov[2], and Roman Olegovich Kolesnikov[4]

[1] *Kuban State Agrarian University named after I.T. Trubilin, Krasnodar, RUSSIA.*
[2] *North Caucasus Federal University, Stavropol, RUSSIA.*
[3] *Stavropol State Agrarian University, Stavropol, RUSSIA.*
[4] *Saints Petersburg State Agrarian University, Pushkin, Saints Petersburg, RUSSIA.*
**Corresponding Author (Tel: +7-9183500889, Email: ruslankalmykov777@yandex.ru).*

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Abstract

Selenium has a special place among the biochemically significant micronutrients. The source of selenium in soils, among other things, is precipitation. Since rainwater includes selenium, it enters the atmosphere as a biological methylation result, as well as with volcanic and industrial emissions. In most natural waters, the concentration of selenium is low, due to the strong adsorption of its ions (selenites) by clay minerals and especially hydroxylated iron oxides. Unfortunately, in any organism, only a certain part of macro-and microelements can be assimilated and synthesized by the body into a metabolically active form. This is due to such a phenomenon as bioavailability - the assimilation efficiency and minerals used. To prevent the occurrence of such problems, it is necessary to control the regular necessary mineral substances intake with fodder in optimum quantity, ratios, and in strict accordance with the needs of animals from different sources or with different physiological body conditions. The purpose of the study was to study the effect of selenium preparation on morphological and biochemical parameters of quail meat.

Disciplinary: Veterinary, Zoology, Biotechnology.

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1 Introduction

A steady increase in the production of cattle breeding products is possible on the basis of the full-fledged animal feeding organization, where minerals have an important place, the lack or surplus of which prejudice to cattle breeding, restrains the livestock's growth, reduces productivity, provokes the diseases, worsens the products' quality [1]. Unfortunately, in any organism, only a certain part of nutrients (proteins, fats, carbohydrates, macro-, and microelements) can be assimilated and synthesized by the body into a metabolically active form [2]. This is due to such a phenomenon as bioavailability - the assimilation efficiency and mineral substances use in animals from different sources or with different physiological body conditions. Balancing diets giving bioavailability makes it possible to more fully satisfy the body needs in macro- and microelements, to use fodder and additives more rationally, to objectively evaluate new fodder products and methods of preparing fodder for feeding [3-5].

2 Literature Review

Selenium (Se) has a special place among biochemically significant microelements. In the soil, the element is in the form of elementary selenium, selenides, selenites, as part of organic compounds. The level of selenium in the soil depends on the redox conditions of the environment, the humidity level, the presence of certain compounds. The combined presence of selenium and sulfur in nature is due to the similarity of their physicochemical and geochemical properties, which makes it possible to judge the selenium level in the earth's crust by the sulfur content, based on the ratio of sulfur: selenium = 6,000:1 [6].

In most natural waters, the concentration of selenium is low, due to the strong adsorption of its ions (selenites) by clay minerals and especially hydroxylated iron oxides. The rivers' waters, springs, and wells contain more selenium than sea and ocean waters. Precipitation is also a source of selenium in soils since rainwater includes selenium entering the atmosphere as a biological methylation result, as well as with volcanic and industrial emissions [7,8].

Thus, we see that in the wild environment, especially in the conditions of biogeochemical provinces, the selenium availability for animals and poultry depends primarily on the ability of plants to accumulate this element in themselves [9,10]. According to the ability to accumulate selenium from soils plants are divided into three groups:

1) plants indifferent to selenium (the content of the element in them is 1-2 times less than in the soil) - soybeans, most grasses of permanent forage lands (accumulate less than 5 mg/kg of selenium);
2) plants with a moderate accumulation of the element - cereals, sunflower (5 - 30 mg/kg of selenium);
3) accumulator plants may contain selenium more than 1000 mg/kg - perennial legume plants, cruciferous and composite family.

Accumulator plants accumulate selenium in the form of selenium-containing amino acids, which accumulate in vacuoles. On the contrary, plants indifferent to selenium use selenium for the

biosynthesis of selenium-containing proteins, which determines their instability to high microelements' concentrations in the soil.

In addition, selenium in a certain dose range is able to increase the plants' adaptive potential [11]. The mechanism of increasing stress resistance of plants includes:

- reduction of the superoxide anion production under the selenium influence – inducer of destructive free-radical processes;
- partial inhibition with selenium of the processes of lipid cell membranes peroxidation;
- protein hydrolysis processes strengthening under the microelement influence, which can lead to the release of special protective proteins from inactive forms, as well as to the accumulation of low molecular polypeptides in the cytosol, which are osmoregulators;
- increased production and accumulation in tissues of a versatile protective substance - the amino acid proline.

Now it is indirectly possible to judge the presence of selenium in raw materials by the presence of sulfur-containing amino acids (methionine, cysteine, taurine), and, in particular, proline [12].

The processes occurring in the bird's body, which are induced under the influence of various diet ingredients, often affect the biological usefulness and nutritional components assimilation [13,14]. These factors in the farming conditions and wildlife can often be very different. Quails are not an exception [15]. Therefore, we have studied the content of the amino acid in the quails' carcasses obtained in the farming industry process, as well as quails obtained during hunting, and determined the differences between them.

3 Method

Bioavailable preparation of the essential trace element selenium, developed and synthesized by specialists of the Department of Physics and Technology of Nanostructures and Materials of the North Caucasus Federal University, was used for the research [16].

Figure 1: Feeding of quails experimental group

Feeding of quails was carried out based on the Kuban Agrarian University (Figure 1). The experimental group used Manchurian quails (golden Phoenix breeding), laying hens, weighing 400+/-10 g. The control group of comparison was wild (Manchurian) quails, obtained during hunting, weighing 400+/-10 g. The developed preparation was added to the daily diet of quails by dissolving in drinking water in concentration 0.1 mg per kg for 3 weeks.

Amino acid composition and general protein content of quail's meats protein were determined according to GOST 32044.1-2012 (ISO 5983-1:2005). Also, the total humidity was determined according to GOST R 57059-2016 in the laboratory of the Stavropol State Agrarian University. Based on the results of the analyses, coefficients were derived and determined the biological value of meat separately from the pectoral muscles and separately from the leg muscles, which was then subjected to mathematical processing by specialists of Saints Petersburg Agrarian University.

4 Result and Discussion

The results of the study of the dynamics of changes in the nutritional values of egg-type quail meat during drying are shown in Table 1.

Table 1: Dynamics of changes in the nutritional value of laying breed quail's meat indicators during drying (sample analysis)

Index	Amino acid score difference coefficient	Amino acid score comparability coefficient	EAA index (essential amino acid index)	The coefficient of rationality	Biological protein value
Absolutely dry substance					
Quail meat (pectoral muscles)	0.186	1.34	3.27	1.34	81.38
Quail meat (leg muscles)	0.345	1.14	3.491	1.14	65.45
Air-dry substance					
Quail meat (pectoral muscles)	0.191	1.5	2.94	1.504	80.91
Quail meat (leg muscles)	0.402	1.06	3.957	1.06	59.83
Source material					
Quail meat (pectoral muscles)	0.269	3.834	1.18	3.83	73.02
Quail meat (leg muscles)	0.34	4.442	0.93	4.44	65.95

During the study of meat obtained from quails kept in the industrial poultry farming conditions, it was revealed that the average indicators characterizing the amino acid score and the protein biological value, which is a part of the pectoral muscles, vary within the intra-group variation, reaching 53.11% at 10 degrees of freedom.

In addition, during the study of meat obtained from quails kept in industrial poultry farming, it was revealed that the average indicators characterizing the amino acid score and the protein biological value, which is a part of the leg muscles, vary within the intra-group variation, reaching 43.3% at 10 degrees of freedom. The concordance coefficient for these protocols is w = 1.171.

During the study of meat obtained from quails got during hunting in the natural habitat, it was revealed that the average indicators characterizing the amino acid score and the protein biological value, which is a part of the pectoral muscles, vary within the intra-group variation, reaching 45.86% at 10 degrees of freedom.

Table 2: Dynamics of changes in the nutritional value of laying breed quail's meat indicators during drying (sample analysis)

Index	Amino acid score difference coefficient	Amino acid score comparability coefficient	EAA index (essential amino acid index)	The coefficient of rationality	Biological protein value
Absolutely dry substance					
Quail meat (pectoral muscles)	0.217	1.38	3.273	1.38	78.3
Quail meat (leg muscles)	0.322	1.53	2.647	1.53	67.78
Air-dry substance					
Quail meat (pectoral muscles)	0.224	1.37	3.113	1.37	77.58
Quail meat (leg muscles)	0.421	1.307	3.406	1.307	57.93
Source material					
Quail meat (pectoral muscles)	0.295	3.526	1.18	3.53	70.52
Quail meat (leg muscles)	0.395	4.07	1.02	4.07	60.49

At the same time, during the study of meat obtained from quails got under hunting conditions in the natural habitat, it was revealed that the average indicators characterizing the amino acid score and the protein biological value included in the leg muscles vary within the intragroup variation, reaching 64.64% at 10 degrees of freedom. The concordance coefficient for this protocol is w = 1.066.

5 Conclusion

Comparing the indicators obtained during the meat obtained from quails analysis, which was got during hunting in their natural habitat and obtained from quails kept in industrial poultry farming, a significant difference in variations within the intergroup variation was revealed, reaching 107.9% for the leg muscles at 20 degrees of freedom, and 98.97% at 20 degrees of freedom for the pectoral muscles. It is more than 5% for each degree of freedom for the leg muscles and more than 4% for each degree of freedom for the pectoral muscles according to such indicators, as the protein biological value, the coefficient of rationality, the essential amino acids index (In. Osera), the coefficient of amino acid score's difference, the coefficient of amino acid score comparability and protein-quality indicator, which is confirmed by calculations using the concordance equations, where we see differences with apparent homogeneity (the concordance coefficient for leg muscle meat in comparison is w = 0.3124, and for breast, respectively, w = 0.2965). The ratio of the amino acid tryptophan to oxyproline (protein-quality indicator), allows us to judge the preference of meat obtained from the game meat or in industrial poultry farming due to taste preferences. Thus, it is indirectly possible to judge the presence of selenium in raw

materials by the presence of sulfur-containing amino acids (methionine, cysteine, taurine), and, in particular, proline, and the presence of glutamic acid characterizes the preference of products produced from this raw material by the factor of animal protein.

6 Availability of Data and Material

Data can be made available by contacting the corresponding authors.

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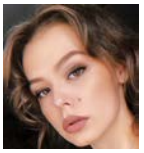
Dr.Ksenia Nikolaevna Bachinina is an Associate professor, Department of Breeding of Agricultural Animals and Animal Technologies, Kuban State Agrarian University named after I.T. Trubilin, Krasnodar, Russia.

Dr.Povetkin Sergey Nikolaevich is an Associate Professor, Department of Food Technology and Engineering, North Caucasus Federal University, Stavropol, Russia.

Dr.Simonov Alexander Nikolaevich is an Associate Professor, De[artment of epizootology and microbiology, Faculty of Veterinary Medicine, Stavropol State Agrarian University, Stavropol, Russia.

Dr.Sergey Viktorovich Pushkin is an Associate Professor, Department of Evolutionary Ecology and Biodiversity, North Caucasus Federal University, Stavropol, Russia.

Anastasiya Alexandrovna Blinova, Dr, Associate Professor, Department of Physics and Technology of Nanostructures and Materials, North Caucasus Federal University, Stavropol, Russia.



Ekaterina Dmitrievna Sukhanova is a student, Department of Food Technology and Engineering, North Caucasus Federal University, Stavropol, Russia.

Dr.Igor Spartakovich Baklanov is a Professor, Department of Philosophy, North Caucasus Federal University, Stavropol, Russia.

Dr.Roman Olegovich Kolesnikov is an Associate professor, Department of Animal Husbandry, Vice-rector for scientific work, Saint-Petersburg State Agrarian University, Pushkin, Saint-Petersburg, Russia.