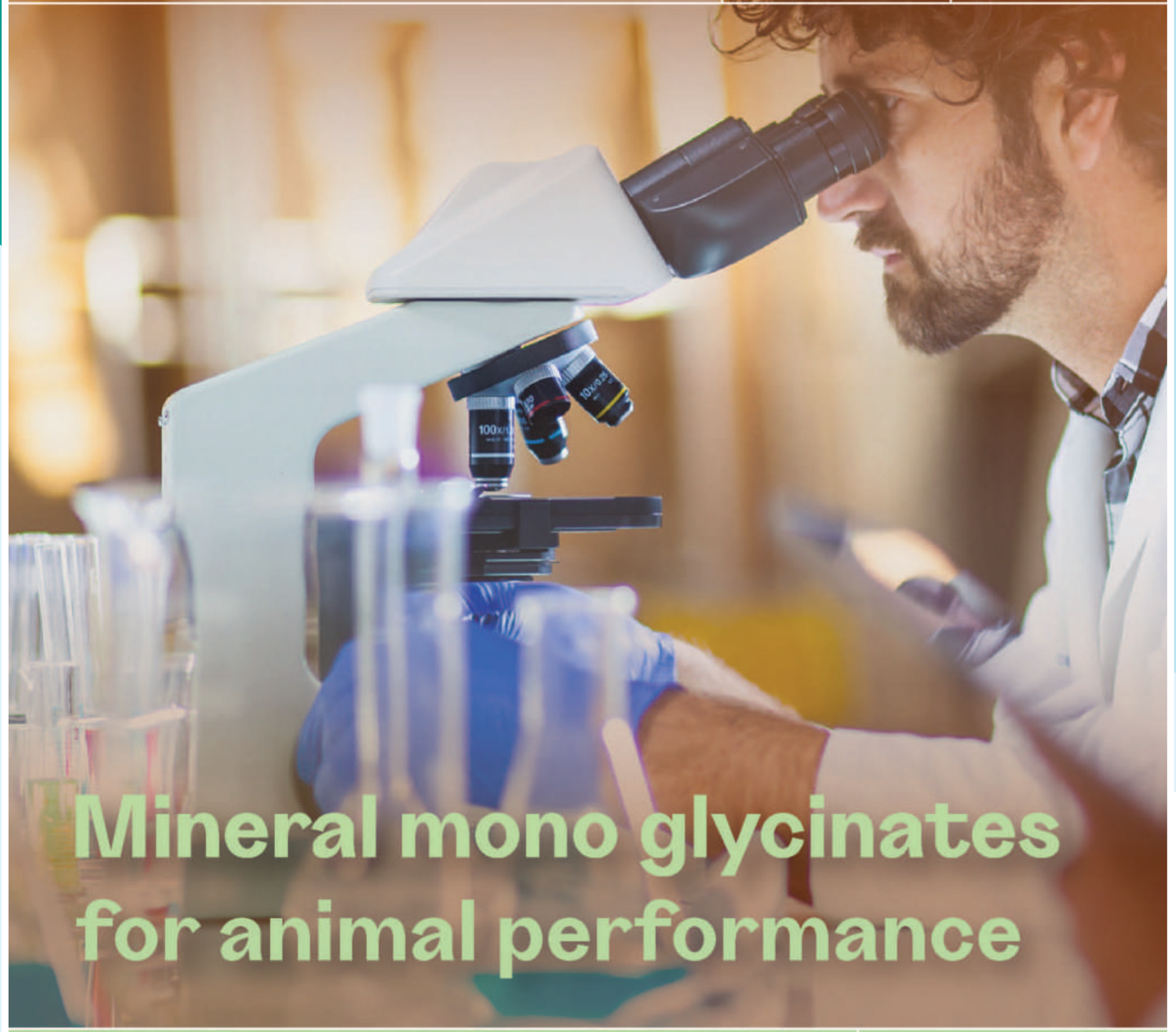


COMPENDIUM (KEYNOTE & LEAD PAPERS)

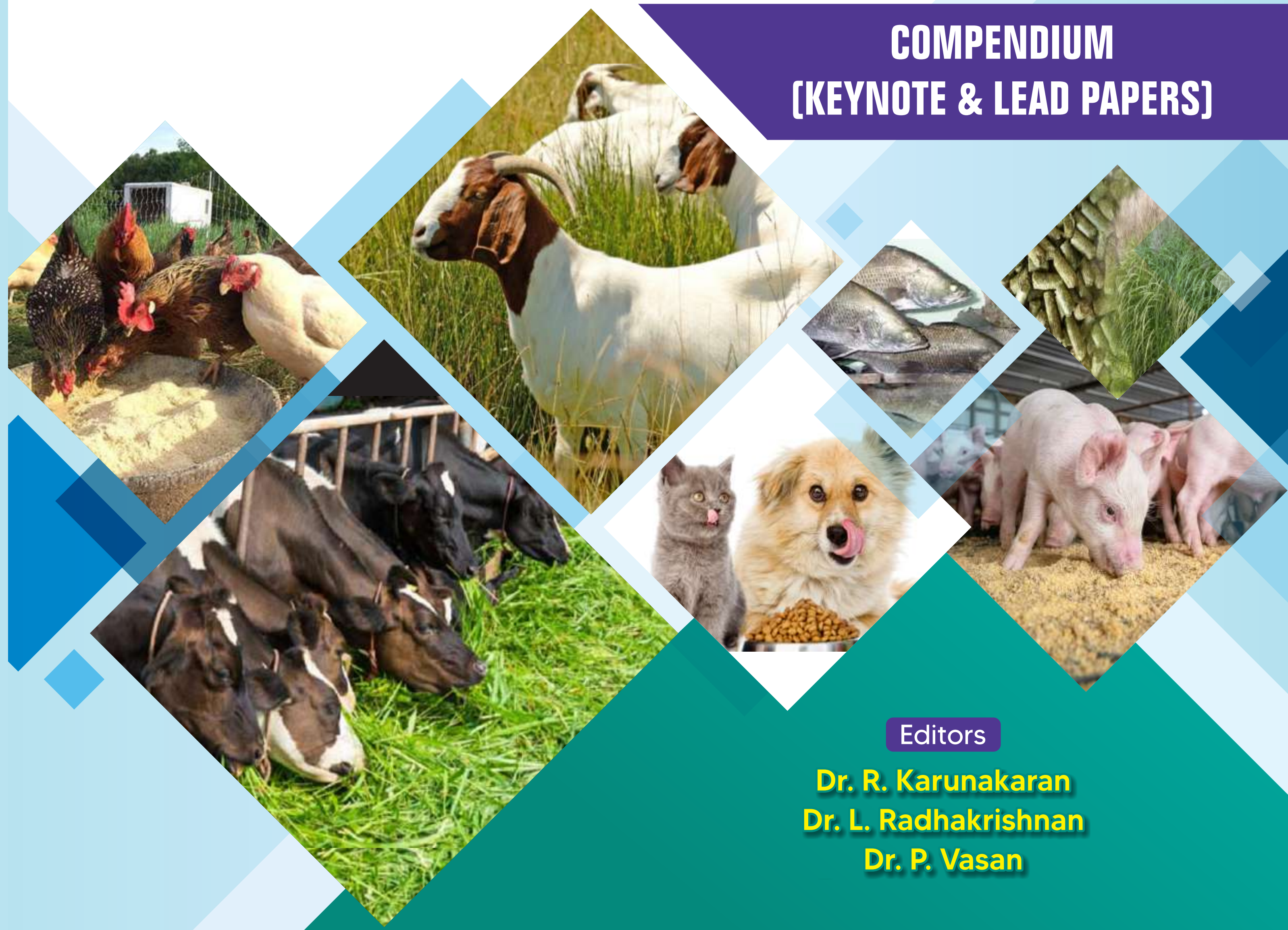
20th BIENNIAL INTERNATIONAL CONFERENCE OF ANIMAL NUTRITION SOCIETY OF INDIA ON SUSTAINABLE ANIMAL NUTRITION FOR GLOBAL HEALTH AND PRODUCTION: INNOVATIONS AND DIRECTIONS

NABARD

20th BIENNIAL INTERNATIONAL CONFERENCE OF ANIMAL NUTRITION SOCIETY OF INDIA ON SUSTAINABLE ANIMAL NUTRITION FOR GLOBAL HEALTH AND PRODUCTION: INNOVATIONS AND DIRECTIONS

23rd to 25th January, 2024

COMPENDIUM (KEYNOTE & LEAD PAPERS)



Editors
Dr. R. Karunakaran
Dr. L. Radhakrishnan
Dr. P. Vasan

DEPARTMENT OF ANIMAL NUTRITION
MADRAS VETERINARY COLLEGE
TAMIL NADU VETERINARY AND ANIMAL SCIENCES UNIVERSITY
CHENNAI – 600 007, TAMIL NADU (INDIA)

20TH BIENNIAL INTERNATIONAL CONFERENCE

OF

ANIMAL NUTRITION SOCIETY OF INDIA

ON

SUSTAINABLE ANIMAL NUTRITION FOR GLOBAL HEALTH AND PRODUCTION: INNOVATIONS AND DIRECTIONS

COMPENDIUM (KEYNOTE & LEAD PAPERS)

23rd to 25th January, 2024

Editors

Dr. R. Karunakaran

Dr. L. Radhakrishnan

Dr. P. Vasan

DEPARTMENT OF ANIMAL NUTRITION

MADRAS VETERINARY COLLEGE

TAMIL NADU VETERINARY AND ANIMAL SCIENCES UNIVERSITY

CHENNAI – 600 007, TAMIL NADU (INDIA)

Title of the Book	:	20th BIENNIAL INTERNATIONAL CONFERENCE OF ANIMAL NUTRITION SOCIETY OF INDIA ON **SUSTAINABLE ANIMAL NUTRITION FOR GLOBAL HEALTH AND PRODUCTION: INNOVATIONS AND DIRECTIONS** COMPENDIUM (KEYNOTE & LEAD PAPERS)
Copy Right	:	ANSI & TANUVAS
Language	:	English
Paper Quality	:	70 gsm Maplitho paper Wrapper 300 gsm art board
Size of Book	:	A4 size
Pages	:	394
Price	:	Academic Purpose; NOT FOR SALE
Year of Publication	:	2024
ISBN	:	978-93-612864-8-3

Superior Way of Human Health Promotion – Selenium Enriched Table Egg

Dragan Šefer*, Stamen Radulović, Svetlana Grdović, Dejan Perić,Radmila Marković
University of Belgrade - Faculty of Veterinary medicine, Department of Animal Nutrition and Botany, Bulevar Oslobodjenja 18, 11000 Belgrade, Serbia
**e-mail: dsefer@vet.bg.ac.rs*

Abstract

Eggs have an important role in human nutrition and are an important source of protein, fat and trace elements. The production and consumption of eggs in the world has been increasing in recent decades. The consumption of eggs has long been associated with negative effects on human health, mainly due to their cholesterol content. However, it is now known that the level of cholesterol in the serum is influenced by several other factors such as genetic predisposition, hormonal status and eating habits, and not only cholesterol from eggs. In recent years, the foods that are used daily in people's diet are not only intended to satisfy the needs in basic nutrients, but food is expected to prevent food-related diseases and acquire a better immune status. By using specific nutritional strategies, it is possible to produce functional food that, in addition to basic nutrients, also contains components that participate in preserving health and reducing the risk of disease. A low concentration of selenium in the soil, and consequently in the nutrients used in feed, can cause a deficiency of this microelement in animals. Deficiency symptoms also occur in humans through foods of animal origin, which significantly weakens the system of antioxidant protection in the body. The utilization of selenium in animals depends on the chemical form in which it is found in the meal. Selenium, which is used as an additive in vitamin-mineral premixes in feed for laying hens, is present in one of two basic forms: organically bound to amino acids (selenocysteine and selenomethionine) or in the form of an inorganic salt (most often sodium selenite). After entering the body through a meal, selenium is incorporated into tissue proteins, which creates its reserve. Deposited selenium in the body is in an inactive state and in cases of oxidative stress or selenium deficiency in feed, it changes to an active form. The source of selenium in feed mixtures for laying hens has an effect on the selenium content of eggs. By adding organic selenium to laying eggs, amounts of 20-25 μg per egg can be achieved, which is about 30% of the recommended daily intake for humans. For the production of such eggs, it is necessary to add organic selenium in the amount of 0.3-0.5 mg/kg to the laying feed. Organic sources of selenium have better biological availability and the content of selenium in table eggs is more stable.

Keywords: feed, food, eggs, organic selenium

Acknowledgement: The study was supported by the Ministry of Science,Technological Development and Innovation of the Republic of Serbia (Contract number 451-03-47/2023-01/200143).

Chemical Composition of Eggs

Consumable chicken eggs represent an exceptional source of nutritionally valuable nutrients and are an inseparable part of a high-quality and well-balanced human diet. At the same time, edible chicken eggs are a moderate source of calories (on average 140kcal/100g), which makes them a food with a favorable ratio of nutritional and energy value. The production and consumption of eggs in the world has been increasing in recent decades. The consumption of eggs has long been associated with negative effects on human health, mainly due to their cholesterol content. However, it is now known that the level of cholesterol in the serum is influenced by several other factors such as genetic predisposition, hormonal status and eating habits, and not only by cholesterol from eggs. In terms of basic chemical composition, the whole egg is a mixture of water, protein, fat, carbohydrates and ash. The content of basic nutrients in eggs is mostly stable (Table 1) and depends of the ratio of egg whites and yolks, while the presence of micronutrients is determined by the influence of several different factors, where the influence of nutrition is dominant. Water is the most abundant ingredient in the egg, followed by proteins, which are evenly distributed in the egg white and yolk, while fats are mostly present in the yolk and vitamins and minerals are mostly concentrated in it.

Table 1. The basic chemical composition of the whole edible hen's egg (USDA, 27; USDA, 23)

Nutrient	g/100 g
Proteins	12.56
Fats	9.51
Carbohydrates	0.72
Moisture	76.15
Ash	1.06

Egg proteins are nutritionally complete proteins because they contain all essential amino acids. Egg whites and yolks contain proteins of high biological value and digestibility. The biological value of egg protein (a measure of the building of food protein into tissue protein) is 94 and is the standard by which the biological value of all other proteins is evaluated. One hen's egg contributes only 3% of the energy value of the recommended daily energy intake, which is 2000 kcal, and at the same time provides 11% of the daily needs in proteins. The contribution of the intake of essential amino acids amounts to 13-31%, depending on the type of essential amino acid. The average protein content in a fresh hen's egg is about 12.5%. Egg yolks contain about 16% proteins, which are a complex of low-density lipoprotein (LDL), high-density lipoprotein (HDL), phosvitine and livetine. In the composition of egg white, the share of proteins is on average 10-11%, and they consist of albumin and globulin (rare part of egg white), ovalbumin (dense part of egg white), mucin and mucoid (structural part of egg white). Ovalbumin makes up more than 50% of the protein in the egg white, it is rich in essential amino acids, which are crucial for the development of the chicken embryo, but also an exceptional source of amino acids in human nutrition. Chicken egg white contains numerous proteins with a unique structure and functional properties, such as ovotransferrin, ovomucoid, ovomucin, ovomacroglobulin (ovostatin), ovoflavoprotein, lysozyme, ovoinhibitor, ovocystatin, avidin. Many of these proteins, as well as their breakdown products, have been proven to have biological activities significant for improving human health, such as antimicrobial, antioxidant and immunoregulatory properties.

The lipid content in the whole edible chicken egg is on average 10% (French Agency for Food, 2017). The entire lipids of the egg are concentrated in the yolk in the form of triglycerides (65%), phospholipids (28-30%) and cholesterol (4-5%). The composition of lipids in the yolk is determined by various factors, of which diet has the greatest influence. Unsaturated (monounsaturated and polyunsaturated) fatty acids make up approximately 50% of the fatty acid composition of egg lipids. Of the monounsaturated fatty acids, the most abundant is oleic (C18:1 n-9), and of the polyunsaturated linoleic (C18:2 n-6) and arachidonic acid (C 20:4 n-6). Saturated fatty acids make up 30-35% of the fatty acid composition of the egg, with the largest share of palmitic (C16:0) and stearic (C18:0) acids. Egg fats also contain sterols, the most important of which is cholesterol. A edible hens egg contains an average of 400 mg of cholesterol per 100 g (USDA, 27).

Chicken eggs are a nutritionally valuable source of water-soluble vitamins, as well as fat-soluble vitamins. Yolks are primarily a source of fat-soluble vitamins A, D, E and K, but also contain vitamins of the B complex (B1, B2, B5, B6, B9 and B12). Egg white contains a high concentration of vitamins B2, B3 and B5, but also significant amounts of vitamins B1, B6, B9 and B12 (Table 2). According to literature data, consuming two chicken eggs can satisfy 10-30% of daily vitamin needs.

Table 2. Vitamins in the whole egg (Maqbool, 2017)

Vitamins	ug/100g
Vitamin A (Retinol)	193
Vitamin D (Cholecalciferol)	1.5
Vitamin E (Tocopherol)	1.3
Vitamin K (Phylloquinone)	0.3
Vitamin B1 (Thiamine)	40
Vitamin B2 (Riboflavin)	450
Vitamin B3 (Niacin)	80
Vitamin B5 (Pantothenic acid)	1700
Vitamin B6 (Pyridoxine)	170
Vitamin B9 (Folate)	47
Vitamin B12 (Cobalamin)	0.89

Consumable chicken eggs contain significant amounts of minerals, primarily potassium, sodium, calcium and phosphorus. Also, they are a source of essential microelements, copper, iron, magnesium, manganese, selenium and zinc (Table 3).

Table 3. Minerals and trace elements in the whole egg (USDA 27)

Minerals and microelements	mg/100g
Calcium	56
Magnesium	12
Selenium	0,03
Sodium	142
Zinc	1,29
Phosphorus	198
Manganese	0,028
Iodine	0,021
Copper	0,072
Iron	1,75
Potassium	138

Functional Food

In recent years, the food that are used daily in humans diet are not only intended to satisfy the needs in basic nutrients, but food is expected to prevent food-related diseases and acquire a better immune status. Functional food cannot be simply defined, since a large number of different food products can be classified as functional foods. That is why the European Commission proposed a "working" definition that implies that functional food must be composed of natural ingredients and must not be in the form of tablets, capsules or food supplements. Functional food must, in addition to the appropriate nutritional effects, have a beneficial effect on the functions of the organism that are important for improving health and/or reducing the risk of disease development. It is consumed as part of the daily, usual diet, and its effectiveness must be scientifically proven. Functional food can be natural food, food enriched with a certain ingredient or a certain ingredient removed from it, food in which the properties or bioavailability of one or more ingredients have been changed, or any combination of the above possibilities (Roberfroid, 2002). The development of functional products and the functional food market has increased with the development of the science of animal nutrition, as a basic condition for the creation of functional food. The success of a new functional product on the market does not only depend on its beneficial effect on health, but also on its acceptable taste, appearance and availability to consumers (Grčević *et al.,* 2011). By using specific nutritional strategies, it is possible to produce functional food that, in addition to basic nutrients, also contains components that participate in preserving health and reducing the risk of disease.

Role of Selenium

Selenium is an essential trace element that has multiple roles in the body due to its participation in biochemical processes. It is a component of 25 selenoproteins. It has a favorable effect on the immune system, preventing the occurrence of inflammatory processes, cancer and oxidative stress, reducing the risk of atherosclerosis and cardiovascular diseases. Selenium has a role in the protection system of biological membranes against oxidative damage. It performs this role together with vitamin E (Marković et al., 2010). Of the total selenium in the body, 40% is present as an active ingredient of the enzyme glutathione percosidase (GPx). Selenium, together with vitamin E, has the role of an antioxidant, and participates in the conversion of free radicals into inactive and less toxic compounds. Free radicals are present in tissues with intensive oxygen circulation, they cause peroxidation of phospholipids, by acting on the double bonds of unsaturated fatty acids of phospholipids that enter into the composition of cell membranes. Free radicals are created when oxygen is added to those fatty acids, from which a hydrogen atom was previously separated. Free radicals can react with another lipid molecule, from which a hydrogen atom has been separated, and the product is hydroperoxide in the first molecule and a new free radical in the “attacked” lipid molecule. Molecules of lipid hydroperoxides are split to form dialdehydes, most often malondialdehyde (MDA). A series of such reactions leads to damage to the cell membrane structure and even to complete destruction (Rayman, 2000).

A series of positive effects of selenium on health resulting from the strengthening of the body’s defenses (strengthening of immunity, prevention of the formation and progression of arteriosclerosis, preservation of sperm fertility) have been confirmed, but with a rather narrow therapeutic range (in a ratio of 1:8) between the average needs (55 μg/day) and upper limit of safe intake (400 μg/day) (Backović, 2005). Relative selenium deficiency in humans is associated with an increased incidence of cardiovascular and other diseases etiopathogenetically related to oxidative stress and immune-mediated inflammation, infertility, and thyroid dysfunction (Lynne, 2004). A complete deficit is observed in long-term total parenteral nutrition with preparations without selenium, and in some regions it is associated with the occurrence of endemic Keshan and Kashin-Boeck diseases (Margaret Rayman, 2000). The addition or restriction of selenium affects the activity and metabolism of neurotransmitters, which causes changes in mood and behavior in humans and animals (Backović *et al.,* 2002). A low concentration of selenium in the soil, and consequently in the nutrients used in animal feed, can cause a deficiency of this microelement in animals. Deficiency symptoms also occur in humans through foods of animal origin, which significantly weakens the system of antioxidant protection in the body.

Production of Selenium Eggs

The utilization of selenium in animals depends on the chemical form in which it is found in the meal. Selenium, which is used as an additive in vitamin-mineral premixes in feed for laying hens, is present in one of two basic forms: organically bound to amino acids (selenocysteine and selenomethionine) or in the form of an inorganic salt (most often sodium selenite). After entering the body through a meal, selenium is incorporated into tissue proteins, which creates its reserve. Deposited selenium in the body is in an inactive state and in cases of oxidative stress or selenium deficiency in feed, it changes to an active form. The source of selenium in feed mixtures for laying hens has an effect on the selenium content of eggs. By adding organic selenium to laying eggs, amounts of 20-25 µg per egg can be achieved, which is about 30% of the recommended daily intake for humans. For the production of such eggs, it is necessary to add organic selenium in the amount of 0.3-0.5 mg/kg to the feed for laying hens. In research carried out at the Department of Animal Nutrition and Botany, Faculty of Veterinary Medicine, a product with a specific composition called selenium egg was obtained with the addition of organic selenium in mixtures for laying hens, with 42 µg of selenium in 100g of egg mass. Based on these results, we can conclude that organic sources of selenium have better biological availability and that the content of selenium in table eggs is more stable. The use of organic forms of selenium in the nutrition of laying hens increases the content of selenium in eggs.

References

Backović D., Jorga J., Milovanović S., Paunović K. 2002. Essential role of selenium and central nervous system. Engrami. 24: 39–47.

French Agency for Food, Environmental, and Occupation Healt&Safety. 2017. Anes-Ciqual French food composition table. Retrieved on01/11/2019from the Ciqual homepage https://ciqual.anses. fr.

Grčević M., Gajčević-Kralik Z., Kralik G., Ivanković S. 2011. Kokošje jaje kao funkcionalna namirnica, Krmiva 53, 2:93-100.

Lynne AD. 2004. Selenium: Essential and toxic but does selenium status have health outcomes beyond overt deficiency? (Editorial). Medical Journal of Australia, 180(8), 373 – 374.

Maqbool MA., Aslam M., Waseem AW., Zubair IZ. 2017. Biological Importance of vitamins for human health: A review. J Agric Basic Sci. 2:3.

Marković R., Baltić M., Šefer D., Radulović S., Drljačić A., Đorđević V., Ristić M. 2010. Einfluss erhöhter Mengen an organischem Selen und Vitamin E in der Broilermast auf ausgewählte Parameter der Fleischqualität. Fleischwirtschaft. 90, 132 – 136.

Rayman M. 2004. The use of high-selenium yeast to raise selenium status: how does it measure up? British Journal of Nutrition. 92, 557 – 573.

Roberfroid, MB. 2002. Global view on functional foods: European perspectives. British Journal of Nutrition. 88, 133-138.

USDA National Nutrient Database for standard Reference, Release 27.

USDA National Nutrient Database, Release 23.