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TSEKHMISTRENKO O., Candidate of Agricultural Sciences

TSEKHMISTRENKO S., Doctor of Agricultural Sciences

Bila Tserkva National Agrarian University

oksytsekhmistrenko@gmail.com

LIPID PEROXIDATION IN THE QUAIL'S KIDNEY UNDER CADMIUM LOAD AND SEL-PLEX INFLUENCE

Досліджена активність ферментів антиоксидантного захисту – супероксиддисмутази і каталази та вміст продуктів пероксидації у нирках перепелів за кадмієвого навантаження та впливу Сел-Плексу. Вивчений вплив препарату на динаміку живої маси та середні прирости маси перепелів, масу яєць та збереженість поголів'я птиці. Встановлено, що під впливом сполук Селену активізуються антиоксидантні ферменти, які сприяють відновленню процесів метаболізму в тканинах організму, зростає маса яєць та яєчна продуктивність, а також збереженість поголів'я.

Ключові слова: пероксидне окиснення, антиоксидантний захист, нирки, Селен, Кадмій.

Formulation of the problem, analysis of recent research and publications. The increasing human impacts the environment, which are accompanied by the scattering of chemical elements, can not avoid modern agricultural production. A significant number of areas subject to contamination, including highly toxic heavy metals [8], one of them is cadmium with severe cumulative properties. After its receiving in the body metabolism of trace elements is disturbed, the synthesis of hemoglobin is inhibited, functioning of the tricarboxylic acid cycle is disturbed, the amino acid composition of the body is changing. The result is a violation course of metabolic processes. Metal can destroy tiogroups of proteins, inhibit enzyme activity and form complex compounds with organic and inorganic ligands promote oxidative stress, change of acid-base balance of the body, accumulate acidic metabolites [6]. Metabolism in the kidneys of birds for the actions of stress causes abnormal functioning of the body, hormonal disorders, egg formation, decreased productivity and egg birds live weight [2].

At present the production of meat and egg products it is necessary to use additives to animal feed, including special attention deserves drug Sel-Plex, which includes selenium in combination with amino acids. This item in physiological norms positively affects all types of metabolism [1], improves overall health [3, 13], its reproductive ability and performance [1, 8, 13]. Selenium has a strong antiradical [1, 12, 14], radiation protection [13], anti-tumor effect [8, 14] and reduces the negative impact on the abiotic factors such as heavy metals [1, 6, 8]. In this context, **the aim of the work** was to determine the characteristics of the activity of the antioxidant system in the quail's kidney in ontogeny, as well as the action of selenium organic nature and cadmium by simulated load.

Material and research methods. To address this goal there was conducted modeling research on Pharaoh quail's species, which were divided into three groups with 50 animals in each. Terms of keeping and feeding birds answered physiological norms. Birds of all groups were fed standard feed (SC). Quails first group served as control. Birds research groups from three days of age with feed added Sel-Plex (0.15 mg / kg of feed), additional birds 3rd group of food added cadmium sulfate (CdSO₄) in the amount of 1% LD50. After bird's decapitation under slight ether anesthesia there were performed biochemical studies in kidney's extract ranging from 1- to 70 days of age with an interval of 10 days. The fabric crushed in Potter-Elvehem homogenator with teflon pestle. In a sample of homogenate it was added 6 ml of saline. The resulting fraction was centrifuged (3000 rev./Min, 10 min). In this solution the activity of antioxidant enzymes - superoxide dismutase (SOD) and catalase, and the content of lipid peroxidation metabolites by conventional methods were determined [5, 7 10, 11]. Biometric treatment results were based by Student t-test.

Results and discussion. Lipid peroxidation is a process that always takes place in the body and is caused by contact with dissolved molecular oxygen in body fluids with easy oxygenized carbon compounds, primarily lipids of biomembranes [1, 3, 12]. An important component of protection systems against oxygen is superoxide dismutase, an enzyme that detoxifies superoxide anion radical by dismutation and transfer to the less reactive molecules of hydrogen peroxide and triplet oxygen [1].

In addition of Sel-Plex it was shown significant increase in enzyme activity relative to control in 10-, 20-day age and the end of the experiment in 60- and 70-day age in 1.36; 2.75; 3.31 and 1.61 times,

respectively (Table 1). In other age groups it was a significant decrease in activity relative to control, which contributes to the intensification of free radical processes. The lower SOD activity appears likely due to reduced formation of superoxide radicals, hence less need to protect them [9, 14]. On the other hand, early bird life high levels of lipid peroxidation and accumulation in tissues peroxides may result in inhibition of superoxide dismutase activity.

Table 1 – Antioxidant enzymes activities in the quail's kidney under Cadmium load and Sel-Plex influence (M±m, n=5)

Birds age, days	SOD activity, standard units/g			Catalase activity, mcat/g		
	1 group control (standart feed, SF)	2 group (SF+SEL-PLEX)	3 group (SF+SEL-PLEX+CdSO ₄)	1 group control (standart feed, SF)	2 group (SF+SEL-PLEX)	3 group (SF+SEL-PLEX+CdSO ₄)
1	9.96±0.18			29.22±0.16		
10	16.87±0.02	9.14±0.12***	23.06±1.19*** ²²²	23.61±0.12	20.72±0.99*	27.91±0.58*** ²²²
20	7.88±0.20	3.55±0.11***	21.67±1.47*** ²²²	20.82±0.14	17.61±0.31***	20.65±0.78 ²²
30	23.79±6.94	7.94±2.37	14.75±1.53 ²	21.93±0.82	11.91±2.13**	19.01±0.29** ²
40	5.53±0.17	5.55±0.34	1.96±0.04*** ²²²	16.76±0.09	24.37±2.86*	18.96±1.46
50	33.38±1.33	12.70±2.34***	2.47±0.50*** ²²²	15.98±0.01	13.44±1.64	15.12±1.50
60	4.77±0.10	14.14±0.78***	15.89±1.97***	12.74±0.63	6.95±0.70***	7.73±0.45***
70	9.29±0.27	13.40±1.71*	15.01±0.73***	22.16±0.12	22.40±0.32	22.34±0.55

Note: there are in Table 1 and 2. The difference is likely to control, at * - p≤0,05; ** - p≤0,01; *** - p≤0,001 and against the other 2 groups.

Hydrogen peroxide which is formed as a result of SOD is oxidizer itself without being radical. Because of this SOD is localized in the cell with catalase, the antioxidant enzyme that completes the protection by converting H₂O₂ to H₂O. The results showed that catalase activity is highest in one-day old birds and are gradually reduced in comparison with that level of birds in all groups, but significantly increased dramatically in the second group of 40-day age, and in all groups in the 70-day age, although it does not reach the level of activity in daily Quails [4, 13].

When organic selenium came into an organism the enzyme activity was significantly reduced compared with the control on 10-, 20-, 30- and 50-day age. In 40- and 70-days-old quail's it was observed increased activity by 45.4% and 1.1% respectively. The 40-day birds given the likely increase.

When a diet included cadmium sulphate the catalase activity increased slightly compared with the control in quails of 3rd group in 10-, 40- and 70-day age, but is only significant changes in 10-day-old birds - 18.2%. In other age groups discernible trend to reduced activity of the studied enzymes significantly in the 30-day age at 13.32% and 60-day - 39.3%. Since catalase is an enzyme that detoxifies hydrogen peroxide and capable of reacting hydrogen with other donors, the decrease in its activity leads to an increase in the content of reactive oxygen in tissues, which is accompanied by the development of cellular metabolism and pathology.

Keeping the intensity of free radical processes at a physiological level is controlled by antioxidant system which includes enzymes, vitamins, natural antioxidants. One of the reasons for the decline are intracellular SOD inhibition of impaired metabolism products. SOD is sensitive to toxic metabolites of lipid peroxidation, as activity of this enzyme in terms of reduced activation of free radical processes. According pathology intensifying processes of lipid peroxidation, hydrogen peroxide content increases and increased catalase activity. The increase catalase activity associated with the role of lipid peroxidation generated in the active forms of oxygen that influenced directly by the enzyme. Interacting with amino acid polypeptide chain radicals toxic metabolites alter the structure of the protein molecule. The results showed that the highest levels of lipid hydroperoxides observed in 50- and 60-day age of both study groups (Table 2).

Table 2 – Lipid peroxidation products content in the quail's kidney under Cadmium loading and Sel-Plex influence (M±m, n=5)

Birds age, days	Lipid peroxidation products content, standard units/g			TBA-active products content, mM/g		
	1 group control (standart feed, SF)	2 group (SF+SEL-PLEX)	3 group (SF+SEL-PLEX+CdSO ₄)	1 group control (standart feed, SF)	2 group (SF+SEL-PLEX)	3 group (SF+SEL-PLEX+CdSO ₄)

1	45.42±0.86			0.52±0.03		
10	59.43±0.54	66.87±1.21***	81.73±0.47*** ²²²	0.38±0.01	0.42±0.04*	0.23±0.02* ²²
20	46.16±0.68	45.31±2.10	63.24±2.42*** ²²²	1.20±0.02	0.32±0.03*	0.29±0.02**
30	49.70±1.13	37.20±5.54*	32.01±0.98***	0.10±0.01	0.07±0.02***	0.08±0.03
40	47.08±1.02	52.26±5.79	46.34±3.82	0.05±0.004	0.03±0.02	0.02±0.01**
50	119.26±1.19	117.00±0.83	116.33±5.58	0.06±0.02	0.03±0.01**	0.44±0.06*** ²²²
60	122.93±0.04	188.81±0.15***	118.91±2.38	0.17±0.01	0.08±0.02**	0.21±0.13
70	55.02±0.07	54.50±0.11**	56.01±0.70	0.42±0.03	0.55±0.08	0.53±0.33

Under using Sel-Plex the level of hydroperoxides significantly increased versus control in 10 and 60-day age. Under modeling of cadmium load it was significantly higher than the level of hydroperoxides control in poultry 10- and 20-day-old 3rd group. In the future, this figure decreased to control significantly in 30-day age 3rd group. The highest content of TBA-active products observed in one day old quails. During the experiment, It was observed a significant increase in control against 10- and 70-day age birds second group 1.1 and 1.3 times. For cadmium load content of TBA-active products significantly reduced versus control in 10-, 20- and 40-day age. Significant significant increase in their number observed in the 50-day age.

Growth of lipid peroxidation products content against the background of decreased activity of antioxidant enzymes indicates the state of stress in the body POL quail. The increase of lipid hydroperoxides content while reducing the amount of content of TBA-active products indicates deterioration transformation of primary products of lipid peroxidation and accumulation in the end first.

Quail live weight increased during the experiment. In the 2 nd experimental group under adding of Sel-Plex weight gain dominated benchmarks. By modeling cadmium load weight gain decreased significantly relative to intact birds, reliable these changes were 20- and 30-tydennomu 3rd age group. The average weight of quail in 70-day age when adding Sel-Plex grew by 13.6%. The average increase quail decreases with age, but maximum values recorded for 2-4 th decades. The maximum average growth recorded during the 3rd decade of life, and in the group, where food preparation added Selenium figure exceeded those in intact birds, and the group where modeled cadmium load was smaller.

It is found that the addition of selenium slightly increases the mass of eggs that in the control group was 11.38 ± 0.35 g, by adding of Sel-Plex – 12.45 ± 0.51 g, and the 3rd group – 11.59 ± 0.61 g. The selenium application in feed composition positively affected for the safety of poultry (compared to control increased by 8%).

In the simulation cadmium load pathological effect toxicant offset under the influence of the drug Selenium and safety of livestock close to the benchmark, dominating it by 4.5% in the 3rd group.

According to the results, it is proved that the addition to the poultry diet drugs selenium improves antioxidant status quail body and reduces the negative impact of heavy metals in the body. This increases safety of livestock and average daily gain. Given appropriate to calculate the cost-effectiveness of adding drugs selenium in feed in growing quail.

Conclusions and prospects for further research. The study suggests that the intensity of lipid metabolism in the tissues of the quail's kidneys depends on exogenous antioxidant mechanisms and their impact. Concerted and continuous functioning of these mechanisms ensures reliable antioxidant system. Exhaustion of one of the components of the system can cause a decrease in all other ingredients and mechanisms abuse rehabilitation.

Age differences quail kidney reactions to the impact of exogenous factors in many biochemical parameters are important in assessing their sensitivity to the formation of toxic products of metabolism. Researches of the lipid metabolism in the bodies of animals under adding of Sel-Plex in age aspect is an important element in establishing the nature of changes in the intensity of metabolic reactions caused by drug and determination of these parameters in animals provides an opportunity to influence the physiological state and normalize it.

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Перекисное окисление липидов в почках перепелов под влиянием Сел-Плекса и кадмиевой нагрузки

О.С. Цехмістренко, С.І. Цехмістренко

Исследована активность основных ферментов антиоксидантной защиты – супероксиддисмутазы и каталазы, а также продуктов пероксидации в тканях почек перепелов при кадмиевой нагрузке и при влиянии Сел-Плекса. Изучено влияние препаратов на динамику живого веса и средней приросты массы перепелов, массу яиц и сохранность поголовья птицы. Установлено, что под влиянием Селена активизируются антиоксидантные ферменты, которые способствуют восстановлению процессов метаболизма в тканях организма, увеличивается масса яиц и яичная продуктивность, а также сохранность поголовья.

Ключевые слова: перекисное окисление, антиоксидантная защита, почки, Селен, Кадмий.

Lipid peroxidation in the quails kidney under Cadmium load and Sel-Plex influence

O. Tsekhmistrenko, S. Tsekhmistrenko

Research on the study of activity of main antioxidant ferments superoxidedismutase and catalase and peroxidation products in quails kidney under condition of Cadmium and Sel-Plex influence is conducted. The influence of drugs on the dynamics of live weight and the average weight gain of quail, the weight of eggs and poultry survival is studied. Antioxidant ferments are activated under Selenium influence, that promotes reconstruction of metabolism processes in organism tissues, increased egg weight, egg productivity and safety of quails.

Key words: lipid peroxidation, antioxidant protection, kidney, Selenium, Cadmium.

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