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TSEKHMISTRENKO O., PhD in Agriculture
Bila Tserkva National Agrarian University
Tsekhmistrenko@rambler.ru

LIPID PEROXIDATION IN POULTRY ORGANISM

Досліджена активність основних ферментів антиоксидантного захисту – супероксиддисмутази і каталази та вміст продуктів пероксидації у нирках перепелів за кадмієвого навантаження. Встановлено, що під впливом кадмію, як екзогенного токсиканту, в клітинах утворюються токсичні продукти обміну, вміст яких інгібує антиоксидантні ферменти. За додавання сполук Селену активізуються супероксиддисмутаза та каталаза, які сприяють відновленню процесів метаболізму в тканинах організму. Проведене дослідження свідчить про вікові відмінності у чутливості нирок перепелів до екзогенних токсикантів та корекції їх впливу. Особливо чутливою птиця є у критичні періоди розвитку: одразу після вилуплення, під час зміни оперення, в період гормональної статевої перебудови і під час встановлення інтенсивної яйцекладки. Додавання з кормами препаратів Селену нівелює токсичний вплив Кадмію і доводить рівень метаболізму до рівня контрольної групи.

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

Statement of the problem. Modern agricultural production is in conditions of growth of anthropogenic impact on the environment, accompanied by dissipation of chemical elements. The special role belongs to a highly toxic heavy metals [5, 9]. One of them is Cadmium, which penetrates into the body and inhibits the synthesis of hemoglobin, violates exchange of trace elements, functioning of citric acid cycle, changes the amino acid composition of proteins [5].

Significant role in maintaining a body constant internal environment belongs to kidneys. They remove from blood exchange products, alien substances. Metabolic disorder in the kidneys under the influence of stress factors leads to disruption of functioning of the whole organism, hormonal disorders, to a violation of oviposition, reduced egg production and poultry live weight [8].

Important role in the development of pathological processes play: malfunction of the body's antioxidant enzymes, intensification of free radical oxidation of lipids and destructive changes in the cell membrane [1, 7, 9]. Selenium is a natural antioxidant, deficit of which makes cells sensitive to stress. Selenium helps to activate thyroid hormone, increases the concentration of immune bodies, reduces the allergy, along with vitamins A, C, E, is able to block the effect of heavy metals [4, 7]. Lipid peroxidation was studied by many researchers [1–4, 6–9], but the characteristics of the process in the body and organs of quails were not studied. Following the above, **the goal and objective** are to investigate the influence of organic forms of selenium on lipid peroxidation in the quail kidney with cadmium load.

Materials and Methods. To reach the goal, the model experiment was conducted on quail breed Pharaoh, who were divided into three groups (50 birds each). Conditions and feeding of birds corresponded the physiological norms [2]. Birds of all groups were fed with standard feed (SF). Quails in the first group were control. Birds from two experimental age groups got Sel-Plex with feed (0,15 mg/kg diet), in addition birds of third group were administered with food cadmium sulfate (CdSO4) in an amount of 1 % LD_{50}. Birds were decapitated under light ether anesthesia, after that biochemical studies of kidney extract were performed, starting from 1- to 70-days age with 10-days intervals. Tissue was crushed in a Potter-Elveheim gomogenatore with Teflon pestle. The obtained fraction was centrifuged (3000 revs/Min, 10 min). Activity of antioxidant enzymes superoxide dismutase (SOD) and catalase were determined.

Results. Lipid peroxidation is a process that is constantly happening in the body and is caused by body fluids contact with dissolved molecular oxygen with carbon easy peroxidated compounds, especially lipids of biological membranes [7]. An important component of the antioxidant system is

superoxide dismutase, an enzyme that detoxifies superoxide anion radicals by dismutation and transfer them into less reactive molecules of hydrogen peroxide and triplet oxygen.

When adding Sel-Plex, there was observed a significant increase in SOD activity in control against 10-, 20-days old quails and at the end of the experiment against 60- and 70-days age by 1,3; 2,7; 3,3 and by 1,6 times respectively.

Table 1 – **Activity of antioxidant enzymes in the quail kidney for cadmium adding Sel-Plex** (M ± m, n = 5)

	Superoxide dismutase activity, conventional units per gram			Catalase activity, microkatals per g		
Bird's age, days	Group 1, control (SF)	Group 2 (SF+ Sel-plex)	Group 3 (SF+ Sel-plex+ $CdSO_4$)	Group 1, control (SF)	Group 2 (SF+Sel-plex)	Group 3 (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*[2]	23,61±0,12	20,72±0,99*	27,91±0,58*[2]
20	7,88±0,20	3,55±0,11*	21,67±1,47*[2]	20,82±0,14	17,61±0,31*	20,65±0,78[2]
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*[2]	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*[2]	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: the difference is significant with respect to control: the * - $p \leq 0,05$ and [2] - against the second group.

In other age groups decrease in activity relative to the control was a significant, which contributes to the intensification of free-radical processes. Decrease in SOD activity appears likely due to the reduction of superoxide radicals. Hence it is less need to protect them. [8] On the other hand, early bird life high level of lipid peroxidation and accumulation of peroxides in the tissues may lead to the inhibition of enzyme activity.

Hydrogen peroxide, as a product from the activities of SOD, is an oxidizing agent himself without being radical. Neutralization of hydrogen peroxide occurs with the participation of catalase, which converts H_2O_2 to H_2O. Studies have shown that catalase activity is the highest in the kidneys of 1 day old birds and gradually decreases with age in all groups of birds. It increases significantly in the second group at 40 days of age and in all groups in the 70-day, although not reaching the level of activity in one day quails [3].

When an organic selenium was added enzyme activity significantly reduced as compared with the control at 10-, 20-, 30- and 50-day age. In the 40- and 70-day-old quails is observed increase in activity by 45,4 % and 1,1 % respectively.

When cadmium sulfate was administered in the quails' diet, catalase activity increased somewhat compared with the control third group quails of 10-, 40-, and 70 days of age. Significant change was only in 10 -day-old chicks by 18.2 %. Other age groups tended to decrease in enzyme activity in the 30 days of age by 13.3% and 60 -day by 39.3 % ($p<0.05$). Since catalase is an enzyme that detoxifies hydrogen peroxide and is capable of reacting with other hydrogen donors, the reduction of its activity leads to an increase in the content of active oxygen forms in tissues accompanied by metabolic disturbance and development of cellular pathology.

Keeping the intensity of free radical processes at the physiological level is controlled by the antioxidant system that includes enzymes, vitamins, natural antioxidants. One of the causes of decreased activity of SOD is an intracellular inhibition of the products of impaired metabolism. SOD is sensitive to the toxic metabolites of lipid peroxidation, because the activity of this enzyme in terms of activation of free radical processes is reduced. Within pathology there are intensifying processes of lipid peroxidation, increased hydrogen peroxide and the activity of catalase. The increase of catalase activity is associated with a generated reactive oxygen role in the process of lipid peroxidation, which influenced directly by the enzyme. Interacting with amino acid polypeptide chain radicals are toxic metabolites that alter the structure of the protein molecule.

Conclusion. Thus, this study suggests that the intensity of lipid metabolism in quails kidney tissues depends on exogenous antioxidants and their mechanisms. Consistent and continuous functioning of these mechanisms ensures the reliability of the organism antioxidant defense. Depletion of one of the

system components can cause a decrease in the content of the other component and a violation of its recovery mechanisms.

Age-related differences in quails kidney reactions to impact of exogenous factors in many biochemical parameters are important in the evaluation of their sensitivity to the formation of toxic products of metabolism. Investigation of lipid abnormalities in the organs of animals when added Sel-Plex in age aspect is an important element in establishing the nature of changes in the intensity of metabolic reactions, caused by the drug, and the definition of these parameters in animals, provides an opportunity to influence the physiological state and normalize it.

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Перекисное окисление липидов в организме птицы

О.С. Цехмистренко

Исследована активность основных ферментов антиоксидантной защиты – супероксиддисмутазы и каталазы и содержание продуктов пероксидации в почках перепелов при кадмиевой нагрузке. Установлено, что под влиянием кадмия, как экзогенного токсиканта, в клетках синтезируются токсичные продукты обмена, содержание которых ингибирует антиоксидантные ферменты. При использовании соединений селена активизируются супероксиддисмутаза и каталаза, способствующие восстановлению процессов метаболизма в тканях организма. Проведенное исследование свидетельствует о возрастных отличиях в чувствительности почек перепелов к экзогенным токсикантам и коррекции их влияния. Особенно чувствительной птица является в критические периоды развития: сразу после рождения, во время смены оперения, в период

гормональной половой перестройки и установки интенсивной яйцекладки. Добавление с кормами препаратов Селена нивелирует токсическое влияние Кадмия и доводит уровень метаболизма до уровня контрольной группы.

Ключевые слова: пероксидное окисление липидов, антиоксидантная защита, почки, Селен, Кадмий.

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