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The Influence of Cadmium and Lead Salts on Morpho-Biochemical Blood Parameters and Productivity of Rabbits

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Annotation: In recent years, in order to preserve the genetic potential of farm animals and meet the population's demand for livestock products, numerous poisonings of animals raised on an industrial basis have been observed due to the use of various synthetic ingredients, food additives and biologically active substances in their feeding.Prevention of this is one of the priorities of biological science. This scientific article examines the negative impact of salts of the heavy metals cadmium and lead on the consumption, digestion and productivity of rabbits that were fed the diet of industrial rabbits at a dose 5 times higher than the norm, studied and experimentally carried out, shown in based on data.Based on data obtained in production experiments, it is recommended to replace 10% of the dry matter of the daily diet with dry matter of higher algae Eykhniya, which has biocorrective properties, to neutralize the level of toxicity of heavy metal salts. and get the planned product from the rabbits at no additional cost.

Keywords: heavy metals, cadmium, lead, toxic poisons, rabbits, eykhniya algae, dose, nutrient intake, digestion, absorption and products.

1. Introduction

By the end of the 20th - beginning of the 21st century, the rapid development of industrial production and a sharp increase in the number of cars cause environmental pollution with toxic gases and substances and extreme inconvenience for the environment.In addition, industrial waste, wastewater, ash and gases, vehicles, emissions from thermal power plants, large-scale use of coal, as well as excessive use of herbicides and insecticides in agricultural production, the use of them by farmers in production shows that the content of the products produced and the food plants grown is enriched toxic substances.Among these toxic substances, one of the leading places is occupied by salts of heavy metals, and many foreign scientists have come to the conclusion that it is necessary to prevent this[1, 2, 4, 8].

All of the above, along with ensuring the chemical purity and environmental safety of products produced for livestock farmers, controls the chemical composition of feed consumed by existing animals, tasks have been set to create drugs to prevent animal poisoning and develop developments for the use of unique seaweed that has biocorrective and bioprotective properties, complete in composition and with low cultivation costs[5, 6, 10, 12].

To achieve a positive solution to these problems, it is necessary to conduct laboratory analyzes of the chemical composition of nutritious plants consumed by animals raised on pasture throughout the year.The manifestation of the vital activity of the animal body as a whole is ensured primarily by blood and its constituent systems, therefore the composition of blood in the animal body requires parallel laboratory analysis.After all, blood serves as an important indicator for assessing the state of various physiological processes in the body, the functional activity of some organs and systems, and increasing resistance to diseases and adverse environmental factors.Having entered the body with food, it is broken down in the digestive system and absorbed into the blood. Blood provides communication between cells, tissues and some systems of the animal body, delivers from there some products to the excretory organs and ensures their removal from the body, that is, it carries out the exchange of moderate substances in the body[7, 13, 14].

Violation of the functional activity of some organs is characterized by a partial change in homeostatic indicators of blood composition. It is clear that studying the composition of blood in the conditions of a constantly changing external environment of the animal body is of great importance for determining the properties of flexibility (plasticity) of their body.It should also be recognized that changes in blood composition are seriously influenced by the age, sex, breed, living conditions, feeding, seasons and other factors of animals[3, 11, 15, 16].

Studying the composition of the blood of animals, assessing the condition of animals and confirming their adaptation to the external environment, as well as providing the opportunity to monitor changes occurring in the body of animals under the influence of nutrition and care factors, and assess the general physiological state of animals.

By dynamically studying the composition of blood and its influence on its properties in combination with other factors, it is possible to obtain information about the factors and processes affecting animal productivity, as well as to assess the possibility of maintaining animal productivity at the proper level. the required level through anthropogenic control of these processes, morphological and biochemical analysis of the blood of experimental rabbits obtained as a result of studying the contents.

The purpose and objectives of the research work. The purpose of this work was to evaluate the biocorrective properties of Eykhniya algae with individual and cumulative excess of heavy metal salts added to the diet of rabbits.

2. Materials and methods of research work

Based on the above, the positive effect of the use of Eykhniya algae on the prevention of the negative effects of various doses of lead and cadmium acetates on metabolic processes in the body of rabbits in the conditions of industrial breeding of Hikol rabbits imported from France was studied.To conduct experimental studies, taking into account the breed, age, sex and live weight of animals in groups according to similar principles, 5 groups (10 animals in each) were formed: - control group, I experimental group, II experimental group, III- and IV - experimental groups.Nothing was added to the diet of the control group and it was fed the basic diet (BD) used on the farm, experimental group I BD + 0.6 mg cadmium acetate salt, experimental group II BD + 5.09 mg lead acetate salt, group III - in If both groups received acetate salts of cadmium and lead, the rabbits of experimental group IV, in addition to the diet of group III, were replaced by 10% of the dry matter content of the diet with the dry matter of tall algae Eykhniya.Animals in all groups were fed and kept under the same conditions. During the experiments, the rabbits were provided with free food and water. The main attention was paid to feeding rabbits with complete diets based on the composition of diets of granulated feed [2, 11].

Rabbits in groups were carefully weighed on scales at the beginning and end of the experiment and their live weight was determined. Blood was also collected from rabbits for hematological and biochemical studies at the beginning and end of the experiment.

Hematological studies were performed using a Mythic 18-vet analyzer. To assess the functional state of rabbits after poisoning with heavy metal salts, total protein, albumin, globulin and its fractions, α-, β- and γ-globulins in blood serum were examined using the Express Plus biochemical analyzer. To determine protein fractions in blood serum, a concentration photoelectrocolorimeter CPC-2 was used.

To analyze the amount of heavy metal salts in the organs and tissues of rabbits, we used a Perken Elmer Aanalyst 200 atomic absorption spectrometer[12].

During the processing of all obtained numerical data using the method of variation statistics, the arithmetic mean (M±), root mean square error (±m) and significance level (P) of the obtained data were determined. The obtained data were considered highly reliable if $P<0.001$, $P<0.01$ and $P<0.05$, and $P<0.05$ – significant if the difference indicator $P>0.1$ was not significant [9].

During the analysis of the data obtained, it was shown that the morphological composition of the blood of rabbits changed during experiments on the use of Eykhniya algae as an additional food additive when feeding rabbits various salts of heavy metals separately and together in a daily diet. diet and in addition to the diet, both salt mixtures are fed (see table below).

The data presented in the table below shows that the form of elements in the blood of rabbits that consumed cadmium acetate and lead acetate salt changed as follows. It should be noted that at the beginning of the experiments, the number of studied parameters in the blood of rabbits was almost the same and was within the physiological norm.

According to the data obtained, it was established that the addition of various heavy metal salts to the feeding rations of experimental rabbits has a negative effect on the hematological parameters of their blood, and the effect affects primarily the growth rate of rabbits in groups.The quantitative level of red blood cells and hemoglobin in the blood is closely related to the productivity of rabbits. According to the method used, it was noted that the use of heavy metal salts in the diet led to a deterioration in the hematological parameters of the blood of experimental rabbits.

Table 1 Morphological parameters of the blood of experimental rabbits (M±m, n=5)

Indicators		Groups

		Control	I	II	III	IV
Red blood cells, million/mm^3	1	5,1±0,5	4,9±0,1	4,9±1,3	4,8 ±0,1	4,9±0,7
	2	5,7±0,5	4,9±0,1*	5,1±1,2**	4,7±0,1	5,4±0,7
Leukocytes, million/mm^3	1	7,3±0,2*	7,2±0,4**	7,4±0,3	7,3±0,2	7,2±0,4
	2	8,3±0,4	7,2±0,2	7,46±0,3	6,9±0,3	8,1±0,7
Hemoglobin, g/l	1	108,6±1,7	106,2±1,4	108,7±1,4	107,9±1,3	106,2±1,6
	2	115±1,7	97,4±1,4	102,6±1,7	94,6±1,3	113±1,7
Neutrophils %	1	35,3±1,2*	34,7±2,0	36,1±1,4	35,6±1,2	36,3±1,4
	2	37,3±1,2	29,7±2,0	30,7±1,5	28,6±1,2	36,2±2,2
Eosinophils,%	1	2,2 ± 0,9	2,3 ± 0,4	1,8±0,8	2,17± 0,3	2,1 ± 0,6
	2	2,4 ± 0,2	4,3 ± 0,4	3,76±0,7	4,8± 0,3	2,2 ± 0,9
Lymphocytes,%	1	54,2±3,2	55,8± 2,3	55,3±1,9	56,1± 1,5	53,6±3,3
	2	58,4±1,3	67,5± 1,5	66,3±1,8	69,4± 3,5	56,5±2,1
Monocytes %	1	2,6 ± 0,5**	2,6± 0,3	2,5±0,5*	2,7±0,4	2,4 ± 0,3
	2	3,1 ± 0,3	2,6± 0,3	2,8±0,2	2,4±0,4	2,9 ± 0,4
Basophils,%	1	0,2± 0,3	0,1 ± 0,2	0,1±0,1	0,2± 0,2	0,3 ± 0,3
	2	0,8 ± 0,2	0,1 ± 0,2	0,1±0,1	0,2± 0,2	0,8 ± 0,3
Thrombocytes thousand/mm^3	1	170,3±9,3	166,2±3,7	168,1±5,3	173,2±3,6	174,3±9,2
	2	184,3±9,3*	149,2±3,7	165,7±5,3**	143,2±2,8	179,3±6,6

Note: R<0.01*; In the tables above and below, numbers 1 and 2 in the columns are the values obtained at the beginning and end of the experiment.

As can be seen from the table, it can be noted that the number and concentration of erythrocytes in the blood of rabbits of the first, second and third experimental groups decreased by 14.03%, 10.52% and 17.5%, respectively, compared to the control group. This indicates a harmful effect of heavy metal salts (cadmium and lead acetate) on the erythropoietic blood tissues of rabbits.The decrease in red blood cells in the blood of the experimental group rabbits and the hemoglobin they contain indicates a decrease in metabolic processes in their body and a state of hypoxia. So, it is clear that the study of blood test parameters carried out in laboratory conditions is one of the important diagnostic methods in modern conditions. For this reason, we took blood samples from rabbits and analyzed the morphological parameters of the blood.

The total number of leukocytes in the experimental groups compared to the control groups is 15.85%; Although it decreased by 10.24 and 16.9%, the number of eosinophils and lymphocytes in the experimental groups increased slightly. The reason is that these blood elements increase in the body under the influence of allergic reactions, parasites and various infectious processes. This means that the number of eosinophils and lymphocytes increased as a result of toxic-allergic reactions in rabbits under the influence of heavy metals.

As a result of the analysis of the results of our research, it was established that the concentration of erythrocytes and leukocytes in the blood of rabbits of the control and IV experimental groups is high, as well as a high concentration of hemoglobin, which corresponds to metabolism, live weight and a high level of resistance in the body.It is also possible that the main reason for such differences between the compared groups was the pathological state of the organism of rabbits that consumed heavy metal salts separately and together.Because, compared to a healthy body, in a pathological state, all types of circulating leukocytes can be mobilized to

phagocytose foreign organisms that have entered the body and neutralize the toxins and toxic substances released by them in order to ensure the health of the body.The total number of leukocytes in the blood of the control group, which received a farm diet, and the IV experimental group, which received the blue mass of higher algae Eykhniya, which reduces their effect and provides the body with all essential amino acids, remained at the level of the physiological norm.We explain that the total number of leukocytes in the blood of rabbits of these groups increased compared to the indicator at the beginning of the experiment, and we explain that this could have happened due to changes in the age of the rabbits, an increase in body weight and protein content in the consumed diet.

It was found that the number of erythrocytes in the blood of rabbits of the control and IV experimental groups was 18.6% or 1.1 million/mm^3 less than the average number of erythrocytes in the blood of rabbits of the I-II- and III-experimental groups.We believe that the decrease in the number of erythrocytes in the blood of rabbits of the first three experimental groups is the result of a weakening of the activity of the erythropoiesis organs, primarily under the influence of heavy metal salts (see table below).

We observed that the changes observed in the hemoglobin concentration in the blood of the compared groups of rabbits, as well as in the total number of red and white blood cells, were repeated.As we mentioned above, hemoglobin is one of the main components of red blood cells, and it constantly changes in parallel with the level of change in the number of red blood cells. Based on the above, we tried to interpret the following results based on the analysis of the data obtained.It was established that the concentration of hemoglobin in the blood of rabbits of the control and IV experimental groups was higher than the concentration of hemoglobin in the blood of rabbits of the first 3 experimental groups. It was found that the amount of hemoglobin in the blood of the first 3 experimental groups was lower than that of the rabbits of the control and IV experimental groups.

In addition, in all experimental groups, we observed that the total number of red blood cells, white blood cells and hemoglobin concentration increased to a certain extent from the beginning of the experiment to the end of the experiment. At the end of the experiment, we observed that the number of leukocytes in the blood of the experimental rabbits also increased to a certain extent compared to the beginning of the experiment.

It should be noted that all quantitative changes in the composition of the blood of rabbits were ensured by the addition of heavy metal salts to the diet of rabbits and the use of blue mass of eichhornia algae as additional nutrition.Since, as a result of the stimulating effect on the digestive processes of the gastrointestinal tract of rabbits, the use of the blue mass of higher algae Eykhniya led to an improvement in the productive performance of rabbits of the IV experimental group and an increase in the natural endurance of rabbits.

The quantitative indicator of total protein in blood serum is one of the most important indicators characterizing the influence of nutritional conditions on the state of the animal's body. This makes it possible to achieve daily weight gain in live animals in accordance with the level of total protein in the blood serum.

According to V.V. Dolgov and A.V. Selivanova (2015), blood proteins, along with the ability to perform a number of biological functions, also serve as a protective (plastic) material for cells and tissues of the body[3, 13].

In addition, the study of the amount of total and fractional proteins in blood serum is of great diagnostic importance.

According to the data obtained during our experiments, it was observed that the total amount of protein in the blood of experimental rabbits increased in the last part of the experiments compared to the beginning of the experiments. (see table below). It should be noted that the amount of total protein in the blood serum at the beginning of the experiments fluctuates in a small range (66.84-68.20 g/l).

At the end of our experiments, it was established that the amount of total protein in the blood of rabbits of the control and IV experimental groups was higher than the values in the blood of rabbits of the first 3 experimental groups.At the end of the experiment, the amount of total protein in the blood of rabbits of the control group increased by 6.1 g/l (8.1%), and the amount of total protein in the blood of rabbits of experimental group IV increased by 8.0 g/l or 11.7%. There was a decrease in the amount of total protein in the blood of rabbits of the original experimental groups by 8.7% compared to the beginning of the experiment (from 67.8 g/l to 61.9 g/l).In the first 3 experimental groups, consuming heavy metal salts separately and together, there were differences in the level of toxicity of the salts, respectively, and differences between the groups in the direction of decrease or increase.

Table 2 Protein composition of blood serum of experimental rabbits (M±m, n=5)

Indicators		Groups				
		control	Experiment I	Experiment II	Experiment III	Experiment IV

Total protein, g/l	1	68,1±0,4	68,2±0,4	67,3±0,4	67,8±0,8	68,3±0,5
	2	74,2±0,3	60,3±0,4	63,7±0,3*	61,8±0,4*	76,3±0,5*
Albumin, g/l	1	33,4±0,3	32,4±0,7	32,0±0,6	31,9±0,7	32,7±0,7
	2	37,2±0,3	32,4±0,2	32,2±0,1*	31,5±0,5*	38,7±0,3*
Globulins, g/l	1	33,9±0,4	32,5±0,3	32,2±0,2	33,7±0,2	34,9±0,2
	2	36,8±0,2	32,4±0,4	32,7±0,3	32,8±0,2	36,6±0,2
α-globulin, g/l	1	9,7±0,2	9,6±0,2	9,6±0,2	9,6±0,3	9,7±0,3
	2	9.8±0,2	9,5±0,1	9,1±0,3	9,4±0,2	9,8±0,2
β-globulin, g/l	1	10,4±0,9	10,4±0,2	10,1±0,2	10,2±0,2	10,1±0,2
	2	10,2±0,3	10,2±0,2	9,8±0,2	9, 8±0,2	9,8±0,3
γ-globulin, g/l	1	15,1± 0,3	15,3±0,1	15,8±0,2	15,0±0,2	15,2±0,3
	2	16,7±0,8	16,1±0,3	16,3±0,2*	16,4±0,2*	17,6±0,2*

The quantitative dynamics of total protein in the blood of the compared groups corresponded to the description of the growth rate of rabbits in all groups.

Serum albumins are involved in maintaining colloid osmotic pressure and blood volume, and are involved in the transport and storage of various substances. Albumins are distinguished by the fact that they bind cholesterol, fatty acids and bilirubin and serve as carriers of hormones such as thyroxine, cortisol and aldosterone.The amount of albumin in the blood of young growing animals depends on the age and growth rate of animals with a high daily growth rate.Analysis of the data obtained showed that there were practically no differences between the amount of albumin in the blood of rabbits of all experimental groups. These differences ranged from 31.9±0.7 – 33.4±0.3 g/l.At the end of the experiment, the highest value was 33.4±0.3 g/l in rabbits of the control group, followed by rabbits of the IV experimental group. It was noted that the consumption of heavy metal salts in experimental groups I, II and III was at the level of 32.4±0.2, 32.2±0.1 and 31.5±0.5 g/l, which corresponds to acidity indicators.

At the end of the experiments, it was observed that the amount of albumin in the blood of rabbits of the control and IV experimental groups exceeded that of the rabbits of the first 3 experimental groups. The high albumin levels observed in these comparison groups confirmed the physiological patterns occurring in the body, that is, rabbits with high serum albumin levels had a high level of daily gain.

The quantitative level of globulins in blood serum is important in the life of the body. Their main function: - transporting hormones, vitamins and other substances, protecting the body from bacteria, viruses, toxins, foreign proteins, producing antibodies against them, controlling blood clotting, attaching to themselves the transport of sex hormones, drugs, carbohydrates and other substances. At the beginning of the experiment, there were no significant differences in the groups in the amount of globulins in the blood serum of rabbits and it ranged from 32.2±0.2 to 34.9±0.2 g/l.It should also be noted that at the end of the experiments there was a slight decrease in the amount of α- and β-globulins in the blood serum of rabbits of all experimental groups, but no significant differences were found between the groups.

It was noted that the quantitative level of γ-globulins ranged from 15.0±0.2 g/l to 15.8±0.2 g/l at the beginning of the experiment. At the same time, at the end of the experiment, there was a tendency to increase the quantitative level of γ-globulins in the blood serum of rabbits of all compared groups.The amount of γ-globulins in the blood of the control group increased by 1.0 g/l or 6.6%, and in the IV experimental group - by 2.4 g/l or 15.8%. Similar data were observed in rabbits of the other first three experimental groups.

Compared with the indicators at the beginning of the experiment, at the end of the experiment the increase in the quantitative level of γ-globulins in the blood of rabbits of the compared groups was due to the fact that the control group consumed a diet consisting of environmentally friendly feed, and in the IV experimental group a diet containing both heavy metals, high Eykhniya algae were added, when used as food, we explain that the additional feed increased the immune status of rabbits due to its biocorrective properties.

According to the results of our studies on the mineral composition of the blood of rabbits, it was shown that the amount of minerals in the blood serum of experimental rabbits increased at the end of the experiment compared to the beginning of the experiment, but a significant decrease was observed in experimental group II, which consumed cadmium salt with a high level of toxicity (separately), as well as the fact that both groups consumed salt together, was also observed in experimental group III.Cadmium salt, due to its toxicity, could

have a negative effect on mineral metabolism in relation to lead. In the second case, the lead salt may have enhanced the negative effect of cadmium on the metabolism of mineral elements in the blood of rabbits of this group, exhibiting its synergetic properties.owever, in our studies, there were no significant differences in calcium and potassium levels between groups.

Table 3 Mineral composition of rabbit blood, mmol/l

Indicators		Groups				
		Control	Experiment I	Experiment II	Experiment III	Experiment IV
Calcium	1	2,36±0,09	2,24±0,08	2,20±0,04	2,26±0,06	2,38±0,09
	2	2,55±0,05	2,42±0,05	2,40±0,09	2,48±0,05	2,54±0,05
Phosphorus	1	1,00±0,06	0,90±0,04	0,90±0,04	0,92±0,04	1,00±0,0
	2	1,12±0,03**	0,17±0,1	1,11±0,04*	1,11±0,05*	1,12±0,03**
Potassium	1	6,11±0,1	6,17±0,2	6,21±0,1	6,13±0,1	6,31±0,2
	2	6,12±0,1	5,91±0,1	6,12±0,2	5,22±0,1	6,11±0,1
Sodium	1	140,0±1,6	137,2±1,9	139,6±4,4	140,6±3,5	142,0±1,6
	2	144,2±2,1	141,6±1,7	139,8±1,3	139,6±1,8**	146,2±2,1

*- P<0,05; ** - P<0,01;

In the last period of experiments, it was observed that the amount of calcium in the blood of rabbits of groups I, II and III, who consumed heavy metal salts separately and together, decreased compared to the amount contained in the blood of the control and IV experimental groups, but increased from the amount in the beginning of the experiment.In the control group - 0.19 mmol/l or by 8.05%, in group 1 - 0.18 mmol/l (8.03%), 2 - 0.20 mmol/l (9.09%) , 3-0.22 mmol/l (9.7%) and increased by 0.16 mmol/l or 9.73% in the IV experimental group, but these figures turned out to be 0.12 mmol/l or 4.5 % lower than in the blood of rabbits that did not consume salts of heavy metals and consumed high Eykhniya algae in addition to the diet, that is, in the control and IV experimental groups.

A similar pattern was determined by the amount of phosphorus in the blood. The concentration of phosphorus in the blood at the end of the experiment was 0.10 mmol/l or 10.0%, in the control group 1-0.8 mmol/l (8.9%), 2-0.22 mmol/l (24.4 %), 3-0.22 mmol/l (23.9%), and in the 4th experimental group there was an increase of 0.12 mmol/l or 12.0%.

The amount of sodium in the blood serum in the initial part of the experiment was in the range of 137.2-142.00 mmol/l. At the end of the experiments, its concentration was 4.2 mmol/l (3.0%) in the control group, 4.4 mmol/l (3.20%) in the 1st experimental group, a total of 20 mmol/l in the 2nd experimental group and even in the 3rd experimental group there was a decrease of -1.0 mmol/g or (0.71%), and in the 4th experimental group an increase of 4.20 mmol/l (2.96%).Overall, compared with the control and IV experimental groups, it was observed that the amount of sodium in the blood serum was 5.0 mmol/l or 3.0% lower in experimental groups I-, II- and III.It was noted that the concentration of mineral elements in the blood serum of rabbits in the experiment was within the physiological norm. This indicates that the rabbits in the experiment did not feel a lack of mineral elements in the blood, and also indicates that the metabolic processes in the rabbits' bodies were at a normal level.

Based on the data obtained, we can draw the following conclusions.

3. Conclusions

When administered 5 times more than normal, experimental studies have shown that they have a negative effect on food intake, digestibility and productivity. Replacing 10% of the dry matter in the diet of a group of rabbits that consumed salts of both metals with the dry matter of high algae Eykhniya ensured metabolic processes in the body of experimental rabbits at the level of rabbits in the control group, that is, at the standard level.

Based on the goals and objectives set in the experiments, we can draw a general conclusion that without laboratory analysis of the vegetation phases of plants feeding on natural pastures, it is advisable to replace 10% of the dry matter in the daily diet with the dry matter of high algae Eykhniya.

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