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ENVIRONMENTAL RATIONALE FOR IMPROVING THE MORPHOLOGICAL AND BIOCHEMICAL PARAMETERS OF BLOOD OF YOUNG CATTLE DUE TO DETOXIFICATION OF HEAVY METALS

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Abstract:

Heavy metals have high biological activity, tend to accumulate in separate links of the biological cycle and to enter the organism of animals in trophic chains, accumulating and negatively affecting their vital activity. The aim of the research was to study the effect of various doses of the adsorbent oftetacinum calcium on the morphological and biochemical values of the blood of the Hereford bull calves fed on rations with a higher content of heavy metals.Methods of research.Scientific and economic experiment was conducted on the Hereford bulls, for which four groups of 10 heads each were formed using the pair-analogue method. In the course of the studies, the bulls of 1 (control) group got the basal diet (BD), and the ration of animals of 2, 3 and 4 (trial) groups were supplemented withtetacinum calcium at the rate of 0.5; 1.0 and 1.5 g / 100 kg of live weight. The results were processed statistically by the Student's methodology using the software package "Microsoft Excel".Results of the research. In the conditions of excessive content of heavy metals in feeds, feeder bulls of the3experimental groupwhich received the preparation of tetacinumcalciumat the rate of 1.0 g / 100 kg of live weight werecharacterized by the best level of intermediate metabolism. In the blood of the bulls of the 3 test group, the highest content of erythrocytes and hemoglobin was found, which exceeded the control by these parameters by 0.45 × 10^{12} / l and 0.98 g / l, respectively. The highest concentration of cadmium - 0.129 mg / kg, lead - 1.68 mg / kg and zinc - 30.75 mg / kg, was observed at the age of 18 months in the serum of young animals of group 1, and the lowest in animals of group 3, yielding to them in saturation of these toxicants, respectively, by 26.8, 30.6 and 48.8%. Although the concentration of zinc, lead and cadmium in the blood of the youngsters of the 3 test group exceeded the maximum concentration limits, their level was approaching the lowest point of this level.

Key words: *feeder bulls, heavy metals, adsorbent, detoxification, morphological and biochemical values of blood.*

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INTRODUCTION:

Relevance of the topic. The work of a number of scientists has proved that the new technologies for growing cattle, the specificity of the organism's reaction, depending on the breed characteristics, on the effect of environmental factors, including the forage and ecological characteristics of locally produced feeds, influence the development and ratio of plastic material in animals, on the yield and quality of meat [1, 2].

The Republic of North Ossetia-Alania is referred to the most polluted with heavy metals areas in the Russian Federation due to the high concentration of industrial facilities in Vladikavkaz. Heavy metals have a high biological activity, tend to accumulate in separate links of the biological cycle and through the trophic chains enter the animal organisms, accumulating and negatively affecting their vital functions. The toxic effect of heavy metals is explained by the fact that they form insoluble compounds with proteins, changing properties and inactivating a number of vital enzymes [3, 4].

To detoxify heavy metals, as divalent elements, which have high activity in various biochemical reactions, preparations that have adsorption properties are widely used in feeding agricultural animals. Adsorbents, linking these elements in the gastrointestinal tract, remove them from the body, providing an increase in productivity and improve the physiological and biochemical status of the animal [5, 6, 7].

The aim of the research was to study the effect of various doses of the tetacinum calcium adsorbent on the morphological and biochemical values of the blood of the Hereford bull calves fed on rations with a higher content of heavy metals.

METHODS OF RESEARCH:

To achieve this goal, in the conditions of the "Rubin" agricultural and production cooperative in the Prigorodny District of the Republic of North Ossetia-Alania, a scientific and economic experiment was conducted on the Hereford bulls, for which four groups of 10 heads each were formed using the pair-analogue method.

In the course of the studies performed according to the scheme presented in Table 1, bulls of the 1 (control) group received basal diet (BD), and to the BD of animals of the 2, 3 and 4 (experimental) groups, tetacinum calcium was added at the rate of 0.5; 1.0 and 1.5 g / 100 kg of live weight.

Table 1 - Scheme of scientific and economic experiment n = 10

Group	Basal diet (BD) with excessive content of Zn,Pb и Cd	Doses of addition of tetacinum calcium preparation g/100 kg live weight
1- control	BD	-
2 -trial	BD	0.5
3 -trial	BD	1.0
4 -trial	BD	1.5

At the age of 6 and 18 months,in the morning before feeding, from the jugular vein of the experimental bulls blood was taken, in the samples of which, according to conventional methods, morphological and biochemical values were determined.

The results of the studies were processed by Student'smethod of variation statistics using the software package "Microsoft Excel".

Results of the research and their discussion. Duringthe scientific and economic experiment the average samples of the entire range of feeds that were available on the farm were selected on a monthly basis. In the feeds used in the rations of experimental animals, the content of heavy metals was studied.

From the entire list of feeds, the green mass of grass oats + vetch, silage corn + sorghum, hay of Sudan grass and grass and grain mixturewerehome-produced feeds.

The basis of concentrated feeds of home production was grass and grain mixture.
As a result of chemical studies,an excessive amount of zinc, lead and cadmium was found in all feeds of home-produced feeds.

Proceeding from the foregoing, we studied the dynamics of the morphological parameters of animal blood in the presence of excess intake of heavy metals with feeds (Table 2).

Table 2 - Dynamics of morphological parameters of blood in experimental animals n = 3

Items	Groups			
	1	2	3	4
At the age of 6 months				
Hemoglobin, g / l	91.89±5.73	92.19±4.75	93.08±4.19	92.23±6.08
Erythrocytes, 10^{12}/l	6.57±0.30	6.75±0.32	6.81±0.18	6.79±0.20
Leukocytes, 10^{9}/l	9.07±0.42	9.19±0.55	9.30±0,12	9.24±0.22
At the age of 18 months				
Hemoglobin,g/l	99.31±4.54	99.67±4.21	100.29±5.47	99.82±5.14
Erythrocytes, 10^{12}/l	6.89±0.28	7.08±0.41	7.34±0.31	7.10±0.35
Leucocytes, 10^{9}/l	9.59±0.38	9.74±0.33	10.11±0.38	9.83±0.40

In the course of the studies, it was found that the blood of the bulls of the 3rd test group had the highest erythrocyte and hemoglobin content, which exceeded the control by these parameters by 0.45 × 10^{12} / l (P> 0.05) and - 0.98 g, respectively.

Leukocytes in the body of animals perform protective functions. The number of white blood cells varies within rather wide limits (it is less constant than in erythrocytes) and depends on the physiological state of the organism. During the experiment, it was found that there were practically no differences in the number of leukocytes in the blood of the experimental animals.

Proteins of blood serum perform a protective function, transport fats, vitamins and metabolic products. Therefore, to study the effect of breed characteristics on protein metabolism in the body of bulls at the age of 18 months, the level of total protein and its fractions in serum was determined.

It was found that the concentration of total protein in the blood serum had a direct proportional relationship with the level of utilization of feed nitrogen and the growth energy of test bulls. Therefore, the lowest level of serum proteins was in the blood of animals of the 1group - 65.3 g/l, and the highest in the blood of the young animals of the 3 group - 69.0 g/l, which is 3.7 g/l more than in the control. This indicates a better protein metabolism in the animals of the 3 experimental group relative to young animals of other breeds.

In the course of the scientific and economic experiment, the content of albumins in the test animals of the 3 group was 0.94% (P <0.05) higher than inthe animals of the same age in the 1 experimental group.With excess content of heavy metals in feeds in animals ofbeef breeds, the protective functions of the body were higher. Thus, relative to peers of 1 experimental group, an increase in the amount of γ-globulins in serum by 2.3% was observed in animals of the 3 experimental group.

The most important qualitative characteristic of the influence of heavy metals on the intermediary metabolism is the biochemical composition of the

blood of the experimental animals (Table 3).

Table 3 - Dynamics of biochemical parameters of blood serum in experimental bulls n = 3

Item	Group			
	I	II	III	IV
At the age of 6 month				
Sugar, mmol/l	2.41±0.02	2.40±0.03	2.41±0.03	2.40±0.04
Totallipids, mmol/l	1.80±0.02	2.20±0.04	2.28±0.01	2.22±0.03
Calcium,mmol/l	2.48±0.12	2.49±0.18	2.48±0.15	2.49±0.13
Phosphorus,mmol/l	1.54±0.12	1.57±0.10	1.57±0.12	1.56±0.10
At the age of 18 month				
Sugar, mmol/l	3.61±0.02	3.68±0.04	3.91±0.05	3.83±0.03
Totallipids, mmol/l	4.49±0.11	4.55±0.08	4.72±0.09	4.63±0.05
Calcium,mmol/l	2.84±0.18	3.11±0.32	3.30±0.11	3.29 ±0.22
Phosphoru, mmol/l	1.88±0.09	2.06±0.03	2.25±0.08	2.17± 0.06

According to the results of the experiment, an increase in the sugar concentration was observed in the blood of bulls of experimental groups at the age of 18 months. At the same time, young animals of the 3 experimental group showed the highest sugar level in the blood – 3.91 mmol/l, which is 0.30 mmol/l more than in the control group.

The content of total lipids in bull-calves at the age of 6 months in the blood serum is much lower than at the age of 18 months, which is determined, in our opinion, by the period of puberty. By the concentration of total lipids in the blood serum, bulls of the 3rd and 4th groups significantly (P <0.05) exceeded the animals of the 2nd group by 0.17 mmol/l and 0.08 mmol/l, respectively, and animals of the 1stest group - by 0.23 and 0.14 mmol/l. This indicates a better metabolism of lipids in animals of the 3rd experimental group.

It is known that the ratio of calcium and phosphorus in the blood of animals depends not only on their amount, but also on the ratio of the elements in the fed diet.

Of the mineral elements, calcium and phosphorus are found in the body of animals in the largest quantities. The content of total calcium and inorganic phosphorus corresponded to the physiological norm. Moreover, in comparison with the bulls of group 1, in animals of group 3, the content of these macronutrients in serum was 0.46 (P <0.05) and 0.37 mmol/l (P <0.05), respectively.

When assessing metabolism in conditions of excessive content of heavy metals in the feeds, it was important to evaluate the ecological characteristics of their liquid internal environment. Therefore, during the studies, we also studied the content of zinc, lead and cadmium ions in the blood serum of fattened young cattle of the Hereford breed (Table 4).

Table 4 - The content of heavy metals in the blood of experimental bulls n = 3

Item	Group			
	1	2	3	4
At the age of 6 month				
Zinc (MPC=22), mcg / kg	27.90±0.56	27.88±0.42	27.75±0.24	27.69±0.37
Cadmium (MPC=0.05), мкг/кг	0.060±0.003	0.062±0.001	0.058±0.002	0.063±0.001
Lead (MPC=1.2),mcg / kg	1.25±0.04	1.26±0.05	1.23±0.05	1.24±0.04
At the age of 18 month				
Zinc (MPC=22), mcg / kg	30.75±0.19	27.21±0.43	21.34±0.47	24.18±0.27
Cadmium (MPC=0.05),mcg / kg	0.129±0.003	0.093±0.002	0.066±0.001	0.087±0.002
Lead (MPC=1.2), mcg/kg	1.68±0.03	1.49±0.06	1.23±0.04	1.39±0.05

Содержание тяжелых металлов в крови животных всех испытуемых группоказалось выше предельно допустимого уровня (ПДК). Однако в возрасте 6 месяцев их концентрация в сыворотке крови была примерно равномерной.

The content of heavy metals in the blood of animals of all experimental groups was above the maximum permissible level (MPC). However, at the age of 6

months, their concentration in blood serum was approximately uniform.

The highest concentration of cadmium 0.129 mcg/kg, lead 1.68 mcg/kg and zinc 30.75 mcg/kg was observed at 18 months of age in the blood serum of young animals of group 1, and the lowest in animals of group 3, significantly (P <0.05) being lower by the saturation of blood with these toxicants, respectively, by 26.8, 30.6 and 48.8%. Moreover, it should be noted that although the concentration of zinc, lead and cadmium in the blood serum of young animals of test group 3 exceeded the MPC, their level was approaching the lowest point of the maximum permissible level.

CONCLUSION:

In the conditions of excessive content of heavy metals in feeds, fattening young animals ofthe 3 experimental groupwhich received the preparation of tetacinumcalcium at the rate of 1.0 g / 100 kg of live weight were characterized by the best level of intermediate metabolism.

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