The effect of the "Biological inactivator of toxic gases" on the formation of ammonia and homeostasis indicators in the cold method of calf rearing

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Abstract. Respiratory diseases of young animals cause significant economic damage. One of the factors of their occurrence is ammonia ("volatile alkali"), which is formed from urine and feces in the litter. The purpose of the research was to study the effect of the sanitary and hygienic agent "Biological inactivator of toxic gases" on the formation of ammonia and some indicators of homeostasis in the cold method of calf rearing. In the course of the study, it was found that the use of an inactivator in animal litter allows for a significant increase in the "gas" purity of the air space, reducing the amount of "volatile alkali" in the air inhaled by calves – up to 107.3% by the 60th day of the experiment. At the same time, the respiratory function of the animal body is activated, which is manifested in an increase in the number of red blood cells by 1.5 times and hemoglobin by 1.2 times, hidden acidosis in calves decreases; intensity of the leukocyte reaction decreases by 2.5 times from the initial values, erythrocyte sedimentation rate - by 3.8 times; degree of blood thickening in animals decreases, as evidenced by the positive dynamics of the proteinogram, namely, a decrease in total protein in the blood serum.

1 Introduction

Improving the efficiency of agricultural production is difficult to implement if there is a loss of livestock, breeding defects, abortions, empty and decrease in livestock production in general. In turn, the main role in reducing the quality of meat and livestock products is played by emerging and constantly complicated diseases of young animals, especially respiratory diseases [1-5].

In the etiology of respiratory diseases, gross violations of zoohygienic and sanitary conditions of keeping are of great importance: crowding of animals, hypothermia and overheating of the body, high humidity and microbial contamination of the room and the gas-air environment, drafts, increased content of ammonia, carbon dioxide, hydrogen

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sulfide. It is also known that the introduction of virus carriers into a susceptible animal herd is the best way to introduce the pathogen of infection [6-10].

Many scientists reasonably believe that violations of microclimatic parameters are the basis for a reduced adaptation of the animal body to environmental conditions, to aggressive stress factors affecting the immune system of animals. This leads to a violation of the barrier function of the lungs, rapid reproduction of microflora in the mucous membrane of the upper and lower respiratory tract, the development of exudative processes and prominent leukocytic reaction [11-16].

As a microflora that complicates the development of respiratory diseases, pneumococci, streptococci, staphylococci, diplococci, salmonellas, pasteurellas, proteus, Escherichia coli are most often isolated. In recent years, many researchers have noted an increase in the incidence of pneumonia caused by mycoplasmas, chlamydia, and fungi. But sometimes the autochthonous microflora becomes a participant in the pathological process in the respiratory tract of young animals [12; 17;18].

Among young farm animals, as a rule, respiratory diseases are registered permanently and have a pronounced seasonality. At the same time, diseases acquire a mass character in the autumn-winter period [8; 9].

Industrial technology of cold keeping of calves provides many advantages, primarily of an economic and organizational nature. Nevertheless, the release of ammonia, which is formed from feces and urine in animal litter, can significantly damage the attractiveness of this method for practical animal husbandry due to an increase in cases of animal respiratory diseases [1; 2].

It is known that volatile alkali, due to its properties, has a high toxicity. That is why, it belongs to the most aggressive abiogenic factors that complicate respiratory diseases. "Sticking" to the mucous membrane of the respiratory tract, ammonia causes coughing, adsorbing on the conjunctiva of the eyes, causes watery eyes, anxiety, then replaced by lethargy and depression, animals lose interest in food. Also it is actively absorbed into the blood, ammonia forms a harmful compound with hemoglobin - alkaline haematin, which quietly, but quickly causes hypochromic anemia. All this together negatively affects the natural resistance of the calf body, provoking the chronization of the pathological process, increasing the mortality rate among the livestock [6; 7].

To correct the parameters of the microclimate in livestock premises, a large number of drugs of various mechanisms of action have been proposed, the problem remains unresolved and the search for the most effective and optimal ways to reduce the amount of toxic gases, and especially ammonia in the inhaled air of livestock premises, is still relevant [19-23].

The purpose of the research was to study the effect of the sanitary and hygienic agent "Biological inactivator of toxic gases" on the formation of ammonia and some indicators of homeostasis in the cold method of calf rearing.

2 Materials and methods

The developed sanitary and hygienic product "Biological inactivator of toxic gases in deep litter" is a milky powder, homogeneous, odorless, with a humidity of 10-15%, which includes spores of the mold fungus of the genus Trichoderma, yeast of the species Saccharomyces cerevisae, probiotic culture of Bac.subtilus and lactic bacteria of genus Lactobacterium, with a content of living microorganisms of at least 10^5 CFU in 1 gram of the product, and as auxiliary substances - dry sorbent.

For the experiment, the calves of the Holstein breed were selected at the age of 15.0±5.0 days, of which two groups were formed according to the principle of pairs-analogues of 15 heads each. In the experimental group of calves, the sanitary and hygienic agent "Biological

inactivator of toxic gases in deep litter" was used at a dose of 25 grams per 1 m^2 of litter material to reduce the influence of abiogenic factors. The suspension of the sanitary and hygienic product was prepared by dilution in 1 liter of non-chlorinated water at a temperature not higher than +50C°. The surface treatment of the litter material was carried out by a single spray of the suspension.

The concentration of ammonia in the inhaled air was measured on the 1st, 30th and 60th day of the experiment using a multi-channel gas analyzer Kometa-M with forced sampling. In the blood of calves on the 1st and 60th day of the experiment, the number of red blood cells and white blood cells was determined by counting blood cells in the Goryaev chamber. The hemoglobin level was determined by the hemoglobin cyanide method. The erythrocyte sedimentation rate was determined by the Panchenkov method. The amount of total protein in the blood serum was determined by colorimetric method using a set of reagents "Clinitest-OB". The method is based on the ability of proteins with copper ions in an alkaline medium to form complex compounds of purple color. The color intensity is proportional to the protein concentration in the test sample. The alkaline reserve of blood serum was determined according to I.P. Kondrakhin.

Statistical data processing was carried out using the table processor "MicrosoftExcel – 2003" and the package of the application program "Biometrics".

3 Results and discussion

The results of the experiment are shown in Figure 1

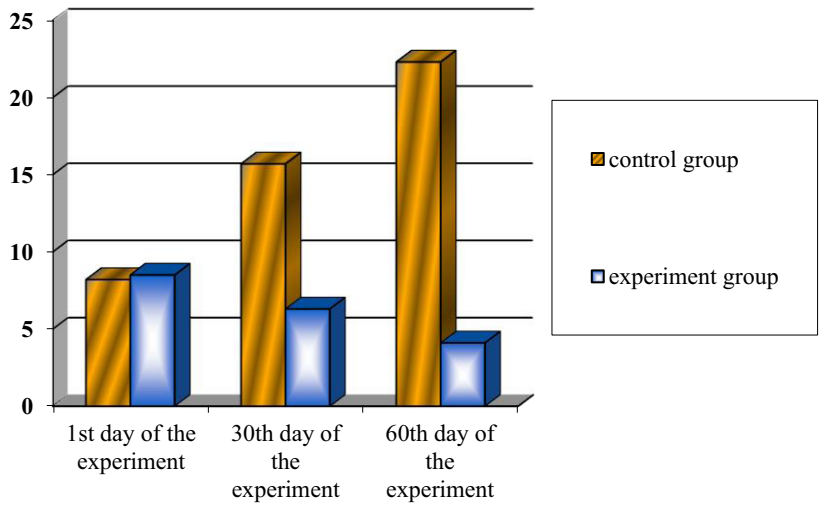

Fig. 1. Concentration of ammonia in the inhaled air, mg/l.

As can be seen from the figure, after a month of the experiment in the air at the level of 15 cm from the litter, there was an increase in the concentration of volatile alkali in the control group by 79.2% relative to the first day of the study, and after two months of the experiment, there was already an increase in the concentration of this toxic gas by more than 2.5 times relative to the first day of the study, which indicates a tendency to increase the overall "pollution" of the air environment of the premises for calves in the control group.

In the experimental group of calves, there was a significant decrease in the amount of volatile alkali in a month after the introduction of the sanitary and hygienic agent by 30.7% relative to the first day of research, and on the 60th day there was a decrease in the ammonia concentration by 107.3% relative to the first day of research.

The results of changes in the respiratory and protective function of the blood are shown in Table 1.

Table 1. Characteristics of indicators of respiratory and protective function of calf blood

Indicator	Norm	day 1		day 60	
		control	experiment	control	experiment
White blood cells, $x10^9$/l	4.5-12.0	17.4±0.2	18.1±0.2	14.13±0.9	7.25±0.7*
Red blood cells, $x10^{12}$/l	5.0-7.5	5.12±0.14	5.89±0.23	7.02±0.64	8.7±0.11*
Hemoglobin, g/l	109-113	89.4±0.1	87.8±0.3	101.3±0.2	105.3±0.6
ESR, mm/h	0.5-1.5	5.4±0.4	5.7±0.9	2.3±0.14	1.5±0.21*

* - $p<0.05$

Analysis of the results of the study of the respiratory function indicators of calf blood showed that in the blood of the experimental calves, compared with the control group, the indicators were restored to the reference values, with the exception of the number of red blood cells. Thus, the number of white blood cells decreased by more than 2.5 times compared to the initial value, and the erythrocyte sedimentation rate decreased by 3.8 times. The number of red blood cells increased by 1.5 times compared to the initial observations, the amount of hemoglobin increased by 1.2 times.

Changes in the total protein and reserve alkalinity of blood serum are shown in Table 2.

Table 2. Total protein content and reserve alkalinity of calf blood

Indicator	Norm	Animal groups			
		day 1		day 60	
		Control	Experiment	Control	Experiment
Total protein, g/l	61-63	69.1±0.2	71.5±0.1	61.1±0.15	62.3±0.1*
Alkaline reserve, Tot.CO_2	46-66	49.21±1.02	45.7±0.6	44.3±0.9	51.8±0.8*

* - $p<0.05$

The data of the tables indicate a decrease in the concentration of total protein in the blood serum by the 60th day of the experiment in both the control and experimental groups. It decreased by 11.6% in the control group, in the experimental group - by 12.9%. The alkaline reserve of blood in the animals of the control group decreased by 10% by the end of the experiment, and in the experimental group it increased by 13.3%.

4 Conclusions

Industrial technology of cold keeping of calves provides many advantages, primarily of an economic and organizational nature. Nevertheless, the release of volatile alkali, which is released in excess during the defecation of animals and the subsequent decomposition of feces, causes significant damage in general for the application of the "cold" method of calf rearing. This damage consists precisely of the spread amplitude of respiratory pathologies in farms, complications of an existing chronic disease in animal, as well as a stable percentage of mortality.

The conducted studies have established that the use of the "Biological inactivator of toxic gases" in the litter for animals allows to achieve a significant reduction in the amount of volatile alkali in the air inhaled by calves of the over-litter layer. At the same time, the respiratory function of the animal body is activated, which is manifested in the normalization of the body homeostasis, improvement of erythropoiesis, balance of the proteinogram, reduction of erythrocyte sedimentation rate, leveling of latent acidosis by increasing the level of the alkaline reserve of the blood, simplification of the leukocyte profile in relation to a decrease in the number of basic white blood cells.

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