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Modern View on the Use of Natural Bentonites in the Prevention of Gastroenteric Pathology of Piglets.

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ABSTRACT

The article presents results of the use of natural aluminum silicate minerals – bentonites for the prevention of diarrheal diseases in piglets-weaners associated with violations of feeding and housing conditions, as well as for the increasing their safety and productivity. It was determined that the addition of bentonites into feed of pigs had a significant impact on the morbidity and animal safety, as well as on the dynamics of changes in hematological and biochemical blood parameters that was manifested by an increase of the red blood cell level by 19.4%, an increase of hemoglobin by 22.8% and an increase of total protein by 21.4%. Their use made it possible to weaken the inflammatory response in the organism of animals, reducing the level of γ-globulins of experimental animals by 16.9%. After the use of natural minerals the effectiveness of the prevention of gastroenteritis increased by 20.0%.

Keywords: gastrointestinal diseases, piglets, prevention

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INTRODUCTION

One of the urgent veterinary problems that reduce the profitability of animal husbandry remains the gastrointestinal diseases of young farm animals – calves and piglets, which, as a rule, are acute and difficult, and often if the sick animal does not receive medical treatment they end in death.

The main reasons for their mass occurrence are the violations of the technology of feeding and keeping animals, the inferiority of rations, poor quality of feed, stress effects and others. These factors reduce the resistance of the body of the young animals and, thereby, create conditions for reproduction and enhance of vital activity in the digestive tract of pathogenic and opportunistic microflora.

The most commonly gastroenteritis of piglets are registered in the weaning period. This occurs because of the violation of the feeding conditions of the lactating sows, the transfer of piglets from the milk ration to the concentrated type of feeding and the stress associated with weaning of piglets from sows. At the same time the mucous membranes of the stomach and intestines are influenced by toxic products, formed as a result of the disturbances of the digestion processes, changes in the composition of the intestinal microflora or trapped with food. An inflammatory reaction occurs: the more intense it is, the worse the condition of the animal is. Poisons from the intestine enter the blood, then occurs general intoxication of the body and appear the signs of a general metabolic disorder (emaciation, changes in skin, signs of hypovitaminosis, appetite distortion, etc.), disorders of the cardiovascular system and symptoms of oxygen starvation of tissues [6].

Improving the technology of veterinary and preventive measures aimed at reducing the morbidity and mortality of young animals from gastroenteritis requires finding new effective means in their prevention and treatment.

Among the symptomatic remedies traditionally used in diarrhea sorbents are widely used. They include natural aluminosilicate minerals – bentonites and zeolites, that due to their physicochemical properties and structure of the crystal lattice are able to bind and to remove toxic substances from the body effectively [1,2]. Mechanism of the adsorbing action of bentonites lay in the fact that water, metabolites and toxic substances diffuse to the outer surface of the sorbent particles, using internal diffusion they enter the mesopores through the macropores, in which the adsorption process takes place by volumetric filling of mesopores [4,7].

The high absorption capacity of aluminosilicate minerals has a beneficial effect on the processes of digestion and absorption as well as on the normalization of intestinal peristalsis. The positive effect of bentonites occurs also due to the maintenance of optimal acidity and pH value in the digestive tract. Stabilizing organic compounds, bentonites slow down the speed of passage of food through the gastrointestinal tract, increasing the digestibility and biological value of incoming food [3]. And the presence of a number of macro-and microelements, which are biologically active substances, contribute to the immobilization of enzyme systems and activation of metabolic processes in a living organism [5].

METHODOLOGY OF RESEARCH

The prophylactic efficiency of bentonites in diarrheal diseases was studied on piglets-weaners of 30-35 days old in an infectious disease-free household. As the object of study were used alkaline-earth bentonite clays from the Kantemirovsky field in the Voronezh region, which are homogeneous powder from gray to light yellow color, odorless and tasteless.

For the first group of piglets (40 animals) 10 days before weaning we mixed bentonite daily in the wet feed in the amount of 1.5%, and then for 10 days after weaning – in the amount of 3%. The second group of pigs (40 animals) served as biological control and was on the main economic ration.

During the entire period of using of the preparation and 7 days later the animals were monitored, taking into account their clinical condition, the occurrence and course of the disease and safety.

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RESULTS

The results of the experiment determined a pronounced prophylactic efficiency of bentonites in gastrointestinal diseases (Table 1).

Table 1: The results of the preventive action of bentonite in gastroenteritis of pigs (M±m; n=40)

Indicators	Group	
	experimental	control
Number of piglets in the group, animals	40	40
Average weight of one piglet at the beginning of the experiment, kg	7.36±0.51	7.42±0.63
Got sick, animals	5	13
Died, animals	–	3
Morbidity, %	12.5	32.5
Mortality, %	–	7.5
Prophylactic effect, %	87.5	67.5
Average weight of one piglet at the end of the experiment, kg	12.82±1.32*	11.20±1.89
Average daily weight gain during the experiment, kg	0.263	0.189
Average daily weight gain to control, %	39.1	–

Note: * – degree of reliability P≤0.05

Thus, the mild gastrointestinal disorder was observed in two experimental animals on the 4th day after weaning and lasted until the 6th day with no signs of growth and further coverage of the experimental piglets. Clinically, this was manifested by the rejection of food, the weak reaction to external irritations, the rapid breathing and the increased thirst. On the first day of the disease vomiting movements were recorded in the piglets, and then they subsequently stopped. Peristalsis of the small and large intestines was strengthened, that was manifested by the increase frequency of defecation acts (diarrhea). A large amount of undigested food and mucus was found in feces. On the 7th day these signs disappeared and there was no recurrence of the disease during the entire period of bentonite feeding. There was no death of the piglets in the experimental group.

In the control group at 3–6 days after weaning 13 animals showed clinical signs of gastroenteritis with their subsequent increase (lack of appetite, depression, frequent acts of defecation and liquid feces with a fetid odor). Body temperature was increased by 1.0-1.3°C, rapid breathing and heartbeat were noted. On the 4th day of disease one piglet died, on the 5th day died two more.

Bentonites along with the prophylactic effect also had the growth-promoting effect, contributing to better absorption of feed nutrients. So, during the experiment, the average daily gain in the experimental group was 263 g versus 189 g in the control group, which was 39.1% to the control, respectively.

Studies of blood of sick piglets in the experimental and control groups showed that bentonite has a positive effect on erythro-and hematopoiesis (Table 2). In blood at the end of the experiment an increase in the level of red blood cells was observed in the experimental and control animals. However, in the experimental group this increase was insignificant and did not go beyond the upper limit of the physiological norm, whereas in the control group there was a significant increase in the number of erythrocytes (at P≤0.05) because of dehydration of the piglets with diarrhea. In the experimental group, bentonite contributed to the retention of fluid in the digestive tract, the weakening of diarrheal syndrome and the decrease in the relative viscosity of blood.

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Table 2: Influence of bentonite on hematological and biochemical blood parameters of piglets in the prevention of gastroenteritis (M±m; n=20)

Indicators	Background	Group	
		experimental	control
RBC, 10^{12}/L	6.2±1.24	7.4±0.86	8.3±0.44*
WBC, 10^9/L	14.4±2.5	16.3±1.92	17.5±2.23
HGB, g/L	84.0±4.2	95.6±5.47	73.8±4.18*
MCH, picograms/cell	0.88	0.81	0.57
HCT, %	42.2±3.1	44.8±4.35	52.6±5.11
ESR, mm/h	28.5±1.9	39.4±2.6	47.1±2.95
Leykoformula,% young neutrophils	0	0	2.6
stab neutrophils	3.5±0.3	2.8±0.2	6.1±0.24
segmented neutrophils	42.0±3.6	39.6±4.1	52.0±4.8
basophils	0	0	0
eosinophils	1.3±0.01	2±0.1	0
lymphocytes	44.4±5.4	51.5±6.2	33.4±5.8
monocytes	8.81±1.0	4.0±1.3	5.9±2.4
Glucose, mmol /L	3.23±0.2	2.76±0.92	1.89±0.09
Total protein, g/L	62.2±5.42	56.4±4.81	43.1±4.9
Protein fractions,% albumins	36.2±4.9	31.4±2.7	26.7±1.8
α-globulins	13.8±2.5	14.3±0.9	13.2±1.1
β-globulins	16.5±3.4	18.1±2.6	16.5±1.6
γ-globulins	33.5±4.7	36.2±5.1	43.6±3.3
Urea, mmol /L	4.67±1.02	3.24±0.96	5.93±1.22

Note: * – degree of reliability $P \leq 0.05$

The hemoglobin level in the control group was significantly lower by 22.8% than its concentration in the blood of experimental piglets and in combination with a low color index, characterized the state of hypochromia resulting from a decrease in red blood cell volume and a decrease in hemoglobin saturation of normal red blood cells.

Acceleration of ESR in both groups was the result of an increase in the amount of globulin fractions in blood. But in animals of the experimental group these signs of the pathological state of red and white blood were not as marked as in the control group, as a result of the normalizing effect of bentonite on the functions of hemo- and erythropoiesis.

The total protein concentration in the blood serum was below the determined norm, both in experimental and control piglets. However, in the experimental group during the experiment the decrease in protein concentration was minimal and amounted to 9.3% of the background values, whereas in the control animals this index decreased by 30.7% (the difference between the groups was 21.4%).

The level of albumin fractions showed a decrease in the amount of albumin by 13.3% and 26.2% compared with background indicators and by 21.5% and 33.3% relative to the values of the physiological norm. In addition, an increase in the level of γ-globulins was recorded in animal proteinograms of both experimental and control groups, which may indicate an inflammatory process with enhanced antibody production (38.2 ± 5.1% and 43.6 ± 3.3% or 131.7% and 150.3% respectively). However, the use of bentonites in piglets allowed to weaken the inflammatory reaction in the organism of animals, the difference between the immunoglobulins of the experimental and control piglets was 18.6% in favor of the experimental piglets.

The decrease in glucose in both groups was reliable, but in the experimental group its concentration decreased slightly, in the control group this indicator dropped beyond the lower limit of the normal

physiological level by 24.4%. This may be because of the inflammatory process in the gastrointestinal tract, which decreases the absorption of carbohydrates.

The urea content in the blood of animals treated with bentonites was significantly lower than in analogues from the control group. Its increased content in blood of control piglets along with the low level of protein may indicate the growing renal failure, whereas, in piglets of the experimental group changes in these indexes indicate the normalization of metabolic processes.

CONCLUSION

Thus, the use of bentonites has a pronounced positive effect on the morphofunctional structures of the body of piglets. The result of this is the activation of systems for regulating homeostasis and protective-adaptation mechanisms, manifested in the stimulation of erythro-and hematopoiesis and the normalization of metabolic processes. The use of natural aluminosilicates prevents the occurrence of gastrointestinal diseases of young pigs associated with violations of feeding and housing conditions.

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