

Enterosorbent based on montmorillonite as a promising tool in the treatment and prevention of intestinal disorders in pigs

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Abstract. The article discusses the treatment and prevention of feed toxicosis of pigs. A composition based on montmorillonite-containing minerals is considered as a promising enterosorbent in combination with the drug vievitin in the treatment of pig dysentery. Studies have shown that the complex use of vievitin with a sorbent by giving individually in 100 ml of drinking water at doses of 5.6 (second group) and 11.1 (third group) mg/kg body weight for vievitin and 400 mg/kg body weight bodies for the sorbent provided a high therapeutic effect in the treatment of piglets suffering from dysentery. Recovery, respectively, was 90.8 and 93.8%.

1 Introduction

Intestinal disorders in the family of non-ruminant artiodactyls of farm animals have different etiologies, are widespread, and significantly affect the productivity and health of the entire livestock population. Moreover, large and medium-sized pig farms are serious sources of microbiological pollution of the environment, especially when outbreaks of diseases of the gastrointestinal tract occur in livestock farms. The cause of this problem can be not only dysentery of various pathogenesis, but also including feed toxicosis. [1]

A characteristic feature of feed toxicosis that distinguishes them from infectious diseases is the absence of contagiousness, while etiological factors may include the presence in the feed of microorganisms, toxic waste products of fungi - mycotoxins, heavy metal ions, radionuclides, half-life products of organic phenols and other substances. [2] The severity and clinical manifestation of feed toxicosis depends on the number of non-benign diet ingredients, the duration of their use and the immuno-biological state of the animal organism.

For the treatment and correction of gastrointestinal disorders developing in acute diarrheal infectious diseases, eubiotics, enzyme preparations, antispasmodics and a number of other groups of drugs are used in clinical practice, among which in recent years they have given increasing importance to enterosorbents. [3] Enterosorption is included in the group of efferent therapy (lat. Efferens - display), i.e. therapeutic measures, the purpose of which is to stop the action of toxins of various origins and their elimination from the body. Enterosorption in intestinal infectious diseases is a pathogenetically substantiated method of therapy. [4]

In recent years, there have been reports of the use of montmorillonite-containing clays for serious intoxication of the body, both humans and animals. No worse than modern antibiotics, they cope with pathogenic bacteria. But, unlike medicines, clay itself remains chemically inert, and, therefore, absolutely harmless to the body, clay inactivates only harmful microbes and toxins, renewing cells, and promotes the formation of immunity. The therapeutic effect of clay natural materials such as montmorillonite (smectite) is explained by their sorption-adhesive and ion-selective properties, as well as by the saturation of various mineral elements, some of which are in a bioavailable form. Once inside the body, natural sorbents, by normalizing the content of micro and macro elements, are able to stimulate the processes of auto-regulation of the metabolism of substances. It has been established that when they are used, intestinal function is normalized, reproductive ability and resistance of the body are increased, live weight gain is increased, and qualitative indicators of production: meat, milk, eggs, are improved. With the help of natural sorbents based on montmorillonite, gastrointestinal diseases can be prevented. [5,6] The authors proved that bentonite clays are effective in the prevention and treatment of diarrhea in piglets, especially in the post-weaning period. [7]

Thus, the aim of this work was to improve the method for the treatment and prevention of intestinal disorders of pigs by oral administration of a composite preparation consisting of: vievitin and enterosorbent.

2 Experimental

Materials and research methods. The therapeutic efficacy of the oral administration of a composite preparation

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(vievitin with enterosorbent) was determined in scientific and economic experiments on 3-4 months of age of pigs with dysentery, of which 5 groups were formed.

The diagnosis of dysentery was established on the basis of epizootological data, clinical signs of the disease, pathological changes and the results of bacteriological studies. Sick piglets were kept in sanitary machines.

During therapeutic and prophylactic treatments of pigs with a composite preparation (Patent for invention No. 2589678), the machines containing patients and pigs suspected of being infected with dysentery were regularly thoroughly cleaned, and the animal excrement areas were disinfected with stalosan - P₂ based on 50.0 g/m². At the same time, the passageways and corridors of the manure collection channels of the dysfunctional premises were disinfected with a 4% hot (70B°C) sodium hydroxide solution.

Vievitinum is an antibacterial drug in the form of a powder for oral use, intended for the treatment of pigs suffering from bacterial and mycoplasma infectious diseases. In 1g of vievitin, 450mg of thiamulin hydrofumarate is contained as the active substance, and 350mg as glucose auxiliary components and 200mg as glucose. The developer of this drug for veterinary use is GNU named after Y.R. Kovalenko, Moscow. The drug was registered by the Federal Service for Veterinary and Phytosanitary Surveillance on December 30, 2010. Registration certificate of the medicinal product for veterinary use No. 000126. Registration certificate number: 77-3-3.0-0105 No. PVR-3-3.0/02656.

In preliminary studies, data were obtained on the determination of the sensitivity of *Brachyspira hyodysenteriae* to vievitin. In this case, the minimum bacteriostatic concentration of the drug (in terms of the active substance) ranged from 0.06-0.38 Ojg/ml, and the bactericidal concentration in the range of 1.9-7.5 Ojg/ml.

The enterosorbent used in the experiment is an enrichment product for clay raw materials from deposits in the Belgorod Region (Patent for the invention No. 2471549).

The composite preparation was prepared in a laboratory ball mill RTA-1 in the following proportions:

- for the first group of animals: 5.6 g of vievitin and 400 g of sorbent (1 g of the drug contained 14 mg of vievitin and 986 mg of sorbent);
- for the second group of animals: 11.1 g of vievitin and 400 g of sorbent (1 g of the drug contained 27 mg of vievitin and 973 mg of sorbent);
- for the third group of animals: 22.0 g of vievitin and 409 g of sorbent (52 g of vievitin and 948 mg of sorbent were contained in 1 g of the drug).

Table 1. Scheme of experience in determining the therapeutic efficacy of a composite preparation (vievitin in combination with a sorbent) in peg dysentery.

Group	Composite preparation, dose mg/kg body weight		Application method	Multiplicity of application
	Vievitin	Enterosorbent		
I	5,6	400	Individually with drinking water	Once a day for three days
II	11,1	400		
III	22,2	400		
Conrol				
IV	11,1	-	Individually with drinking water	Once a day for three days
V	-	400	Individually with drinking water	Once a day for three days

Animals of the first group (n = 63) received a composite preparation at a dose of 5.6 mg/kg of body weight of vievitin (2.5 mg/kg of active substance) and 400 mg/kg of body weight of the sorbent, the second (n = 65) - 11, 1 mg/kg body weight of vievitin (5 mg/kg of active substance) and 400 mg/kg of body weight of the sorbent, the third (n = 64) - 22.2 mg/kg of body weight of vievitin (10 mg/kg of active substance) and 400 mg/kg of body weight of the sorbent.

Piglets of the fourth and fifth groups served as control. The fourth group (n = 58) was orally administered with vievitin at a dose of 11.1 mg/kg, and the fifth (n = 60) was administered sorbent at a dose of 400 mg/kg of body weight (Table 1).

Each dose of the drug was dissolved in 100 ml of drinking water and was individually drunk from a rubber bottle once a day for three days.

3 Results and discussions

The sorption efficiency of enterosorbent prepared on the basis of montmorillonite-containing clay (MCC) and the cell wall of *Pichia Pastoris* was studied, and a comparison was made with the American analogue of Mikosorb. In Fig. 1. The comparative characteristic of the sorption ability, determined by the absorption of the dye, is presented. During the experiment, it was proved that the enterosorbent based on montmorillonite has a more pronounced sorption ability in relation to the Mikosorb analog by 59.1%.

Clinical studies of enterosorbent in combination with vievetin showed that on the second day of treatment, animals of groups II and III were characterized by an improvement in the clinical condition, instead of bloody diarrhea, liquid or watery bowel movements were observed, and single brahispir was found in smears from feces. Among the main number of piglets of the first group, clinical signs of dysentery were noted.

The bulk of the experimental animals of the second and third groups recovered after two or three days of treatment (the appetite recovered, feces were formed, there were no brachyspurs in smears from rectal samples), and only a few individuals on the next day after the end of the course of treatment. Mortality among piglets of the second and third groups was observed on the first day of the experiment. In addition, two heads were forcedly killed in the second and third groups.

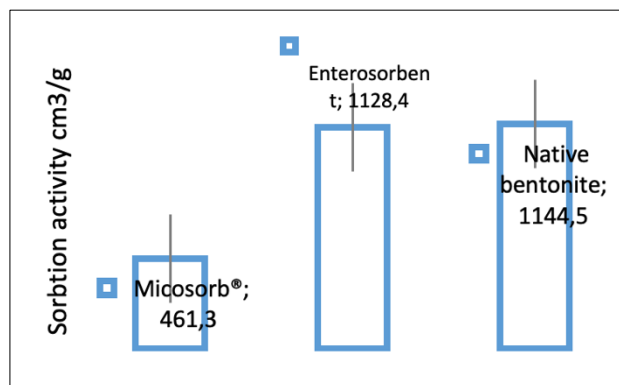


Fig. 1. Comparative characteristic of the sorption capacity for dye absorption

In the first group, animals were cured only three days after the start of treatment, a small proportion of pigs recovered after the end of treatment, and 20.6% did not recover. The waste of animals in this group was large, since 7 animals fell and 6 were forcedly killed (Table 2).

Cured animals quickly returned to normal (food intake was restored, feces acquired a dense consistency, and brahispira were not found in rectal samples). Relapse of the disease in all three groups during the 3-week observation period was not recorded.

In the control groups, where the fourth group used vievitin at a dose of 11.1 mg/kg, and the fifth used a sorbent at a dose of 400 mg/kg, on the second day of treatment the clinical picture of the disease did not disappear, but the general condition of the animals was fifth the group worsened (appetite is reduced or absent, sunken sides, dull hair and disheveled, diarrhea with impurities of blood and mucus, voice squeaky hoarse). There was also a large departure of animals (in the fourth group, 5 animals fell and 3 were killed, and in the fifth - 6 animals and 3 were killed).

On the third day of treatment in the fourth group, the death of the pigs stopped, but 4 piglets were rejected. In the fifth group, 3 gilts fell and 4 were forcedly killed. In order to prevent further mortality, the remaining animals of the fifth group were treated with injections of tiamulin hydrofumarate. The antibiotic was administered intramuscularly once a day for three days at a dose of 15 mg/kg.

After the course of treatment, the pigs of the fourth group are completely healthy.

Given the fact that the therapeutic efficacy of using vievitin with sorbent in appropriate doses of 11.1 mg/kg

body weight of vievitin (5 mg/kg of active substance) and 400 mg/kg of body weight of the sorbent was 90.8%, then this dose used as a preventive when giving food.

Also, the decision to use the studied complex with food was based on the fact that piglets suspected of dysentery infection, as a rule, do not suffer from a lack of appetite, and the appointment of these funds with food is less time-consuming and technologically advanced than the individual giving of therapeutic drugs with drinking water. Therefore, the composite preparation was dissolved in water, mixed with food and fed in a group way to 60 piglets in contact with pigs suffering from dysentery once a day for two days. During the 3-week follow-up, these pigs were clinically healthy, and no brahispira were found in smears from feces.

Studies have shown that the combined use of vievitin with a sorbent by giving individually 100 ml of drinking water at doses of 5.6 (second group) and 22.2 (third group) mg/kg body weight for vievitin and 400 mg/kg wt - body for the sorbent provided a high therapeutic effect in the treatment of piglets suffering from dysentery. Recovery, respectively, was 90.8 and 93.8%.

The oral form of using vievitin with enterosorbent, unlike the injection form of thiamulin hydrofumarate, does not lead to the development of prophylactic reactions, has a more sparing effect on the immune system, is safer and more convenient in practice, which expands the scope of the drug. The combined use of vievitin in combination with an enriched montmorillonite-containing sorbent additionally provides efferent therapy, increases the effectiveness of treatment and prevention of dysentery, promotes the rapid recovery of sick animals, and reduces the expense and side effect of vivitin on the body.

Giving sorbent selectivity by immobilizing specific vievitin ligands on its surface is a new direction in sorption therapy. The weakly immobilized vievitin ligands formed upon enterosorption are quite easily desorbed from the surface of the sorbent. In this case, the sorbent acts as a carrier for the delivery, dosed release and prolongation of the action of bioactive ligands, and also additionally performs the function of protecting immobilized ligands from inactivating factors of the external (during long-term storage) and internal (e.g., gastric juice) environment. In addition, in this embodiment, the sorbent-immobilized vievitin system has a certain buffer capacity, that is, it works as a depot warehouse, from which the body selects the antibiotic for its needs in necessary quantities as necessary, and the risks of overdoses are reduced.

Table 2. Therapeutic efficacy of a composite preparation (vievitin in combination with sorbent) in pig dysentery.

Group	Number of heads	Died		Forced killed		Recovered	
		Heads	%	Heads	%	Heads	%
I	63	7	11,1	6	9,5	50	79,4
II	65	4	6,1	2	3,1	59	90,8
III	64	2	3,1	2	3,1	60	93,8
Control							
IV	58	5	8,6	7	12,1	46	79,3
V	60	9	15,0	7	11,7	*	*

Note: * - treatment is discontinued due to lack of therapeutic effect.

4 Conclusion

Summarizing the above materials, it can be noted that enterosorption in intestinal infectious diseases is a pathogenetically substantiated method of therapy. An approach based on imparting specific properties to the sorbent by immobilizing bioactive vievitin ligands on its surface is promising. [8] It allows you to reduce or even eliminate the negative impact on the body of the animal drug substance vievitin. The use of montmorillonite-containing clays, which ensure the effectiveness of efferent methods of therapy, in combination with promising antibacterial drugs, provides a wide opportunity for the development of preventive and therapeutic complex preparations with increased therapeutic activity. [9]

These drugs are usually more cost-effective than antibiotics, due to the fact that their main ingredient is, as a rule, environmentally friendly enterosorbents obtained on the basis of natural domestic raw materials and having increased efficiency of sorption of exo- and endotoxins of enteropathogenic microorganisms, products of decay yes the contents of the intestines and other pollutants. The duration of their use in the treatment and prevention of gastroenteritis of infectious etiology is much shorter than that of antibacterial drugs, because many antibiotics are designed for a long course of treatment.

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