

PREVENTION OF GASTROINTESTINAL DISEASES IN PIGLETS AT WEANING USING PROBIOTICS *BACILLUS COAGULANS* AND *BACILLUS MEGATERIUM*

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Abstract

The aim of the study is to determine the preventive effect of the use of probiotics *Bacillus coagulans* and *Bacillus megaterium* in case of gastrointestinal diseases in piglets and as a potential strategy to reduce the misuse of antibiotics in monogastric animals by adding probiotics to the diet of pregnant sows and piglets in the period before and after weaning.

Materials and methods. Three research groups were formed to study the preventive effect of probiotics of the genus *Bacillus coagulans* and *Bacillus megaterium*. The piglets of the first experimental group received probiotics at the rate of 0.4 kg per 1 ton of feed in the periods before and after weaning, and that is, the moment of the entire study, the second experimental group received probiotics in the period after weaning, before that they received milk from the sow. The third group was the control group, which received only milk from the sow, and fodder during the weaning period. The effectiveness of the prevention result was determined by the absence/presence of clinical signs of morbidity and % survival of animals during the study period.

The results. It was established that the preservation of livestock in the 1st experimental group was 90 %, and in the 2nd group – 70 %, and control – 50 %.

Conclusions. Research results show that probiotics of the genus *Bacillus coagulans* and *Bacillus megaterium*, the components of which provide a wide spectrum of antimicrobial activity, are a reliable preventive measure for gastrointestinal diseases in piglets.

Keywords: probiotics, prevention, weaning, stress, fattening, weanling piglets, antibiotic resistance, economic threat, monogastric animals.

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1. Introduction

Pig farming is a branch of agricultural production that provides the population of many countries with valuable food products.

One of the most important stages of the successful breeding of piglets is the timely prevention of gastrointestinal diseases, which lead to the mortality of piglets and pose a significant economic threat to farms. Mass gastrointestinal diseases of piglets currently belong to the factor infections associated with a violation of the intestinal biocenosis, resulting in an immunodeficiency state. Primary and secondary immunodeficiencies in weaning piglets, reduction of colostral immunity, violation of feeding conditions, and maintenance of sows and their offspring, resulting in the development of dysbacteriosis and the infectious process, are the main reasons that cause a shift in microbiocenosis of the gastrointestinal tract. Therefore, the basis of the prevention of gastrointestinal diseases of newborn piglets should first be the improvement of their immunological protection, improvement of the technology of feeding and maintenance of sows and their offspring, as well as research into new ways of weaning piglets from the sow without stressful factors. In terms of effectiveness, probiotics are not inferior to many antibiotics and chemotherapeutic agents; they do not negatively affect the microflora of the digestive tract; they do not contaminate products of animal origin and the environment. Therefore, the development and research of probiotic preparations for the correction of the immunological state of the homeostasis of piglets is an urgent task today.

Literary sources indicate that antimicrobial drugs were often used prophylactically and metaphylactically to counteract gastrointestinal diseases or as growth promoters in piglets. [1].

Antibiotic resistance is an urgent issue today, as the incorrect use of antibiotics over a long period causes selection pressure on bacteria, which leads to a rapid increase in antibiotic resistance.

Furthermore, variations in antibiotic resistance across countries are partly explained by different volumes and antibiotic consumption patterns [2]. Therefore, the need for the correct use of antibiotics and for the study of new safe alternative drugs in pig farming is an urgent challenge for veterinary medicine.

Scientists note that from 2000 to 2010, the consumption of antibiotics worldwide increased by 35 % [3]. Since 2006, the entire European Union has abandoned antibiotics and growth stimulants in animals [4, 5].

Studies indicate that microorganisms directly introduced into feed are defined as probiotics and are one of the most promising strategies among natural and alternative feed additives in animal husbandry [6].

Probiotics are living microorganisms that, when administered in the correct dose, are beneficial for the host animal. Taking probiotics to restore the ideal balance between beneficial and pathogenic microorganisms is preferable during periods of stress when this balance can be altered [7]. Several studies have been conducted to check the probiotics of the *Bacillus* family, which were most thoroughly studied as probiotics for monogastric animals, were most often isolated from the soil and gastrointestinal tract of animals, and these are *Bacillus subtilis*, *Bacillus licheniformis*, *Bacillus coagulans*, *Bacillus amyloliquefaeciens*, *Bacillus velezensis* and *Bacillus cereus* [8–10].

According to detailed feeding norms, balanced rations are the key to increasing the productive effect of feed. In recent years, in order to increase the efficiency of animal use of feed nutrients, various feed additives, including probiotics and enzyme preparations, have been included in the rations [11]. The works of many scientists have been devoted to the theoretical and practical substantiation of the expediency of using probiotics in the rations of weanling piglets and productive groups of animals. In 2010, scientists B. V. Yegorov together with A. V. Makarynska, characterized modern feed forms of phytobiotics, probiotics, prebiotics, premixes and compound feeds, proving that natural growth stimulants, unlike antibiotic drugs, have a great potential for beneficial effects on the digestive tract, growth and productivity of animals, and their choice and rate of administration directly depends on the set components in the recipe, purpose of compound feed and method of its feeding [12]. In 2013, researchers N. A. Gogitidze and O. V. Berbenets studied the effect of the enzyme-probiotic supplement “Bacel” on the growth and development of weaned piglets from 28 to 77 days of age in farm conditions. They proved that the probiotic has a positive effect on the growth and development of piglets, which, in turn, depends on improving the hygienic improvement of feed [13]. Scientists were interested in pig farming, Chorny M. V., Gerasimenko O. M., Donskikh O. D., and Shepetilnikov Yu. O. are concerned about the problems of the successful development of this industry. Its effectiveness cannot be achieved without a full-fledged and balanced feeding of all ingredients, provision of a comfortable living environment and selection work, and not only thanks to the mass application of medicines. Preventive focus is the way to ensure healthy, productive pig farming. They claim that non-contagious diseases are widespread in pig farms – 60–80 % and – 10–15 % are infectious and invasive diseases [14].

2. Materials and methods

The research was conducted at the SE “RF of the Northeast Agriculture University” farm in 2019–2021.

Three research groups were formed to study the preventive effect of probiotics of the genus *Bacillus coagulans* and *Bacillus megaterium*. The research was conducted on pregnant sows of the Ukrainian white breed aged up to 2 years with a live weight of 240 kg. Sows were kept in the same conditions on the appropriate diet, after confirmation of pregnancy. Sows of the I and II experimental groups were given probiotics of the genus *Bacillus coagulans* and *Bacillus megaterium* from the 15th day of pregnancy until the period of weaning of piglets from the sow. Sows of the control group were not given probiotics.

Clinical examination of animals of all groups was carried out every day. The piglets of the control group drank milk from the sow before the weaning period; after weaning, the animals received a completely rational compound feed. The piglets of the first experimental group received probiotics, respectively, at the rate of 0.4 kg per 1 ton of feed, in the periods before and after wean-

ing, that is, the moment of the entire study, the second experimental group received probiotics in the period after weaning, before that they received milk from the sow. The effectiveness of the prevention result was determined by the absence/presence of clinical signs of morbidity and % survival of animals during the study period.

3. Results

When conducting statistical data for three years from 2019–2021, the following were most often registered: gastroenteritis – 24 %, dyspepsia – 20 %, and gastric ulcer – 7 %.

As a result of our research, which is presented in **Table 1**, it was established that the most effective were the preventive measures carried out according to the scheme I.

Table 1

Piglet survival record

Groups of animals	Number of live piglets, head		
	Newborn piglets	Before weaning In 21 days of age	After weaning In 22–42 days of age
Study group I	15	15	14
Study group II	14	13	11
Control group	12	10	6

As can be seen from the data in Tab. 1, in the first experimental group of 15 live newborn piglets, 14 heads were preserved by the age of 42 days, which is 90 %. In addition, the animals did not show significant clinical signs of the disease during the experiment. In the second experimental group, three piglets died during the weaning period at 22–42 days of age, which is 70 %. Signs such as lethargy, refusal of feed, and weight loss were observed in the dead piglets. Visible mucous membranes become pale. Diffuse diarrhoea was observed – liquid stools with mucus, sometimes bloody. In the control group of 12 live newborn piglets up to 42 days of age, 6 heads remained alive, which is 50 %. In addition, two piglets died on the 8th day of their lives; the animals were emaciated, and with the help of clinical examination, it was seen that the mucous membranes were pale and dry, the eyes were inflamed, there was a decrease in appetite and bloody diarrhoea. Other dead animals had a visible decrease in activity, appetite, diarrhoea, abdominal distension, and pain when palpated.

4. Discussion of research results

Lemishevsky V. M. proved in his research that feeding the genus *Bacillus probiotics* to piglets with an effective level of antagonistic activity. A thin layer of mucus is a favourable environment for microorganisms, which are distributed precisely in the wall layer, and consists of glycosaminoglycans [15].

According to the data of several foreign researchers [16], the addition of probiotics of the *Bacillus* family has a beneficial effect on the growth performance of piglets, including diarrhoea after weaning. It modulates the immune system and intestinal microbiota of weaned piglets, which indicates that *Bacillus* can be used as a functional probiotic in the diet animals.

Many authors note that among many probiotics, *Bacillus coagulans* has become a key player in the field of probiotics in recent years. Many studies have demonstrated its activity in regulating the balance of intestinal microbiota, stimulating metabolism, improves the body's immune defence, *B. Coagulans* have a useful role as a feed additive [17, 18].

In 2004, scientists characterized probiotic strains *B. cereus*, *B. clausii*, and *B. pumilus* for colonization ability [19]. The authors established that three strains of *B. cereus* produced Hbl (hemolytic) and Nhe (nonhemolytic) enterotoxins, as well as an emetic toxin–cereulide (a toxin that causes vomiting). The production of these toxins is a key factor in the pathogenesis of toxic gastrointestinal infections. O. Shkromada, Yu. Dudchenko, Ya. Udovenko analyzed the effect of probiotics of the *Bacillus* genus on the microflora of the gastrointestinal tract of animals and proved that the maximum positive effect of probiotics is up to 30 days of the age of animals, while *Lactobacil-*

lus sp. was the maximum up to 800 CFU/g, while the level of opportunistic pathogens in the experimental group with *B. coagulans* had minimal indicators. Moreover, they claim that when probiotics are prescribed, the activity of enzymes, and the level of proteins and glucose in the blood serum of animals are within the normal range, which indicates the normal course of metabolic processes and the absence of a toxic effect of the probiotic [20].

Discussing the prevention schemes of our experiment, we see that used in the II research group, where the herd conservation is 70 %, it can be assumed that the sow infects the piglets. The probability of infection is higher, especially in the presence of factors that worsen the general condition of both the sow and the offspring and reduce the resistance of the animal body.

Thus, in the control group, sows and piglets were not protected by any prophylactic during the critical periods of growth and development. It should also be noted that according to our observations in the 1st and 2nd research groups, the largest number of clinically ill animals was recorded during the weaning period, and this, in turn, is a stress for piglets.

Study limitations. A limitation of the study is the insufficient number of animals in the experiment for a more accurate statistical calculation. However, this study provides a basis for using experimental probiotic strains of the *Bacillus* genus in farms to correct microflora in young piglets.

Prospects for further research. The purpose of our further research is to study the effectiveness of the use of probiotic preparations during the stress period of piglets, which cause diseases of the gastrointestinal tract.

5. Conclusions

As a potential alternative to antibiotics, a growing list of probiotics is being studied and tested for their ability to prevent post-weaning diarrhoea in piglets. However, as a rule, feeding probiotics can be a better alternative for the treatment of acute gastrointestinal diseases in piglets.

The use of probiotic strains of *Bacillus coagulans* and *Bacillus megaterium* in the form of separate mixtures with feed during the sow's pregnancy and piglets during the weaning period is an excellent preventive measure for signs of gastrointestinal diseases.

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