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Influence of mannan oligosaccharides for getting high quality and ecologically safe swine production

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Based on the data obtained during the production experiment, it was proved that adding of mannanoligosaccharides in the form of a prebiotic Bio-Mos into the composition of feed during the entire period of fattening positively affects the qualitative and quantitative compound of the digestive tract of pigs growing for meat. According to the results of the experiment, prebiotic Bio-Mos, as a feed additive during the whole period of fattening, helps to increase the intensity of pigs'growth on fattening due to changes in the number of conditionally pathogenicand symbiotic microorganisms. The accumulation of symbiotic microflora in feces provides harmful effects on the environment and does not cause infection of animals and humans.
Key words: pigs; feed; productivity; digestive canal; prebiotic Bio-Mos; mannan-oligosaccharides; microflora

Introduction

A significant place in pollution of the environment, especially soils and water belongs to the waste of livestock farms. With feces of animals, a significant number of microorganisms enter the environment, some of which can cause infection of both animals and humans.

Recently, a large number of feed additives of various origins have been used in the pigs feeding. Some of them normalize the general digestive processes in the body, the others are aimed only at digestibility, and still others – effectively correct the qualitative and quantitative composition of the microflora of the digestive tract of animals. Modern market of biologically active supplies is very diverse. However, no matter what supplies we use in animal nutrition, they should be aimed at obtaining environmentally friendly food products. Only by ensuring a full-fledged feeding of pigs and maintaining their health, can quality and safe food be obtained (Kuz'menko, 2013; Mookiah et al., 2014; Ducatelle et al., 2015).

Prebiotics do as well belong to the environmentally safe drugs. They normalize the microflora of the digestive tract of young animals and aduls with the development of dysbacterioses of various etiologies; they are used as prophylactic remedies for the animal organism; they strengthen immunity; stimulate the growth and development of animals; eliminate stresses (Patterson et al., 2003; Kravchenko et al., 2014; Abdel-Raheem et al., 2012).

Prebiotics, based on mannanoligosaccharides, contribute to the development of symbiotic microflora, which, in turn, inhibits the growth of opportunistic microorganisms (Chernikova, 2016).

Mannanoligosaccharides (MOS) via mannose residues bind to bacterial receptors. MOS, are not destroyed by digestive enzymes and are firmly retained on the surface of bacteria. Bacteria with blocked receptors cannot fix on the surface of epithelial cells and pass the digestive canal in transit. Reducing the amount of pathogenic microflora in animal feces is an important step towards improving the world ecological situation (Lukashhuk, 2013; Kuz'menko, 2013; Veterinarna praktika, 2014).

It is known that certain polysaccharides of microbial origin, injected into the body together with the vaccine, work as immunostimulants. The presence in the vaccine of certain adjuvants significantly increases the antibody titres and, consequently, enhances the non-specific immunity of the animal (humoral immunity). Moreover, these polysaccharides are characterized by antigenic properties (Kosjanenko et al., 2013; Bujarov et al., 2014).

Thus, one of the directions in animal feeding is to study the impact of various feed supplies not only on the productive qualities of animals, but also on the quantitative and qualitative composition of the fecal microflora. Because a healthy animal organism means quality and safe food.

Material and methods of research

The research was carried out on the farm "Nadia" of the Cherkassy region on two groups of young pigs on the fattening of a large white breed of analogs in terms of live weight, age and origin, with 100 heads each.
The first group was a control group, the animals of which received full-feed mixed fodders taken at the farm. Prebiotic Bio-Mos was fed as a part of the compound feed of young pigs of the 2nd test group for 120 days, previously mixed with PMVS (protein mineral vitamin supplement) in an amount of 0.06 % by weight of the mixed feed (Table 1).

Table 1. Scheme of scientific and economic experience

Group	Livestock, heads	Feeding conditions	
		comparative period (30 days)	main period (90 days)
Control	100	MF	MF
Test	100	MF	MF+0.06% Bio-Mos by the weight of the mixed feed

MF - mixed fodder

According to the scheme of the experiment, the animals of the control group received a diet taken at the farm. It consists of, %: corn – 10, barley – 50, wheat – 20 and PMVS – 20. The pigs were kept in groups, weighed monthly. Fodder was filled in bunker feeders.
Since the pigs were fed full-feed mixed fodders, which completely replaced the diet of animals, the chemical composition and nutritional value of it were determined by the method of (Petukhova et al., 2010).
The study of feces on the contents of microorganisms was carried out before and after the drug was fed. Selected samples of feces of 3 piglets from each group to study the qualitative and quantitative composition of the microflora, without preservatives, in an ice thermos, were delivered to the laboratory for 2 hours and examined by the method of (Lisenko et al., 1999).
Selected fecal samples for studying the qualitative and quantitative composition of the microflora were suspended in an isotonic sodium chloride solution (pH = 7.2–7.4) in the ratio of 1:10 (1 g of feces and 9 ml of NaCl) were shaken in the “Shutel” apparatus during 10 minutes and leftto stay for another 10 minutes. Then they were sown on culture medium. For the determination of salmonella, the medium "XLD" (Ploskireva) and "BSA" were used, for enter bacteria - "Endo’s" and "Simons" medium, and for staphylococcus - "Baird-Parker" (modern alternative of "YSA") were used. “Saburo” medium was used to cultivate fungi and yeast.For the cultivation of bifid bacteria, the “Blauroc” medium (bottom seed) was used. Lactobacillus were cultured on a “medium for the isolation of lactobacilli” (dense).
To quantify the cultivated conditionally pathogenic microorganisms, colonies of each species are calculated on differentially selective media according to (Efimov et al., 1991; Kavrok et al., 1999).

The quantitative composition of all types of microorganisms (S) in 1 g of feces was determined by the formula (1):

$$S = n \times a \times b, \quad (1),$$

where: *S*-number of microorganisms in 1 g faeces;

n - number of colonies grown on a cup;
a - seeding rate (for sowing 0.1 ml = 10; 1.0 ml = 1; 0.,05 ml = 20;
b - the degree of material dilution.

Biometric processing of the obtained results was carried out on a PC using the MS Excel software with the built-in statistical functions. The probability of a difference between the indicators was assessed by Student's criteria (Melnichenko et al., 2006).

Results and discussion

The studies conducted on the pig farm "Nadiya" established quite a widerange of microorganisms separated out of feces. According to the results of the study of fecal samples, the highest percentage among the separated pathogenic and opportunistic microorganisms has *E. Coli* – 38.4 % (most often piglets die from colibacteriosis), the second place take the causative agent of salmonellosis – 20.6 %. *Proteus vulgaris was also high* – 12,3 %; *Staphylococcus aureus* – 9.,5 %; *Pseudomonas aeruginosa* – 7.8 %; *Clebsiellapntumoniae* – 5.2 % (Fig. 1).
Microorganisms such as *Campylobacter jejunia, Citrobacterfreundji, Melissococcus* were singled out in small amounts (1.2-3%), it is not significantly affect the formation of porcine intestine microbiocenosis and do not cause diseases. Due to this diversity of conditionally pathogenic microflora in the digestive tract of pigs, the dominant microorganisms were singled outof pigs’feces, which are grown for meat.

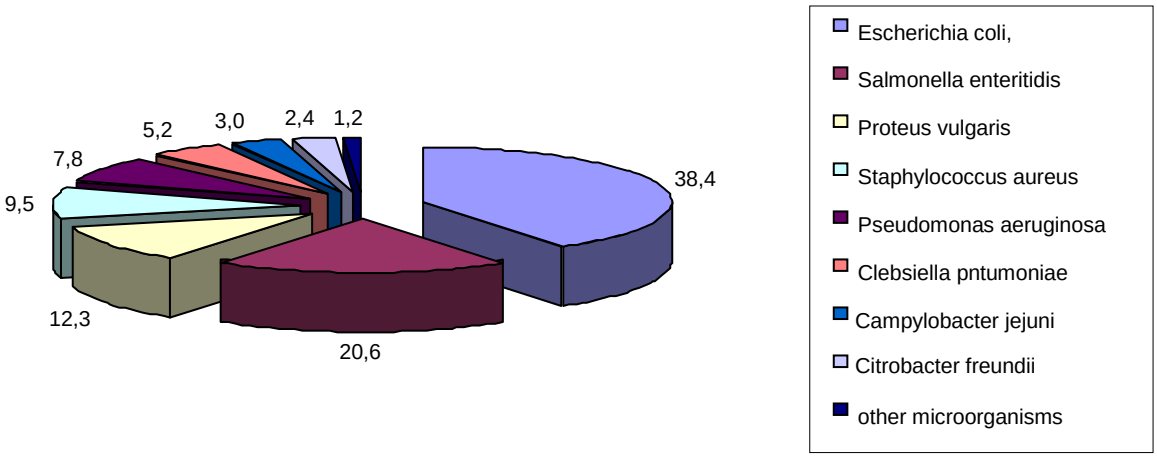

Fig. 1. Quantitative and qualitative composition of representatives of the conditionally pathogenic microflora of young pigs' feces.

During the production experiment, a significant effect of mannanoligosaccharides on the number of pathogenic and opportunistic microflora of the pigs'digestive tract was established. Thus, in the experimental group, during the growing period, the amount of singled out *Salmonella* (by 49%) and *Staphylococcus aureus* (by 42%) was significantly decreased in comparison with the control group (Table 1).

Table 1. Content of conditionally pathogenic microorganisms in young pigs' feces, lg CFU/g, M±m, n = 3

Microorganisms	Comparative period		Main period	
	Group			
	Control	Test	Control	Test
Salmonella enteritidis	6.09±0.535	6.11±0.621	6.54±0.567	3.34±0.625*
Escherichia coli	8.77±0.312	8.78±0.287	9.19±1.04	7.34±0.476*
Enterococci	7.42±0.224	7.40±0.217	7.87±0.635	8.12±0.361
Staphylococcus aureus	2.47±0.526	2.51±0.574	3.15±0.541	1.85±0.712*
Candida albicans and etc.	4.35±0.202	4.32±0.218	7.27±0.512	5.20±0.422*

The number of bacteria in the *E. Coli* group and enterococcus in this group decreased less intensively. However, at the end of the experiment, a significant decrease in *E. Coli* inpigs' feces of the test group was established – by 20%.
Symbiotic microflora, which promotes optimization of digestive processes, on the contrary, was better multiplied in the digestive canal of the test grouppigs. Thus, during the period of pigs' growing, the number of bifid bacteria has doubledin comparison with the control, indicating the normalization of the intestinal microbiocenosis (Fig. 2).

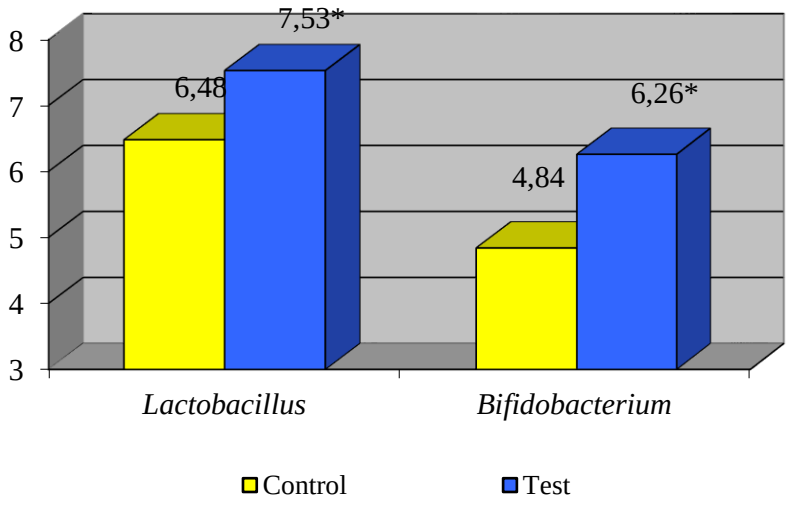

Fig. 2. Content of symbiotic microorganisms in feces of young pigs

Young pigs cease to receive lactose when they stop drinking breast milk. Carbohydrates of feed contain galactose whichis nutrient medium of lactic acid bacteria. As a result, lactic acid bacteria begin to use the galactose contained in the mucin.If there are large pathogenic microflora colonies in the body, mucin galactose is used and lactic acid bacteria stop their growth.
Mannan oligosaccharides have a positive effect on the growth of bacteria producing lactic acid, such as *Bifidobacterium and Lactobacilus* by blocking the colonization of the intestines by pathogens. This, in turn, leads to the colonization of the digestive tract by conditionally pathogenic microflora, which begins to stand out more with feces into the external environment.Under such conditions, in animals develop digestive and dysbacterioses disorders, reduce the state of nonspecific protective forces of the organism, and decreases the intensity of their growth and development.
According to the data, the number of lactobacilli in the feces of pigs that consumed the prebiotic Bio-Mos, compared to the control, changed insignificantly, however, by the end of the experiment their number increased by 16%. It is known that in the absence of appropriate conditions for the growth of symbionts in the intestine, a decrease in their number occurs, however, in the feces of the test grouppigs the amount of bifidobacteria during the entire period of the experiment was significantly higher than that of the control group pigs (by 29 %). Thus, the use of Bio-Mos prebiotics contributes to an increase in the growth rate of pigs on fattening and a reduction in the amount of conditionally pathogenicmicroflora in the digestive tract, and hence in feces entering the environment. According to the results of the conducted studies, there is no doubt in the positive effect of the prebiotics Bio-Mos on the microflora of the intestines of pigs growing for meat. They clearly showed the bacteriostatic effect of the drug relatively undesirable in the colon microflora, stabilizing the symbiotic microflora.

Conclusions

Adding to the compound feeding of youn gpigs on fattening prebiotic Bio-Mos on the basis of mannanoligosaccharides during the whole period of fattening positively affects the qualitative and quantitative composition of the conditionally pathogenic and symbiotic microflora in the digestive tract. The use of the Bio-Mos prebiotic indicates its harmful effects on the body of animals and the safety of contamination by environmental exchange products.

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