THE EFFECTIVENESS OF THE COMPLEX ADDITIVE PROBIOTIC "VITAKORM-BIO" IN GROWTH, NUTRIENT DIGESTIBILITY AND FECAL MICROFLORA COMPOSITION IN YOUNG PIGS

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Abstract

The aim of the research was to study the effect of different levels of supplementation with "Vitakorm-Bio" complex probiotic of mixed fodder in the growth, nutrient digestibility and microbial content in the feces of growing pigs. In order to conduct the trial, twelve piglets of Landrace breed were selected at the Enterprise "Moldsuinhibrid" on the basis of analogies, taking into account the origin, age, body weight and growth energy. Four experimental groups of three head each were created. The dietary treatment included: 1) CG (main diet); 2) EG_1 (main diet + complex probiotic 1.5 kg/t); 3) EG_2 (main diet + complex probiotic 3.0 kg/t); 4) EG_3 (main diet + complex probiotic 4.5 kg/t). It was established that the supplementation of the mixed fodder for the piglets in the experimental groups with the complex probiotic "Vitakorm-Bio" had a positive impact on the growth of their body weight, which was the highest in EG_2 and EG_3, in which the pigs received the preparation at the level 3.0 and 4.5 kg/t, whereas the average daily gain during the whole trial was the highest in group EG_2, where the level of the supplementation was of 3.0 kg/t (0.248 kg, by 2.48% higher than in the CG). The supplementation with the complex probiotic at the level of 4.5 kg/t of the diet for the gilts in EG_3 helped to improve the digestibility of the organic and dry substances, crude protein, fiber and ash which were higher in comparison with CG by 0.69, 0.05, 1.92, 0.71 and 7.42% respectively. The comparative analysis of fecal matter on content of pathogenic organisms at the beginning and the end of trial revealed no significant effect under the influence of additives synbiotics.

Key words: growing pigs, probiotics, digestibility, growth performance, microbial population

INTRODUCTION

When managing intensively the pig breeding under the modern industrial technology, a complete biological diet is an essential factor in obtaining a high productivity of pigs.

In recent years, numerous investigations related to the structure and the functions of the microflora of the gastrointestinal tract of animals have been subjected to considerable review. Important scientific knowledge has been acquired which permits to examine the gastro-intestinal microflora of live-stock as an important ecosystem, the normal functioning of which contributes to the digestibility of the nutrients in diets [5].

Currently, probiotics are largely utilized. They are used for the prophylaxis of infectious gastrointestinal tract diseases in young live-stock; the replacement of antibiotics in the composition of mixed fodder for young animals; the improvement of digestion processes; the acceleration of the adaptation of animals to high energy diets and nonproteinaceous nitrogenous substances; the increase of the efficiency of fodder utilization and animal productivity [15].

Probiotics are able to live in the digestive tract in order to improve the digestion and assimilation of nutrients. They increase the body stamina, and strengthen its protection function [4, 7, 13].

They are also used to prevent and treat livestock diseases, and to stimulate economic growth [16].

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In order to improve the functional activity of probiotic preparations, representatives of several types of normal microflora should be included in the composition of the preparations.

To obtain new bioactive multicomponent agents, probiotic substances are combined with prebiotics complexes [14, 17].

The combination of pre- and probiotics to form synbiotics, means the increase of their beneficial effect, the improvement of the survival of the probiotic bacteria during their passage through the gastrointestinal tract, and together with prebiotics, which affect both exogenous and endogenous microorganisms, the impact on the efficiency of the microorganisms implantation introduced into the colon microflora. It is believed that undigested prebiotics, when getting the large intestine, create favorable conditions for probiotic bacteria, which have a positive effect on animal body. This will provide more efficient support than pro- and prebiotics when used separately [17, 14].

Currently, there exist complex probiotic supplements. However, not enough research has been conducted on this matter.

MATERIAL AND METHOD

To determine the nutrient digestibility of the mixed fodder for young pigs under the influence of pro-prebiotic preparation "Vitakorm-Bio" a physiological experience "in vivo" was carried out using the direct method. Twelve sows of Landrace breed served as biological research materials. They were selected according to the method of similar groups [18, 9] by age, body weight and the increase of growth intensity.

The animals selected were divided into four experimental groups: control group (CG), experimental group I (EG_1), experimental group II (EG_2), and experimental group III (EG_3).

The difference between the groups was that the animals in the experimental groups E_1, E_2 and E_3 received the examined preparation pro-prebiotic "Vitakorm-Bio" at different levels in addition to the basic mixed fodder according to the trial scheme (Table 1).

Table 1 The scheme of the physiological trial

Group	Animals, heads	Peculiarities of feeding
CG	3	Basic mixed fodder (BMF)
EG1	3	BMF + 1.5 kg/ton Vitakorm-Bio*
EG2	3	BMF + 3.0 kg/ton Vitakorm-Bio
EG3	3	BMF + 4.5 kg/ton Vitakorm-Bio

* Note: the *investigated preparation "Vitakorm-Bio", a synbiotic (pro-prebiotic) fodder additive, has activation properties which increases immunity, helping the development of the normal intestinal microflora (lacto- and bifidobacteria). The composition of this preparation is: highly activated cellulose, lignin, pectin, hemicellulases, beta-glucans of plant origin, bentonite, strains of Bacillus subtilis micro-organisms not less than 500 mln colonies per 1g of preparation.*

The experimental animals were fed with mixed fodder completely composed of indigenous raw materials traditionally used for feeding pigs (Table 2).

Table 2 The structure of the mixed fodder

Ingredients	%
Barley	20.0
Extruded barley	14.5
Corn	10.0
Extruded corn	11.0
Wheat	11.0
Extruded wheat	11.0
Extruded peas	8.0
Extruded soya	5.0
Sunflower meal	3.0
Fish meal	3.5
Premix 2231	1.5
Fodder chalk	1.0
Solt	0.5

The concentration of nutrients in a kg of fodder for young pigs was in line with the nutritional standards in force [3].

The physiological trial consisted of two periods: preparatory period when the animals were prepared for the trial and their gastrointestinal tract was emptied of the fodder they used before, and the recording (control) period with a duration of 8 days [8] The animals were kept in individual feeding cages.

The monitored zootechnical parameters were: the daily fodder consumption (by measuring daily intake), the weight dynamics (by individual weighing), and specific consumption.

For this purpose it was necessary to determine the exact quantity of fodders ingested by the gilts, first determining their chemical composition [11].

The elimination of feces was also taken into account.

At the end of each day, an average sample from the total amount of fecal was collected, which was preserved for subsequent chemical analysis.

The processing and statistical analysis of the experimental data was done by statistics calculation, the variance analysis method and the testing of the difference significance by Student test [10].

RESULTS AND DISCUSSIONS

The physiological trial was conducted at the State Enterprise for Pig Breeding and Hybridization "Moldsuinhibrid"in July 2011.

During the physiological trial the animals were weighed at the beginning of each experimental period and its end. The dynamics of the body mass data are presented in table 3.

Table 3 Data on the gilts' live weight during the trial, kg (X ± Sx)

Group	At the beginning of the record period	At the end of the trial
CG	25.35 ± 0.55	27.28 ± 0.41
EG_1	26.20 ± 0.97	28.07 ± 1.00
EG_2	25.92 ± 0.12	27.90 ± 0.15
EG_3	25.88 ± 0.33	27.83 ± 0.26

The live weight of the gilts selected at the beginning of the trial was within 22.23 - 22.90 kg; at the end of the trial the body weight of the experimental gilts was higher compared to the CG by 2.90, 2.27 and 2.02% respectively.

A similar trend of live weight increase in young pigs owing to different levels of probiotic administration was also established by Liu P. [20].

The absolute gain in the gilts in EG_2 and EG_3 was of 2.59 and 1.04% compared with the gilts in the CG; the same trend was noticed in the average daily gain – by 2.48 and 0.83% higher than in the CG (fig. 1).

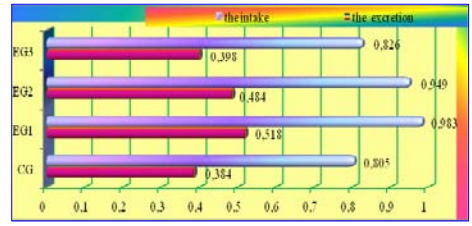

Fig. 1 Average daily gain during the trial, kg

The data on fodder intake and eliminated products (fig. 2) showed that the gilts, the ration of which was supplemented with the pro-prebiotic preparation "Vitakorm-Bio" at different levels, consumed a greater quantity of mixed fodder compared to the CG – by 22.11%, 17.89% and 2.61% respectively in EG_1, EG_2, EG_3).

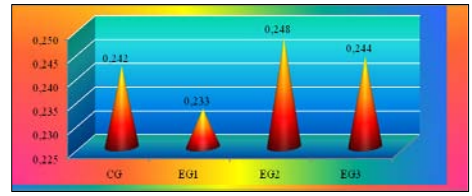

Fig. 2 The dynamics of the mixed fodder intake and excretion on average per day during the trial, kg

At the same time it was observed that the elimination of feces was higher in EG_1 and EG_2 by 34.90 and 26.04% respectively compared to the CG, and by 3.65% in EG_3.

During the investigations the major nutrients were chemically analyzed: the dry (DS) and the organic substances (OS), crude ash (CA), crude protein (CP), crude fat (CF), crude cellulose (CC) and crude non nitrogenous extractive substances (CNES) (Table 4).

According to the data on mixed fodder consumption and feces eliminations during the digestibility test and the basic chemical analysis, the digestibility coefficients of the nutrients in the mixed fodder which was supplemented with the experimental preparation at different levels in the experimental groups were determined (Table 5).

The digestibility of dry and organic substances in gilts in EG_3 was at the level of 85.90 and 87.09%, which was by 0.69 and 0.05% higher when compared with the CG. The gilts in the experimental groups EG_1 and EG_2 showed a digestibility of dry and organic substances slightly lower than in the CG.

Table 4 Chemical composition of the mixed fodder intake and feces excretion, %

Groups	Animals	DS	OS	CA	CP	CF	CC	CNES
Fodder		83.51	79.39	4.12	14.06	1.66	5.96	57.71
CG	1	25.30	20.89	4.41	5.95	1.23	6.83	6.88
	2	26.18	21.69	4.49	6.72	1.43	6.25	7.29
	3	25.86	21.91	3.95	5.61	1.35	7.44	7.51
EG_1	4	24.19	20.17	4.02	5.58	1.68	6.80	6.11
	5	23.75	20.06	3.69	6.10	1.48	6.32	6.16
	6	22.99	18.99	4.00	6.34	1.65	5.87	5.13
EG_2	7	25.25	21.32	3.93	5.50	1.19	6.34	8.29
	8	24.21	20.38	3.83	5.49	1.52	6.49	6.88
	9	25.78	21.64	4.14	5.86	1.67	6.27	7.84
EG_3	10	23.38	19.92	3.46	5.54	1.25	6.86	6.27
	11	25.82	21.84	3.98	5.59	1.47	6.43	8.35
	12	24.21	20.72	3.49	5.45	1.51	6.83	6.93

Table 5 Digestibility coefficients of the nutrients

Indices		Groups			
		CG	EG_1	EG_2	EG_3
DS		85.21±0.96	84.99±0.36	84.74±0.47	85.90±0.70
OS		87.04±0.78	86.85±0.30	86.49±0.41	87.09±0.40
CA		49.99±4.84	49.87±2.16	51.09±1.75	57.41±2.81*
CP		79.12±2.38	77.21±1.66	79.60±0.68	81.04±0.46*
CF		61.38±3.47	48.91±2.43	55.31±4.60	59.09±2.93*
CC		45.38±0.62	43.96±0.41	45.77±0.20**	46.09±0.47**
CNES		93.76±0.38	94.30±0.20	93.84±0.41	93.93±0.27
td	$EG_2 - EG_1$	-	-	** B ≥ 0.95	-
	$EG_3 - EG_1$	-	-	-	* B ≥0.90
	$EG_3 - EG_1$	-	-	-	** B ≥0.95

The results of the physiological experience showed that the gilts in EG_2 and EG_3 which were fed with fodder supplemented with the pro-prebiotic at the level of 3.0 and 4.5 kg/t, had a slightly higher digestibility of crude protein - 79.60 and 81.04% respectively (B ≥ 0.90), which was by 0.48 and 1.92% higher than in the CG.

So, the obtained data showed that the crude fat digestibility was the highest in the gilts in the control group – 61.38%. The gilts in the experimental groups EG_1, EG_2 and EG_3 showed a lower level compared to the CG – by 12.47, 6.07, 2.29% respectively ($B \geq 0.90_{-EG3-EG1}$).

The supplementation of the basic diet with the preparation pro-prebiotic influenced the crude cellulose digestibility in gilts in EG_2 and EG_3; it was by 0.39 and 0.71% higher when compared with the CG ($B \geq 0.95_{-EG3-EG1 \text{ and } EG2-EG1}$).

The lowest coefficient of digestibility of crude ash was found in the gilts in the CG and EG_1 – the level was of 49.99 – 49.87%. The gilts in EG_2 and EG_3 showed a higher digestibility – 51.09 and 57.41%, which was by 1.10% and 7.42% higher than in the CG ($B \geq 0.90_{-EG3-EG1}$).

The amount of the non nitrogenous extractive substances in EG_1 and EG_3 was between 94.30% and 93.93%, which was higher by 0.54 and 0.17% than in the CG (93.76%). When the mixed fodder for young pigs was supplemented with the complex preparation pro-prebiotic "Vitakorm-Bio", the increase and the uniformity of the conditioning pathogenic microorganisms and

bifidobacteria were established, without statistically assured values between the experimental and control groups because of the short experimental period (Table 6).

Table 6 Intestinal bacterial background at the end of the trial

Groups	№ of animals	Conditioning pathogenic microorganisms	Total coliforms, m/g	Escherichia coli with faint enzymatic properties	Staphylococcus aureus	Enterococci	Bifidobacteria	Lactic acid Bacillus	Lactic acid bacteria	Fungi such as Candida
CG	1	10^{*6}	1	10%	10^{*4}	10^{*5}	10^{*12}	10^{*8}	10^{*8}	10^{*4}
	2	10^{*6}	1	10%	10^{*4}	10^{*5}	10^{*13}	10^{*8}	10^{*8}	10^{*4}
	3	10^{*6}	3	10%	10^{*4}	10^{*5}	10^{*13}	10^{*8}	10^{*8}	10^{*4}
EG_1	4	10^{*6}	1	10%	10^{*4}	10^{*5}	10^{*13}	10^{*8}	10^{*8}	10^{*4}
	5	10^{*6}	23	10%	10^{*4}	10^{*5}	10^{*13}	10^{*8}	10^{*8}	10^{*4}
	6	10^{*6}	1	10%	10^{*4}	10^{*5}	10^{*13}	10^{*7}	10^{*7}	10^{*4}
EG_2	7	10^{*6}	1	10%	10^{*4}	10^{*5}	10^{*13}	10^{*8}	10^{*8}	10^{*4}
	8	10^{*6}	69	10%	10^{*4}	10^{*5}	10^{*13}	10^{*8}	10^{*8}	10^{*4}
	9	10^{*6}	1	10%	10^{*4}	10^{*5}	10^{*12}	10^{*7}	10^{*7}	10^{*4}
EG_3	10	10^{*6}	1	10%	10^{*4}	10^{*5}	10^{*13}	10^{*8}	10^{*8}	10^{*4}
	11	10^{*6}	1	10%	10^{*4}	10^{*5}	10^{*13}	10^{*8}	10^{*8}	10^{*4}
	12	10^{*6}	9	10%	10^{*4}	10^{*7}	10^{*13}	10^{*8}	10^{*8}	10^{*4}

There is a general conviction that bifidobacteria are useful in maintaining the right balance of microbiota in the gastrointestinal tract, and in the reduction of the risk of pathogenic infection.

Biavati and Mattarelli [2] consider that the presence of a large number of bifidobacteria in the intestinal tract of the animals is the guarantee of their good health.

CONCLUSIONS

The supplementation of the basic fodder with the preparation pro-prebiotic "Vitakorm-Bio" during the growth period of the breeding gilts at the level of 3.0 and 4.5 kg/t (EG_2 and EG_3) allowed the obtaining of an absolute increase in weight during the recording period of the physiological trial with 2.59 and 1.04% higher in comparison with the CG.

The digestibility of dry and organic substances in EG_3 increased by 0.69% and 0.05% compared to the CG. The crude protein showed a higher digestibility in the gilts in EG_2 and EG_3 which was by 0.48% and 1.92% higher compared to the CG.

The level of 4.5 kg/t of the preparation "Vitakorm-Bio" also influenced positively the fiber digestibility in EG_3, which was by 0.71% higher compared to the CG.

The gilts in EG_2 and EG_3 showed a higher digestibility of crude ash which was by 1.10% and 7.42% higher than in the CG.

Owing to the supplementation with the synbiotic "Vitakorm-Bio" the increase and uniformity (with no statistically assured values the experimental groups) of the conditional pathogenic microorganisms and bifidobacteria were established.

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