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PORN STOMACH MORPHOLOGY WHEN FEEDING FOOD SAPPLEMENTS

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МОРФОЛОГИЯ ЖЕЛУДКА СВИНЕЙ ПРИ СКАРМЛИВАНИИ КОРМОВЫХ ДОБАВОК

Abstract. It is shown that the use of new food supplements MAK- BTU-3, Minovit and Minaze in pigs` diet effects positively on productivity but causes structural changes of adaptable character in rumen fuctional zones membranes.

Аннотация. Показано, что использование в рационах свиней кормовых добавок МЕК-БТУ-3,- Миновита и Минази положительно влияет на продуктивность, но обуславливает структурные изменения в оболочках функциональных зон желудка приспособительного характера.

Key words: pigs, productivity, stomach, feeding, additives, cardial, fundal, pyloric zones, enzymes, minovit, minase.

Ключевые слова: свиньи, продуктивность, желудок, кормление, добавки, кардиальная, фундальная, пилорическая зоны, ферменты, миновит, миназа.

Introduction.

One of the urgent directions of increasing the productivity of animals is the search, testing and introduction of new biologically active substances into the diets. Their use in feeding pigs makes it possible to increase the level of transformation of nutrients in livestock products, to more fully realize the genetic potential of the organism, to maintain the reproductive functions and vitality of animals within the physiological norm. This is especially true in the modern economic conditions of animal husbandry, when the overwhelming majority of products are produced on fodder of their own production and on farms where it is impossible to apply modern technologies of keeping and feeding. This will be helped by biologically active substances that are produced by the biotechnological industry, in particular, enzyme preparations. They occupy a special place in animal feeding, and their industrial production and use is practiced in many countries of the world [1]

Enzyme preparations are biologically active factors of feeding that have a positive effect on the digestion and absorption of nutrients in feed. These are waste products of bacteria and microscopic fungi.

In recent years, scientists have created a significant number of new enzyme preparations and other feed additives with their participation. New biologically active additives include macerobacillin and macerase, minovit and minase, multienzyme compositions MEK-1, MEK-2, MEK-3, MEK-4, MEK-5 and others.

The list of feed additives includes tens of thousands of different feed products, which is constantly updated. But manufacturers must necessarily demonstrate both the effectiveness and safety of feed additives for animals and humans. Only then can they expect to receive a certificate that allows them to manufacture and sell the supplement. Significant reserves for increasing the production of livestock products lie in increasing the efficiency of feed through the use of enzyme preparations [2].

The mechanism of action of enzyme preparations in an animal organism is the subject of research by many scientists. In their opinion, enzyme preparations increase the specific enzymatic activity in the digestive system, enhance the transformation of feed nutrients. Complex substances (protein, carbohydrates, fats) are broken down to simpler ones, easily assimilated by the body [3].

In Ukraine, the majority of livestock products, including pork, are produced using feed of our own production, without the use of industrial feed and premixes. Therefore, it is rather difficult to balance the diets of pigs with the necessary nutrients without the use of feed additives of various natures, which are currently widely produced by various companies. Therefore, how they affect the adaptive abilities and stability of animals in the process of forming productivity is a priority task.

The effectiveness of the use of biologically active and feed additives is determined by conducting scientific, economic and physiological experiments on animals using the method of similar groups. At the

same time, information is obtained on the productivity and quality of metabolism, the digestibility of nutrients in the diet, the effect on the structures of the internal organs of animals, the payback of additives [4].

The purpose of the research was, when some enzyme preparations were included in the diets of fattening young pigs, along with the study of productivity, to investigate their effect on the organs of the digestive system.

Materials and research methods.

The studies were carried out by the method of similar groups on young pigs of a large white breed. The studied feed additives made according to TU U 15.7-301 656 03-012-2004 (MEK-BTU-3) and TU 15.7-301 656 03-015-2007 (minovit and minase) were fed in the doses indicated in the tables.

MSC is a multienzyme composition with enzymes of predominantly pectolytic action. The composition of minovit includes: enzyme, trace elements and vitamins of group B. Minase contains enzymes and trace elements. To prevent the inactivation of enzymes and vitamins in the acidic environment of the stomach, these ingredients are presented in an immobilized form [5].

The composition of the preparation MEK-BTU-3 includes: pectates-transelyminase, activity of 1500 units/g, amylase - 400 units/g, beta-glucanase - 100 units/g. The enzymes of these drugs are biological catalysts that provide the breakdown of non-starch polysaccharides, and are practically not synthesized in the alimentary canal of animals. The basis of the preparations is an enzyme with macerating properties - pectate-transelyminase in the form of MEK-3 immobilized on wheat bran.

Minovit is a new biologically active additive (premix) for animal feed (TU U 15.7 - 30165603 - 0.15: 2007). On the technical side, it is a free-flowing mass of red color with a gray tint, contains pectates-trans-eliminase - 11000-45000mg, vitamin B12 – 2,102,90mg, manganese - 3150-8800mg, zinc - 4500-6600mg, copper - 315- 880mg, iron - 2700-6600mg, cobalt – 22,5-145,0mg, iodine – 22,5-55,0mg, sodium bicarbonate – 14,5-36,5 mg, zeolite (filler) up to 1kg. Optimal conditions for action: temperature 35-45°C, pH 5,5 – 7,5.

The specific enzyme pectate-transelyminase compensates for the absence of enzymes in the pig's body that are capable of hydrolyzing plant non-starch polysaccharides (pectin, lignin, hemicellulose, glucan, pentosans, etc.), loosens the intercellular structure of plant materials, promotes the release of nutrients from the cells of plant feed. It catalyzes the rupture of the α-1,4 glycoside bond in pectin substances and hemicellulose, which leads to loosening of the cementitious substances of plant feed and the destruction of cell wall structures. Thus, it ensures the release of reserve internal nutrients for their breakdown by the enzyme systems of the animal body. Minaza is an environmentally friendly product that does not contain hormones and artificial growth stimulants.

New additives are characterized by the manufacturability of their addition to feed mixtures, mixed feed, premixes, they are well preserved throughout the year. Their use in animal feeding contributes to the production of environmentally safe, high-quality pork while reducing the cost of its production [6].

The preparations were fed to young pigs during a three-month period of final fattening, after which control slaughter was carried out and stomachs were removed from four animals from each group. After release from the contents, they were weighed, samples of the wall from the cardiac, fundic and pyloric zones were excised, which were fixed in 10% formalin [7].

The thickness of the wall and its shells was measured on an MBS-9 stereoscopic microscope using an eyepiece-micrometer ruler. Biometric processing of digital material was carried out by N.A. Plokhinsky [8].

Results and its discussion.

Feeding young pigs with the studied feed additives had a positive effect on their productivity. Average daily gains when feeding MEK-BTU-3 preparation were: in group 1 566 ± 20g, in group 2 - 583 ± 25g, in group 3 - 654 ± 19g, in group 4 - 688 ± 22g or respectively, 3%, 15,5 and 21,5% above the reference level.

In animals with Minovit in the diet, the level of average daily gains was as follows: 1 gr.- 348 ± 15g, 2gr.- 395 ± 22g, 3gr.- 403 ± 12g with a predominance of the experimental groups against the control indicators by 13,3 and 15,8%, respectively.

When Minasa was fed, the gains in the control group were 353 ± 14g, in the experimental group- 422 ± 19g, or by 19,5% were higher (fig. 1).

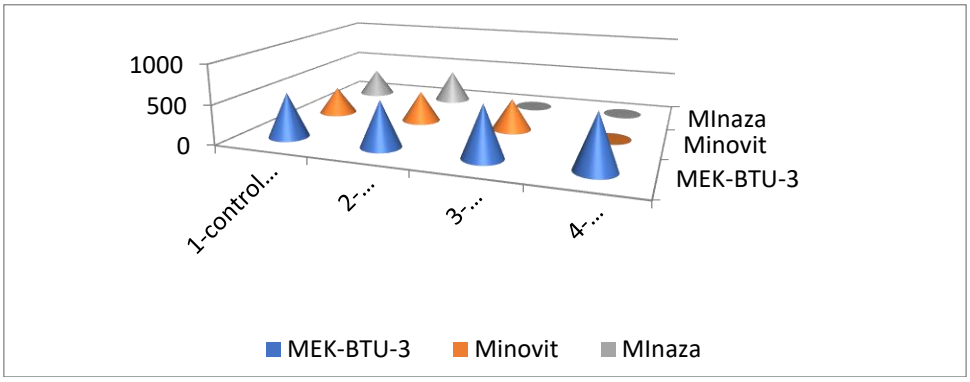

Figure 1. Average daily gains of fattening pigs are for feeding different doses of feed additives, g.

Morphological studies have shown that feeding young pigs with different doses of MEK-BTU-3 causes a tendency to increase the stomach mass, especially with the minimum dose of the supplement in the diet (0,5g/bird per day) (fig. 2).

In general, structural changes in various functional zones of the stomach during the consumption of all three doses of MEK-BTU-3 consist in a tendency to decrease both the thickness of the wall and its membranes (tabl. 1, 2).

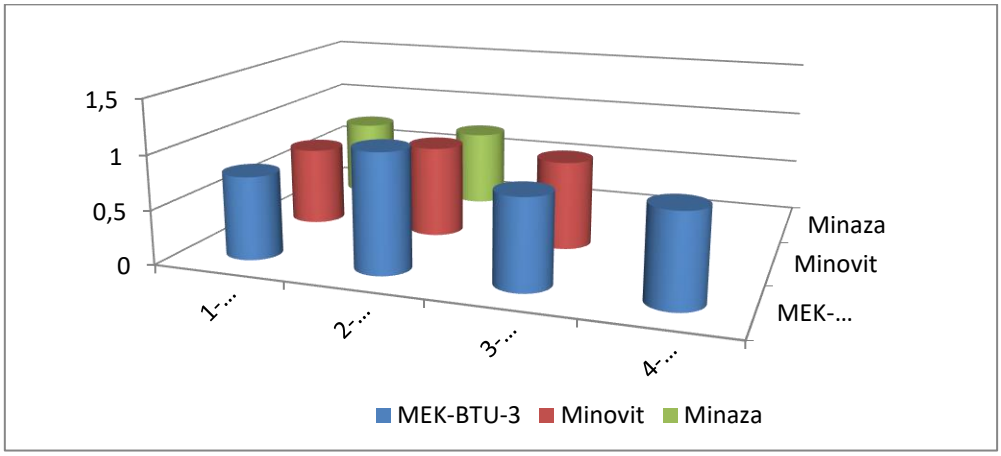

Figure 2. Mass of the stomach of pigs of different experimental groups is after slaughter, kg.

Table 1

Stomach weight of the pig, morphometric parameters are of its cardiac zone

Group and dose of the drug	Stomach weight, kg	Cardiac zone, mm		
		wall	mucous membrane	serous-muscular membrane
Experience 1 – MEK-BTU-3				
1- control, MD*	0,77 ± 0,07	6,09 ± 0,31	2,06 ± 0,23	4,03 ± 0,19
2- experimental, MD+0,5g/head per day	1,1 ± 0,09*	5,62 ± 1,15	1,88 ± 0,1	3,74 ± 1,05
3- experimental, MD + 1,0g/head per day	0,83 ± 0,03	5,42 ± 0,51	2,01 ± 0,14	3,41 ± 3,37
4- experimental, MD +1,5 g/head per day	0,84 ± 0,07	5,37 ± 0,1	2,0 ± 0,42	3,37 ± 0,42
Experience 2 – Minovit				
1- control, MD	0,73 ± 0,05	5,94 ± 0,14	2,51 ± 0,44	3,43 ± 0,56
2- experimental, MD +3 g/100kg of live weight	0,85 ± 0,02	6,46 ± 0,16	2,71 ± 0,11	3,76 ± 0,13
3- experimental, MD +6g/100kg of live weight	0,82 ± 0,07	5,52 ± 0,43	2,54 ± 0,63	2,98±0,56*
Experience 3 – Minaza				
1- control, MD	0,73 ± 0,05	5,94 ± 0,09	2,51 ± 0,29	3,43 ± 0,37
2- experimental, MD +0,6g/100kg of live weight	0,72 ± 0,01	5,74 ± 0,06	2,22 ± 0,12	3,51 ± 0,09

Примітка: MD* - main diet.

Table 2

Morphometric indicators of the fundic and pyloric zones are of the stomach of pigs, mm

Group and dose of the drug	Fundic zone			Pyloric zone		
	wall	mucous membrane	serous-muscular membrane	wall	mucous membrane	serous-muscular membrane
Experience 1 – MEK-BTU-3						
1- control, MD*	3,55 ± 0,5	1,62 ± 0,12	1,85 ± 0,37	5,97 ± 1,6	1,45 ± 0,06	4,52 ± 1,57
2- experimental, MD+0,5g/head per day	2,9 ± 0,47	1,42 ± 0,33	1,48 ± 0,18	5,05 ± 0,39	1,63 ± 0,15	3,41 ± 0,3
3- experimental, MD + 1,0g/head per day	3,28 ± 0,06	1,95 ± 0,04	1,33 ± 0,09	5,13 ± 0,5	2,1 ± 0,48	3,03 ± 0,54
4- experimental, MD +1,5 g/head per day	3,11 ± 0,16	1,72 ± 0,19	1,39 ± 0,5	4,98 ± 0,11	1,44 ± 0,34	3,54 ± 0,37
Experience 2 – Minovit						
1- control, MD	4,86 ± 0,82	2,3 ± 0,98	2,56 ± 0,17	6,84 ± 0,56	1,39 ± 0,19	5,54 ± 0,64
2- experimental, MD +3 g/100kg of live weight	5,87 ± 0,58	3,97 ± 0,53*	1,9 ± 0,05	5,72 ± 0,34	1,26 ± 0,1	4,46 ± 0,23
3- experimental, MD +6g/100kg of live weight	5,71 ± 1,3	2,03 ± 0,38*	3,69 ± 1,1	5,81 ± 0,57	1,27 ± 0,14*	4,54 ± 0,71
Experience 3 – Minaza						
1- control, MD	4,82 ± 0,54	2,26 ± 0,64	2,56 ± 0,11	6,81 ± 0,37	1,36 ± 0,43	5,54 ± 0,11
2- experimental, MD +0,6g/100kg of live weight	4,83 ± 0,15	2,2 ± 0,19	2,61 ± 0,04	5,47 ± 0,28	1,3 ± 0,12	4,17 ± 0,38

In the cardiac zone, the most significant decrease in the thickness of the stomach wall in the experimental groups is observed due to the serous-muscular membrane, which in groups 2-4 becomes thinner by 7,8, 15,4 and 16,4%, respectively (fig. 3).

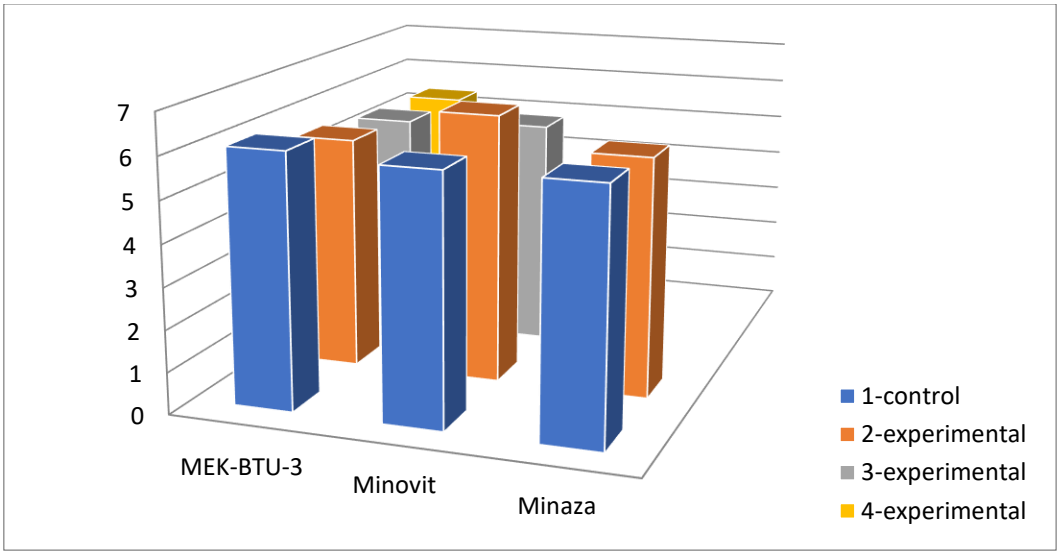

Figure 3. Wall thickness of the cardiac part of the pig`s stomach are for different experimental groups after slaughter, mm.

In the fundic zone, the decrease in the wall thickness of the mucous and serous-muscular membranes of the stomach of pigs in the experimental groups is 20,6, 18,1 and 24,9% compared with the control. In the pyloric zone, these values are even more expressive, that is, the thickness of the serous-muscular membrane decreases by 24,6, 33,0 and 21,7%, respectively, in groups 2-4. The thickness of the mucous membrane also decreases, but to a lesser extent. And in the fourth group, at a dose of MEK-BTU-3 – 1,5g per head per day, the indicators of the mucous membrane are practically at the level of the control indicator.

Feeding Minovit does not significantly affect the change in stomach mass (see fig. 2). But there is a thickening of its wall in pigs of the 2-nd group in the cardiac zone due to an increase in the size of both the mucous membrane and the serous-muscular

membranes. In pigs of the 3-rd group in the cardiac zone, a decrease in wall thickness is observed due to a possible (P <0,05) decrease in the thickness of the serous-muscular membrane. In the fundic zone of the stomach of pigs from research groups, an increase in thickness is observed.

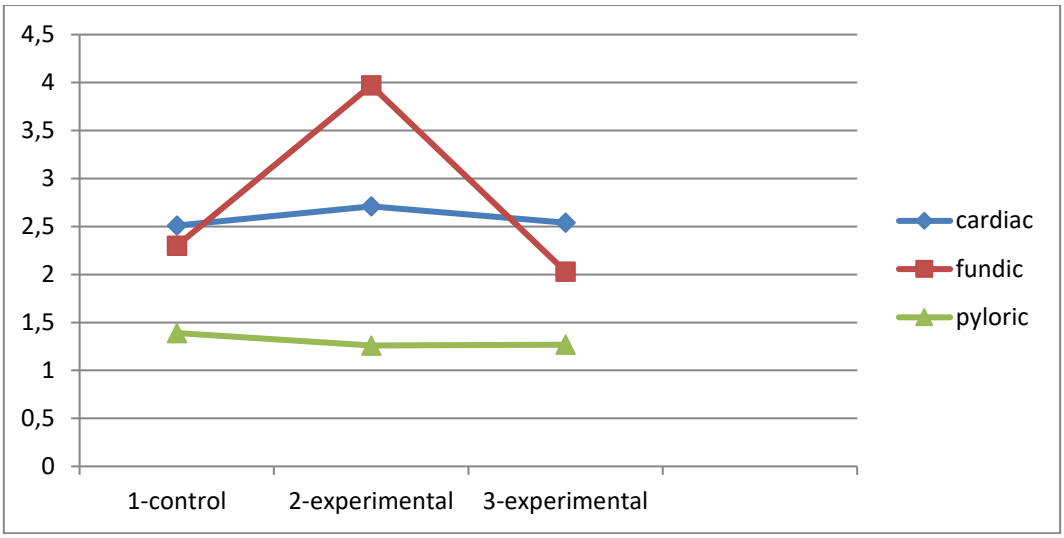

Figure 4. The mucous membrane of different parts of the pig's stomach is for the feeding of Minovite, mm.

The decrease in the thickness of the mucous membrane in the 3rd group (P <0.05) was significant (fig. 5).

When enriching the diet of pigs with minase, no significant difference was obtained between the groups in terms of mass and wall thickness of the functional zones of the stomach. This may indicate the adequacy of the chemical composition of the diet with the drug minase and its effect on the structure of the stomach of pigs. Therefore, no hypertrophic, non-involutional or other shifts in the dimensions of the wall and its membranes are observed. Against this background of feeding, one can only trace a tendency towards a decrease in the thickness of the wall, mucous and serous-muscular membranes in the pyloric zone of the stomach.

When feeding enzyme preparations, it was noted that the cardiac zone of the stomach reacted more to the new feed factor. In it, a thickening of the wall and especially of the serous-muscular membrane took place.

The effect of the feed additive can be stimulating, neutral or impairing. With all these three effects inside

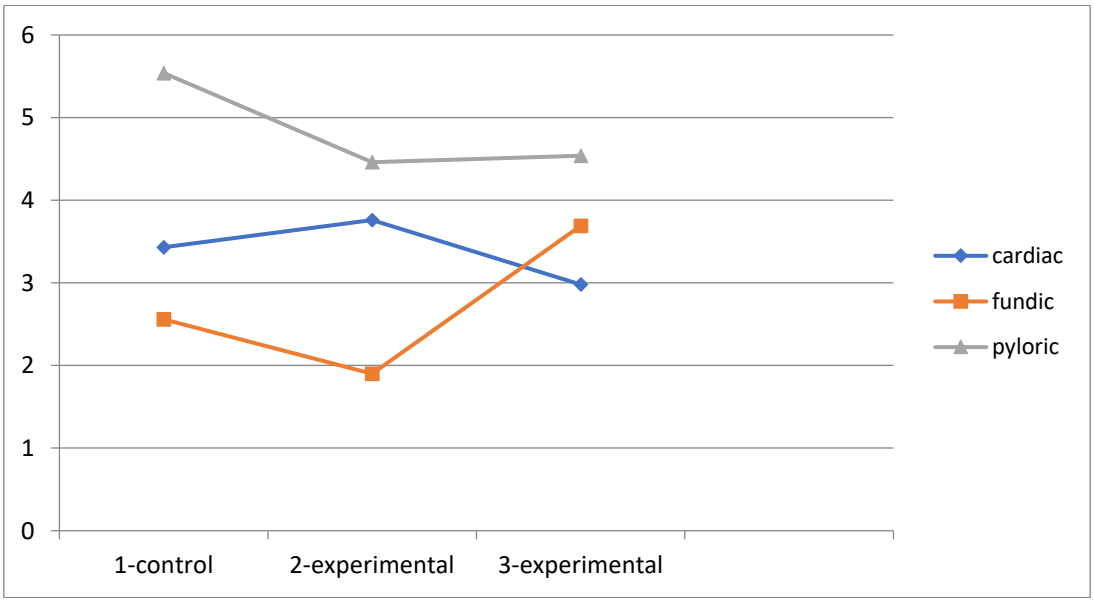

Figure 5. The serous-muscular membrane of different parts of the pig's stomach is for the feeding of Minovit, mm.

organism, complex adaptive processes of a different nature take place, which depend on the chemical composition of the ingredients of the diet, and which do not have an external manifestation. This is especially true for the cavity organs with direct contact of the feed additive with mucous membranes.

Conclusion.

The feeding young pigs with various doses of the MEK-BTU-3 enzyme preparation tends to increase the stomach mass and decrease the thickness of its wall, mucous and serous-muscular membranes in the cardiac, fundic and pyloric zones.

The feeding pigs on fattening of Minovit does not affect the change in stomach mass. 3g of Minovit per 100kg of live weight causes an increase in wall thickness in the cardiac, fundic zones and a decrease in it in the pyloric zone. At 6g per 100 kg of live weight - a decrease in wall thickness in the cardiac zone due to a decrease in the serous-muscular membrane; an increase in wall thickness in the fundic zone due to the serous-muscular membrane with a slight decrease in the size of its mucous wall, and in the pyloric zone of the stomach of pigs - a decrease in wall thickness due to the serous-muscular and mucous membranes.

Minasa in the diets of pigs has no significant effect on the change in the thickness of the wall and its membranes in various functional zones of the stomach.

The obtained results of morphological changes in different zones of the stomach of pigs when they are fed with fattening enzyme preparations may indicate the adaptation of the digestive organs of an adaptive nature, which is advisable in the use of feed additives to increase the productivity of fattening pigs.

In the future, it is necessary to study the reaction of other organs and systems of the pig's body to new feed factors in order to reduce the importance of adaptation to them, so that more feed energy is spent on the formation of products.

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