The effect of fermented feed on the intestinal biocenosis of piglets

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Abstract. By the thirtieth day of life in the feces of piglets, whose mothers and they themselves received biofermented microbiological starter culture of Lesnov compound feed, a significantly higher content of beneficial microflora was found: bifidobacteria, lactobacilli, enterococcus, escherichia in comparison with animals receiving standard compound feed, which indicates a faster quantitative and qualitative formation of obligate microflora. A high quantitative level of normal microflora prevents the reproduction of opportunistic microorganisms in the intestines of young animals and protects piglets from nonspecific gastroenteritis. Keywords. Pigs, biofermentation, obligate microflora, Bifidobacteria (Bifidobacterium), Lactobacilli (Lactobacillus sp.), enterococci (Enterococcus), Escherichia coli (Escherichia coli, Escherichia coli (O157:H7)).

1 Introduction

The disposal of agricultural waste and the secondary use of the obtained products is aimed at solving several important problems: environmental in relation to environmental pollution by industrial waste and a source of additional feed resources for farm animals [1-5]. An effective and safe method of disposal is microbiological biofermentation with Lesnov's starter culture, which is an association of beneficial microorganisms that multiply and act under optimal conditions of humidity (45-55%) and raw material temperature (50-550C) for 24-42 hours [3, 4]. Since the feed product we are testing, which includes beer pellets, bran, sunflower cake, and spent mushroom substrate were subjected to microbiological biofermentation, and we found it necessary to study its effect on their own beneficial microflora after feeding to animals. From the modern point of view, the normal microflora of an animal is considered as a phylogenetically developed system of many microbiocenoses characterized by a certain species composition and occupying one or another biotope in the animal's body [5].

It should be noted that more than 60% of the total number of microorganisms is concentrated in the gastrointestinal tract. The intestinal microflora performs a wide range of

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functions, among which the following are distinguished: formation of the macro- and microscopic structure of the internal organs of an animal; participation in water-salt metabolism, metabolism of carbohydrates, proteins, lipids and other compounds; immunogenic role; protection from pathogenic microorganisms; detoxification of exogenous and endogenous substrates and metabolites [1]. The intestinal microflora includes lacto- and bifidobacteria, which are active antagonists of opportunistic and pathogenic enterobacteria. The level of antagonistic activity of the intestinal autoflora and its performance of the above functions directly depends on the composition and quantitative characteristics of the beneficial microflora of the gastrointestinal tract [2]. Numerous studies have proved that the intestinal microbiocenosis reacts sensitively with qualitative and quantitative shifts to the effects of various factors and, above all, to the qualitative and quantitative composition of feed.

2 The purpose of the research

To study the effect of biofermented feed consisting of beer pellets, wheat bran, sunflower cake, spent mushroom substrate on the quantitative and qualitative composition of the beneficial intestinal microflora of piglets.

3 Materials and methods of research

The object of the study were purebred sows and piglets of a large white breed under the age of one month. According to the principle of analogues, two groups of pregnant sows of 10 heads each were formed, contained in groups in separate machines. During pregnancy and after farrowing, sows with piglets of the first group were on a diet that included fermented compound feed. The animals of the second group were fed with ready-made compound feed produced by Provimi–Azov CJSC SK 15-71 – pregnant sows, SK 14-71 - lactating sows. In the first group, 10 piglets were selected from sows that received fermented feed and ate the same fermented compound feed. In the second group there were 10 piglets-analogues obtained from sows, which were fed with ready-made compound feed produced by Provimi–Azov CJSC (SK 11-01 - piglets of group 0-2).

Bacteriological studies of the microflora in feces (bifidobacteria, lactobacilli, enterococci, Escherichia, Proteus spp., staphylococci, Salmonella, Klebsiella, hemolytic Escherichia, clostridia) were carried out according to generally accepted methods in microbiology for qualitative and quantitative studies of microorganisms.

4 Research results and discussion

From the first 24 hours of life, piglets showed differences in the quantitative and qualitative composition of the intestinal microflora (Fig.1). Thus, in all piglets of the second group, feces contained non-pathogenic escherichia in the amount of 5.93±0.694 lg/g. In three piglets from sows receiving fermented feed, the titer was below 0.5 lg/g feces, and the range of values in the sample ranged from 0.28 to 9.27 lg/g feces, it was not possible to isolate Escherichia from one piglet. According to the literature we have studied, non-pathogenic escherichia are the normal intestinal microflora in piglets for the first 24 hours of life. Based on this, the isolation of these bacteria in large numbers in animals of the second group cannot be considered as dysbiosis or another pathogenic condition. Enterococci were sown from the feces of animals of both groups, while in the first group they were isolated from 7 (70%), and in the second group from 8 piglets, which amounted to 80.0%. When comparing these groups, statistically significant differences in the number of enterococci in feces were revealed.
Lactobacilli were sown in 70.0% and 50.0% of piglets of the first and second groups, respectively, and statistical differences in the content of lactobacilli in piglets of the first 24 hours of life were also found. So, in the first group, their number ranged from 0 to 11.14 lg/g of feces, whereas in the second group from 0 to 3.12. Bifidobacteria in animals of both groups were not sown in the first 24 hours of life.

In addition, one piglet from the second group had klebsiella in the amount of 0.2 lg/g of feces and hemolytic escherichia in two piglets (20.0%) in the amount of 0.96 and 0.49 lg/g.

Thus, a comparative bacteriological study of piglets feces obtained from sows of the first group (fermented feed) and from animals of the second group (standard diet) revealed statistically significant differences, the pathogenetic significance of which is not entirely clear. At the same time, sowing from the feces of piglets obtained from sows of the second group a significantly larger number of Escherichia and hemolytic strains of escherichia gives reason to speak about a higher probability of developing bacterial lesions of the gastrointestinal tract in these animals. Quantitative determination of obligate microflora was performed in the same animals at the age of 5 days (Fig.2).
The main difference in the qualitative composition of the fecal microflora obtained from piglets at the age of five days, compared with them, but in the first 24 hours of life, is the presence of a large number of bifidobacteria. At the same time, in the first group, bifidobacteria were sown in 80.0% of piglets in an amount from 2.59 to 13.52 lg/g feces; in four piglets of this group, bifidobacteria were not isolated. In the second group, bifidobacteria were isolated from 8 heads (80.0%) in amounts from 2.71 to 5.83 and were not detected in two piglets.

We notice that the content of lactobacilli in the feces of five-day-old piglets has sharply increased. Thus, in the first and second groups, their average number increased 2.8 times, while in the first group the average number of lactobacilli was 37.4% higher than in the second.

We observe that all (100.0%) five-day-old piglets had enterococci and Escherichia in their feces. The average number of piglets in the feces of the first group has sharply increased. Thus, the number of enterococci increased 3.6 times; Escherichia - 3.2 times. In the second group, there was a slightly smaller increase: 2.8 times the number of enterococci and 1.1 times Escherichia. The average number of enterococci in 1 g of feces of piglets of the first group was higher than that in comparison with the second by 18.6%, escherichia by 34.1%.

In addition, three piglets of the second group (30.0%) were isolated with staphylococci in the amount from 1.26 to 11.37 lg/g feces. Thus, piglets of the second group have a statistically lower content of all representatives of beneficial microflora and the appearance of opportunistic microflora.

Fig. 3. The quantitative composition of the fecal microflora in piglets on the fifteenth day of life.

In the same animals at the age of 15 days, the content of beneficial microflora in feces was determined (Fig. 3). At this age, the quantitative composition of obligate microflora in piglets begins to stabilize, as evidenced by only a slight increase in the number of bifidobacteria in the first group (by 15.4%) and more noticeable in the second (by 40.0%), after that, the values of this indicator in the first and second groups began to differ by 20.4%.

It is interesting to note that the number of lactobacilli decreased in the first group compared to the five-day age by 15.6%, whereas in the second group the number of these
bacteria increased by 13.1%, which led to a decrease in the difference between the value of the indicator in the first group and the second to 24.1%.

Enterococci were sown from the feces of all (100.0%) fifteen-day-old piglets of the first group in the same average amount as in five-day-old piglets, in the second group the value of this indicator increased by 40.3%, due to which the difference in the numerical value of enterococci between the groups decreased to 7.4%. The number of escherichia by the age of fifteen days in piglets of the first group decreased by 9.4%, in piglets of the second group increased by 62.1%, which reduced the difference between the groups to 33.0%.

Staphylococci were found in the feces of 41.7% of piglets of the first group, in the second group at the age of fifteen days they were found in the same number of piglets, the average numerical index of the content of microbial bodies in 1 g of feces decreased by 14.1%. The difference between the groups was 27.1%.

![Fig. 4](image)

**Fig. 4.** The quantitative composition of the fecal microflora in piglets on the thirtieth day of life.

We continued the study of stool samples from piglets of the same groups on the thirtieth day of life (Fig.4). It should be noted that by the 30th day, the proportion of mothers' milk in the diet of piglets is physiologically significantly reduced. Young animals switch to a diet whose composition is close to that of adult animals, which is manifested by a general decrease in the amount of their own beneficial microflora in both groups. The lactation ability of sows decreases especially sharply when they are insufficiently or inadequately fed, then the piglets completely switch to the diet of adult animals, and this affects the composition of the intestinal microflora. In our experience, the number of bifidobacteria in the first group decreased by 15.4%, lactobacilli – 21.9%, in the second – bifidobacteria by 19.6%, lactobacilli – by 38.5%, due to which the difference in average numerical values between the groups of piglets again became significant.

The number of escherichia in the first group remained at the same level, while in the second group it increased by 38.3%, which by day 30 led to a convergence of the numerical value of the indicator, but the difference still remained statistically significant.

The number of enterococci in the first group decreased by 5.2%, in the second group it remained the same, the difference between the groups continued to be significant and by the month of life amounted to 22.6%.

In all experimental animals (100.0%), staphylococci were sown from the feces by the 30th day of life, but the average number of them decreased by 29.5% compared to the 15th day of life in the first group, and by 31.1% in the second.
Thus, at the age of thirty days, the numerical values of bifidobacteria, lactobacilli, enterococci and escherichia secreted from the feces of piglets of the first group are significantly higher in comparison with the second group (Fig. 5, 6, 7, 8).

**Fig. 5.** Dynamics of changes in the number of bifidobacteria in the feces of piglets of the first month of life.

**Fig. 6.** Dynamics of changes in the number of lactobacilli in the feces of piglets of the first month of life.

**Fig. 7.** Dynamics of changes in the number of enterococci in the faeces of piglets of the first month of life.
5 Conclusion

By the thirtieth day of life in the feces of piglets, whose mothers and they themselves received biofermented feed, there was a significantly higher content of beneficial microflora: bifidobacteria, lactobacilli, enterococci, escherichia in comparison with animals receiving standard compound feed, which indicates a faster quantitative and qualitative formation of obligate microflora. A high quantitative level of its own normal microflora, exceeding the protective one, prevents the reproduction of conditionally pathogenic microorganisms in the intestines of young animals and protects piglets from nonspecific gastroenteritis.

6 Recommendation

During pregnancy and lactation, sows and piglets should use a diet up to the thirtieth day of life, which includes compound feed processed by the method of microbiological biofermentation with Lesnov's starter culture.

References