Dairy goats productivity using the probiotic preparation "Plantarum" in the diet

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Abstract. The influence of the experimental probiotic "Plantarum" on the productive and some exterior-constitutional features of dairy Saanen breed goats was studied. The preparation was developed in the microbiology laboratory of milk and dairy products of the department "Siberian Research Institute for Cheese Making" of the Federal State Budgetary Scientific Institution "Federal Altai Scientific Center of Agrobiotechnology" (FSBSI FASCA). The composition of the preparation includes pure cultures of probiotic strains of lactobacilli and propionic acid bacteria from the "Siberian collection of microorganisms". The probiotic preparation in liquid form was introduced into concentrated feed (oats). The positive effect of the use of the probiotic "Plantarum" on the average daily milk yield of the experimental groups of fully developed (assessed by the exterior) pregnant female goats was established. A significant increase in milk yield was observed in the second and third groups by 1.66% (p < 0.05) and 3.27% (p < 0.05), respectively. With an increase in the average daily milk yield, the main physical and chemical parameters of milk (mass fraction of fat, mass fraction of protein) of the experimental groups did not decrease. There was a tendency to improve the safety of young animals in the second and third groups with an increase in the probiotic dose. At this stage of the work, the optimal dose with the maximum positive effect of introducing the probiotic preparation into the diet of experimental animals (0.8 ml/kg of body weight per day) was established. In this connection, it is necessary to conduct an additional experiment with an increase in the dose of probiotic administration when feeding it to experimental animals.

1. Introduction
The Russian Federation has adopted a Strategy for Improving the Quality of Food up to 2030 in order to provide the country's population with quality and safe food (Decree of the Government of the Russian Federation of 29.06.2016 No. 1364-r). Stimulation of the development of the agro-industrial complex of the Russian Federation, including agriculture, is one of the directions of the Strategy. In this regard, the requirements for intensively developing agriculture are increasing. And the main task is to obtain maximum product yield while maintaining the productive health of the animal. Proper care, maintenance of the animals, as well as balanced complete feeding contribute to the best manifestation of their genetic potential (reproduction, productivity). However, in real conditions of
some livestock farms (lack of feed, unsanitary conditions when keeping animals, etc.), the susceptibility of animals to infectious and non-infectious diseases increases, dysbacteriosis and immunodeficiency develop. This affects the productivity, morbidity and safety of animals [1-2].

For a long time, agricultural producers have used feed antibiotics to prevent the occurrence of various infectious and non-infectious diseases. However, their widespread use contributed to the emergence of antibiotic-resistant strains of pathogenic and opportunistic microorganisms. This leads to the integrity violation of the so-called "biofilm" of the animal gastrointestinal tract. In addition, it was found that antibiotics accumulate in the animal organs and tissues and enter the human body with the finished production. The problem of the antibiotic-resistant microorganisms emergence contributed to the widespread use of safe biologically active and environmentally friendly preparations in animal husbandry, in particular, probiotics. Representatives of the normal microflora of the animal gastrointestinal tract are part of probiotics. That's why these preparations are considered safe and eco-friendly. The use of probiotics in husbandry allows to increase the animal productivity and get high-quality and biologically valuable products from them. Despite the wide range of probiotic preparations used in animal husbandry, the development of new probiotics does not lose its relevance [3-5].

Dairy goat breeding is one of the promising areas of livestock industries. The interest of consumers in goat milk is due to its dietary and therapeutic-prophylactic properties, in particular, the prospects for its use in elderly nutrition and baby food. Increasing the level of milk production in dairy goat breeding will ensure the cost-effective work of agricultural producers. Exterior-constitutional parameters determine the usefulness of the goat development and are an important criterion for assessing the milk production level. Rational balanced feeding using biologically active preparations, in particular probiotics, is the key to raising normally developed animals. Currently, much attention is paid to the use of probiotics in animal husbandry. However, their use in goat breeding remains poorly understood, that justifies the relevance of this scientific work [6-7].

2. Materials and methods

Research of the experimental probiotic preparation "Plantarum" was carried out in the microbiology laboratory of milk and dairy products of the department "Siberian Research Institute for Cheese Making" of the Federal State Budgetary Scientific Institution "Federal Altai Scientific Center of Agrobiotechnology" (FSBSI FASCA) and in the Regional State Budgetary Institution (RSBI) "Altai Regional Veterinary Center for Prevention and Diagnostics of Animal Diseases". The microbiological and biochemical parameters of the probiotic were determined in accordance with the guidelines of MR 2.3.2. 2327 – 08. The scientific and economic experience was carried out in the Peasant Farm Household "Sinkov" in the Kalmansk district of Altai Krai.

Four groups of pregnant goats of 20 heads in each were formed by the method of analog groups to assess the influence of the probiotic "Plantarum" on the productive and some exterior-constitutional features of dairy goats in the type of Saanen breed [8]. The probiotic preparation "Plantarum" was introduced into the basic diet of the first group at a dose of 0.4 ml/kg of body weight per day, of the second group - 0.6 ml/kg of body weight per day and of the 3rd group - 0.8 ml/kg of body weight per day. The control group (4) received a basic diet consisting of concentrates (oats). The diet with the probiotic preparation was continued for 28 days at 100% feed intake. Exterior-constitutional characteristics of the experimental animals were assessed by measuring the basic body parameters (using measuring tape and compasses) and calculating some physique indices. The live weight of the experimental animals was recorded on electronic scales VT-8908-200C with an accuracy of 50 g. The milk productivity of the experimental animals was determined by multiplying by 5 (the number of kg of mother's milk consumed per kg of live weight gain) the absolute increase in the live weight of young animals in the first 20 days of life [9]. Physico-chemical and microbiological milk characteristics of goat experimental groups were determined in the department "Siberian Research Institute for Cheese Making" of FSBSI FASCA.
3. Results

The composition of the developed probiotics must include strains of microorganisms - representatives of the normal microflora of the gastrointestinal tract (GIT) of animals, which will be resistant to aggressive environmental conditions of the digestive tract [5]. The composition of the developed experimental probiotic preparation "Plantarum" included pure cultures of lactobacilli (\textit{Lactobacillus plantarum}, \textit{Lactobacillus casei}) and a multi-strain culture of propionic acid bacteria (\textit{Propionibacterium} spp.). Probiotic cultures from the “Siberian collection of microorganisms” of FSBSI FASCA were selected according to technologically valuable properties: the number of probiotic microflora, antagonistic activity, active acidity, etc. The number of probiotic microflora of the "Plantarum" preparation remained at a therapeutically significant level for 60 days (1x10^6 CFU/ml). The finished probiotic is a light brown suspension with a pronounced fermented milk smell. The appearance of the probiotic preparation is shown in figure 1.

Biologically active drugs used in feeding productive farm animals, including goats, must be tested for toxicity and pathogenicity [10]. The safety of the "Plantarum" was established by studies at the RSBI "Altai Regional Veterinary Center for Prevention and Diagnostics of Animal Diseases".

The experimental groups of female goats in terms of their exterior-constitutional features (measurements of body, body build indices) were fully developed and met the requirements for dairy goats [11].

The efficiency of farm animals using is assessed by their reproductive ability. The increased fertility of goats and the safety of young animals affect the economic performance of animal husbandry, reducing the cost of producing a unit of production.

When feeding goats in the second half of pregnancy with various doses of the probiotic preparation "Plantarum", fertility was within the normal range and amounted to 160% in the first, third and fourth groups, and 155% in the second. The results of the influence of the probiotic on the safety of young animals are presented in table 1.

| Index                             | group 1 | group 2 | group 3 | group 4 |
|-----------------------------------|---------|---------|---------|---------|
| Number of goatlings at birth, heads | 32      | 31      | 32      | 32      |
| Number of goatlings when weaning, heads | 28      | 28      | 30      | 28      |
| Safety, %                         | 87.5    | 90.5    | 93.8    | 87.5    |

The data in table 1 show that the least survival rate of young animals (87.5%) was observed in groups 1 and 4. It should also be noted that with an increase in the dose of probiotic, the mortality of goatlings decreased. Perhaps due to the normalization of the microflora of the gastrointestinal tract and an increase in the body's resistance. The highest percentage of young animal preservation (93.8%) was
noted with the probiotic administration into the diet of female goats of group 3 at a dose of 0.8 ml/kg of body weight per day.

Milk is the main product of dairy goat breeding. Increasing milk productivity and improving the physico-chemical indicators of milk is an important criterion for assessing the work of agricultural producers.

The introduction of a probiotic preparation into the diet of pregnant goats had a positive effect on the milk productivity of experimental animals (figure 2).

The analysis of the data obtained shows that the average daily milk yield of the second (2015 ± 3.54 g) and third (2047 ± 1.87 g) groups exceeded the average daily milk yield of the control group (1982 ± 1.87) by 1.66% (p < 0.05) and by 3.27% (p < 0.05), respectively.

The quality of raw milk is characterized by physical, chemical and microbiological parameters that determine its biological value. Changes in milk production can lead to positive or negative fluctuations in the qualitative and quantitative indicators of raw goat milk. The content of the mass fraction of fat and protein in raw milk is an important criterion when changing the milk productivity of dairy farm animals (figure 3).

According to figure 3, the highest indicators of the mass fraction of fat (8.33 ± 0.01%) and the mass fraction of protein (4.24 ± 0.04%) of raw milk of experimental animals were observed in the third group goats. These indicators significantly exceed the norms (3.2% and 2.8%, respectively) established by regulatory documents, which may be associated with the initial period of lactation [12]. Physico-chemical and microbiological indicators: nonfat milk solids, titratable acidity and the content of somatic cells were within the normal range and no significant differences were found across groups. Quantity of Mesophilic Aerobic and Facultative Anaerobic Microorganisms (QMAFAnM) in four milk samples of Saanen breed goat groups was within the normal range (5x10⁵ CFU/ml). It should be noted that there was a tendency towards a decrease in bacterial contamination of raw milk in the experimental groups in comparison with the control. The smallest bacterial contamination of raw milk...
was determined in a sample from goats of the third group (5x10^3 CFU/ml). It can be assumed that the decrease in bacterial contamination of milk is caused by the antagonistic activity of probiotic microorganisms from the "Plantarum" preparation against the sanitary-indicative microflora (coliform bacteria, QMAFAnM).

The results of measuring the body parameters and body build indices of animals from the experimental groups of dairy goats before and after the experiment did not differ significantly. The greatest positive effect (an increase in the safety of young animals, an increase in the average daily milk yield) was obtained in the third group when the probiotic preparation "Plantarum" was introduced into the diet of goats at a dose of 0.8 ml/kg of body weight per day. These results indicate the advisability of conducting an additional experiment with an increase in the dose of the probiotic preparation.

4. Discussion
Quality and safe food is of great importance in maintaining the health of the population. Nowadays, the idea of a healthy diet is gaining more and more popularity, including the use of organic agricultural products [13-14]. Goat milk can be attributed to a constituent component of a healthy diet due to its dietary, therapeutic and prophylactic properties [15].

To increase milk production and maintain the optimal protein and fat content in milk, probiotics can be used. The developed probiotic preparation "Plantarum" had a positive effect on the milk productivity of the Saanen breed goats. The probiotic increased the average daily milk yield by 1.66% when administered at a dose of 0.6 ml / kg of body weight per day and by 3.27% when administered at a dose of 0.8 ml / kg of body weight per day compared to the control. The indicators of the mass fraction of fat and mass fraction of protein did not decrease. The introduction of the probiotic into the diet of pregnant goats also affected the safety of their young. This indicator in the second group was increased by 3% and by 6.3% in the third group compared with the control. Perhaps, the maximum effect of the probiotic preparation "Plantarum" will be obtained with an increase in its dose of introduction into the basic diet. For that additional experiment is necessary.

5. Conclusion
The experimental probiotic preparation "Plantarum", which includes pure cultures of lactobacilli and propionic acid bacteria, was developed in the department "Siberian Research Institute for Cheese Making" of FSBSI FASCA. The introduction of different doses of probiotic into the diet of the experimental groups of pregnant goats significantly increased the average daily milk yield of the second group by 1.66% (p < 0.05) and the third group by 3.27% (p < 0.05). With increasing dose of probiotics in the second and third groups, there was a tendency to improve the safety of young goats.

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