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RESEARCH OF THE INFLUENCE OF THE DOSE OF PREBIOTIC SUBSTANCES ON THE QUALITY OF SOUR MILK PRODUCTS

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Fermented milk products (yogurt, kefir, acidophilic products) are especially beneficial. They contain live microorganisms that contribute to the normal functioning of the intestines, inhibit the activity of putrefactive microorganisms, enrich the body with B vitamins and natural antibiotics. These products are absorbed faster than milk. They are used for various diseases of the gastrointestinal tract (dysbiosis, gastritis with reduced secretion, colitis, etc.).

As for yoghurts, it is worth emphasizing that real "live" yoghurts are useful, having a shelf life of no more than seven days at a temperature of no higher than 8 degrees Celsius. These products are widely used in the nutrition of various segments of the population, including children under one year of age for the prevention and treatment of dysbacteriosis.

Consequently, the study of the effect of starter culture on functional products is an urgent task in the development and improvement of lactic acid products intended for consumption by the population.

From the analysis of literary sources, it was determined that bifidobacteria in milk develop poorly. The growth of bifidobacteria in milk can be stimulated by substances of a different nature: plant and microbial extracts (carrot, corn yeast, etc.), vitamins, trace elements, mono-oligo- and polysaccharides, etc.

Currently, it is promising to use galactooligosaccharides, a class of indigestible oligosaccharides, derivatives of lactose, as a bifidogenic factor.

They do not break down in the human gastrointestinal tract and reach the large intestine, where they are fermented by the microflora present in it, mainly bifidobacteria and lactobacilli. In addition, they help to improve the absorption of minerals, especially calcium, galactooligosaccharides (GOS) get from lactose.

Therefore, we set the task to investigate the effect of the dose of lactose on the physicochemical, rheological, microbiological and organoleptic characteristics of fermented milk products.

During the experiment, 3 samples of skim milk were used with the addition of lactose in an amount of 0.4 to 2.0% of the milk weight in increments of 0.4. Skim milk without the addition of GOS was used as a control. For fermentation of the samples, 2 versions of starter cultures were used, consisting of: 1) Streptococcus thermophilus, Lactobacillus acidophilus, Bifidobacterium bifidum, in a ratio of 4: 1: 1; 2) Streptococcus thermophilus, Lactobacillus casei subsp. casei, Bifidobacterium bifidum, in a ratio of 4: 1: 1. The starter culture was added in an amount of 3% by weight of milk and a fermented sample at a temperature of (36 ± 2) ° C until a dense curd was formed.

In the finished samples, titrated acidity, microbiological and organoleptic indicators were determined.

With an increase in the dose of the prebiotic (GOS), the titratable acidity increases somewhat more intensively, which may be associated with the stimulating effect of lactose on the microflora of the starter culture, in particular, on the strongest one.

We also studied the effect of the prebiotic dose with different types of starter cultures on the properties of the clots.

Analyzing the data obtained, we can say about a decrease in the capacity of clots in both versions of starter cultures with an increase in the prebiotic dose. This may be due to the water-holding capacity of galactooligosaccharides. Moreover, when using the second version of the starter culture, the clots with a stronger structure retained moisture well.

We also studied the effect of lactose on the growth and development of lactic acid bacteria and bifidobacteria in the studied samples of fermented milk products.

The following was used as a nutrient medium: to determine the quantitative count of bifidobacteria - hydrolyzed milk base (TU 10-02-02-789-192-95), to determine the total number of lactic acid bacteria - sterile skim milk.

The dynamics of the total number of lactic acid microorganisms in the fermentation process using 1 and 2 starter cultures is shown in Table 1 and 2.

Table 1.

Change in the number of lactic acid microorganisms in the process of fermentation of fermented milk drinks (1 version of the starter culture)

Dose of lactose, %	The number of lactic acid microorganisms, CFU / cm^3			
	Duration of fermentation, hours			
	1	2	3	4
0,4	$5\text{-}10^3$	$6\text{-}10^3$	$2\text{-}10^7$	$8\text{-}10^7$
1,6	$5\text{-}10^3$	$9\text{-}10^7$	$6\text{-}10^8$	$6\text{-}10^9$
2,0	$7\text{-}10^5$	$2\text{-}10^5$	$5\text{-}10^7$	$5\text{-}10^9$
0 (control 1)	$2\text{-}10^3$	$5\text{-}10^4$	$3\text{-}10^6$	$2\text{-}10^7$

Table 2.

Change in the number of lactic acid microorganisms in the process of fermentation of fermented milk drinks (option 2 of the starter culture)

Dose of lactose, %	The number of lactic acid microorganisms, CFU / cm^3			
	Duration of fermentation, hours			
	1	2	3	4
0,4	$2\text{-}10^3$	$5\text{-}10^4$	$6\text{-}10^6$	$3\text{-}10^7$
1,6	$9\text{-}10^4$	$3\text{-}10^7$	$2\text{-}10^8$	$4\text{-}10^9$
2,0	$3\text{-}10^5$	$7\text{-}10^7$	$5\text{-}10^8$	$7\text{-}10^9$
0 (control 2)	$3\text{-}10^3$	$8\text{-}10^3$	$3\text{-}10^5$	$5\text{-}10^7$

Analysis of the data given in tables 1 and 2 shows that with an increase in the dose of lactose in the product, a more intensive growth of lactic acid microflora is observed. Increasing the dose of lactose to 1.6% leads to a significant increase in microorganisms compared to the control sample. The subsequent increase in the dose of lactose to 2.0% does not have a significant effect on the growth of lactic acid microflora, which is associated with an increase in the acidity of the environment and the accumulation of metabolic products.

Growth curves of bifidobacteria during fermentation with starter cultures of both variants are shown in Figures 1 and 2.

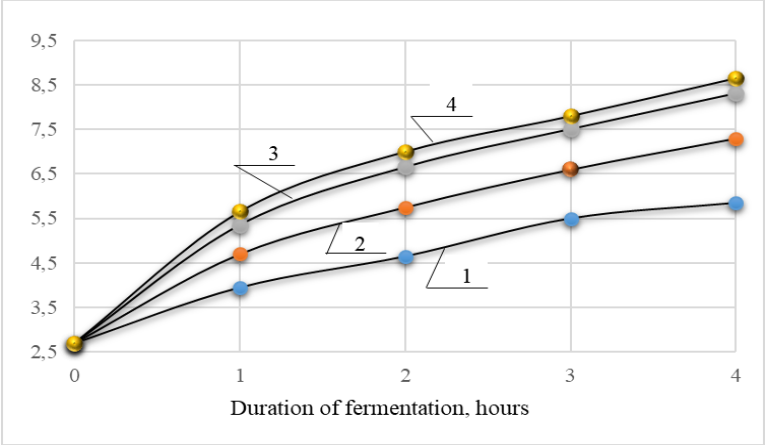

Figure 1. Growth curve of bifidobacteria in the process of fermentation (1 variant of the starter culture) depending on the dose of lactose: 1-0 (control); 2 - 0.4; 3 - 1.6; 4 - 2.0% by weight of milk.

As can be seen from Figures 1 and 2, with an increase in the dose of lactose from 0.4 to 1.6%, there is a noticeable increase in the cells of bifidobacteria in the initial phase of growth, covering the time interval between the achievement of the maximum rate of cell division in comparison with the control sample. A subsequent increase in the dose of lactose does not have a noticeable effect on the growth of bifidoflora, since in these

samples there is a significant accumulation of lactic acid and other metabolic products, as well as as a result of a high density of the bacterial population.

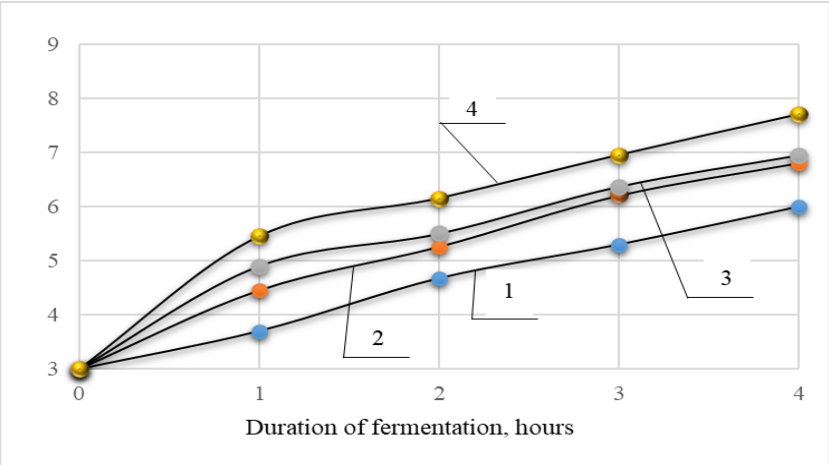

Figure 1. Growth curve of bifidobacteria during fermentation (fermentation option 2) depending on the dose of lactose: 1-0 (control); 2 - 0.4; 3 - 1.6; 4 - 2.0% by weight of milk.

To have a beneficial effect on the human body, a fermented milk product must during the entire shelf life contain at least 10^7 CFU/cm^3 of the total number of lactic acid microorganisms and at least 10^7 CFU/cm^3 of viable cells of bifidobacteria. In this regard, studies were carried out to establish the total number of lactic acid microorganisms and the number of bifidobacteria during storage. The finished samples were stored at a temperature of (4 ± 2) °C. The total amount of lactic acid microflora and bifidobacteria was determined on the 1st, 3rd, 5th, 7th, and 10th days of storage. The research results are presented in table 3.

Table 3.

Change in the number of lactic acid microorganisms during storage of fermented milk products

Dose of lactose, %	The number of lactic acid microorganisms, CFU/cm^3 per day of storage:				
	1	3	5	7	10
1 sourdough option					
0,4	8-10^7	2-10^7	9-10^6	5-10^6	3-10^6
1,6	6-10^9	4-10^9	9-10^8	5-10^8	9-10^7
2,0	5-10^9	4-10^9	1-10^9	7-10^8	1-10^8
(control)	2-10^7	1-10^7	7-10^6	4-10^6	2-10^6
2 sourdough option					
0,4	3-10^7	8-10^6	3-10^6	7-10^5	2-10^5
1,6	4-10^9	2-10^8	8-10^7	4-10^7	2-10^7
2,0	7- 10^9	4-10^8	1-10^8	3-10^7	1-10^7
(control)	5-10^6	1-10^6	6-10^5	2-10^5	1-10^5

Analysis of the data obtained showed that in all samples with the addition of lactose during storage, the number of lactic acid microorganisms and the number of bifidobacterial cells remained at the required level. In the control sample without the addition of GOS, already on the 5th day of storage, the amount of lactic acid microorganisms of bifidobacteria was lower than the required indicator.

Taking into account the data obtained, it can be concluded that GOS have a stimulating effect in relation to bifidobacteria, in particular to the Bifidobacterium bifidum strain, while the required level of viable cells of bifidobacteria will remain during storage of the product at a dose of 0.8% GOS. It is advisable to use this component as a bifidogenic factor in the production of fermented milk products.

References:

1. Бахнова Н.В., Анищенко И.П. Бактериальные концентраты для продуктов функционального назначения. *Молочная промышленность*. 2008. № 3. С. 60-61.

2. Гончарова Г.И., Семенова Л.Л., Ляная А.М., Козлова Э.П. Бифидофлора человека, её нормализующие и защитные функции. Антибиотики и медицинская биотехнология. 2014. Т. 32. № 3. С. 17 - 25.

3. Наукові основи використання синбіотичних комплексів з чистими культурами Bifidobacterium Iongum у виробництві ферментованих функціональних молочних продуктів. Молочное Дело. 2008. № 3. С. 21 – 23.