Production of yoghurts by incorporating stevia powder as a functional ingredient

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Abstract. The functional ingredients in yoghurt are a trending topic and they are easily degradable increasing the usage in food and agriculture industry. The yogurt is combined with the volatile components of stevia powder while adhering to the conventional method. This yoghurt's effectiveness was determined by analyzing its chemical composition, microbiological makeup, and sensory assessment when stevia powder was added. The results implied that sample 1 showed that a liquid mass had formed, which did not give the result we expected. Sample 2 was found to be a homogeneous, thick, viscous mass, and sample 3 was found exactly what we expected: a homogeneous mass with the same viscosity. The taste and smell became specific and white. As a result, T3 was approved and subjected to additional testing for the presence of mold and live bacteria in yoghurt. The results of these tests showed that the bioactive ingredient contained in the yoghurt was reducing the microbial counts.

1 Introduction

Yoghurts are dairy products fermented with lactobacilli. During the digestion of milk protein, these lactobacilli process nutrients beneficial to the body. Yoghurt is a valuable product among dairy products. One glass of kefir contains 8 grams of protein, 400 mg of calcium, potassium, and B preparations. As a result of the activity of lactobacilli, yoghurt contains more vitamins B12, B3, and A compared to milk. Like any other finished product, commercial yoghurt contains preservatives, stabilizers, emulsifiers, flavours and colours, refined sugar, gelatin, and a small number of lactobacilli. Yoghurt is produced by the usage of thermophilic lactic acid bacteria [1-3].

The process of cooling and preparing these products is carried out for 3-5 hours at a temperature of around 40-45°C. The microflora of yoghurt includes thermophilic streptococcus starters at a ratio of 4:1. The use of non-traditional natural means to sweeten the composition of products is considered one of the current problems. With this in mind, based on research, we decided to add stevia to yoghurt to give it a sweeter taste [4].

Stevia (*Stevia rebaudiana Becht*) is a herbaceous plant of Asteraceae family, native to Paraguay and grown in Japan, China, Indonesia, Bulgaria and other countries. Reaches 1.5

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m in height. The leaves are large, 4-7 cm, opposite, pubescent. Stevia blooms in autumn. This is a subtropical crop that requires warmth and moisture. Stevia leaves (6.0-6.5%), stems (1.5%) and roots (0.6%) contain valuable stevioside, which is approximately 150-300 times sweeter than sucrose. Taking these parameters into account, experiments were carried out on the use of stevia plant powder as a sugar substitute in the production of yoghurts for our diabetic patients. The stevia plant can be grown, and its leaves can be easily brewed as tea or consumed in its pure form, without processing. However, we used ready-made yoghurt powder [5-8].

The global demand for functional yoghurt is increasing; particularly dried plant leaves, fruit juices and powdered forms of plant derivatives are expanding. Consequently, the aim of the research was to check the possibility of incorporating stevia powder in dairy products. The main conclusions on the merits and demerits of physical-chemical, chemical, and physical techniques were provided.

2 Materials and methods

In our scientific work, there is an unconventional method of preparing yoghurt and its implementation, for which we conducted several experiments. The yoghurt samples were prepared according to different recipes. Initial laboratory work was carried out in the research laboratory of the department "Technology for the production of food products and functional products" of the Tashkent Institute of Chemical Technology. First of all, freshly milked milk with a fat content of 3.2% was chosen for the experiment; in addition, the necessary ingredients for preparing classic yoghurt were prepared, in particular, bacterial drops, kefir 1%, corn starch, and stevia plant powder.

The yoghurt was prepared in laboratory conditions with the addition of the stevia plant. Sample recipes are given below; each of our recipes contains the stevia plant, except for samples 1 and 2, in addition to stevia, kefir, and corn starch [9-11].

The shelf life of the acquired items was tested by using the microbial counts, with a 10-day gap between the first and 30th days. Every ten days, the medium's pH and titratable acidity were examined, along with the samples' chemical makeup. A thorough organoleptic assessment was done to identify the best samples with extended shelf life. A 5-point hedonic scale was used by ten members of the tasting panel to evaluate the scent, texture, and general acceptability. Yogurt compositions with stevia powder added are displayed in Table 1 [12-14].

The Figure 1 shows the stevia powder which was used to produce the yoghurt and the measurement was done through the electronic scale.

Table 1. Yoghurt samples added with stevia powder.

Ingredients	**T_0**	**T_1**	**T_2**	**T_3**
Milk (fat -3.2%) - L	10	10	10	90
Stevia powder – g	-	90	90	90
Kefir - g	-	-	100	100
Starter culture - g	50	50	50	50
Corn starch -g	-	-	100	-

Figure 2 illustrates the sample preparation, chemicals and utensils used in the experiments and the method of analyzing the yoghurt and the sample bottle which was used to keep for further analysis.


Fig. 1. Stevia sample measurement and preparation.


Fig. 2. Yoghurt sample preparation and analysis.

Samples prepared according to the proposed recipes were kept inside the incubator for 6 hours at 40-42°C. The organoleptic appearance of the finished yoghurt samples was as follows [9, 15, 16].

3 Results and discussion

The final product complies with GOST 31981-2013 "Yoghurts," which is the standard used for classifying yoghurts. Group 1 includes enhanced semi-fat yoghurt, which is the product under "general technical conditions." Tables 2 and 3 provide the derived products' physico-chemical and organoleptic properties [16].

Table 2. Organoleptic properties of yoghurt.

Indicator	**The GOST norms**	**T-1**	**T-2**	**T-3**	**T-4**
Appearance and consistency	Homogeneous and fairly viscous when add flavor components - with their existence	Same as the standard			
Taste and smell	Because of the additional ingredients while working with food flavoring agents and components.	With the taste of milk	A homogeneous liquid mass with a sweet taste characteristic of a particular yoghurt. White color.	A homogeneous, thicker, viscous mass. White color. The taste is sweet, characteristic of a particular yoghurt.	A uniform, white mass of equal viscosity with a sweet taste characteristic of a particular yoghurt.
Colour	Because of the color of the additional component, while working with food flavor components.	Slight greenish white, uniform			

Based on the experiments carried out, the following results were obtained; the organoleptic properties of product samples were studied. Analysis of the samples showed that a liquid mass had formed in sample 1, which did not give the result we expected. Sample 2 gave a homogeneous, thick, viscous mass, and sample 3 gave exactly what we expected: a homogeneous mass with the same viscosity. The taste and smell became specific and white.

Table 3. Physical characteristics and the chemical properties of yoghurt.

Indicator	GOST norms	T_0	T_1	T_2	T_3
Fat %	0.1-10.0	3.19	3.23	3.31	3.34
Protein, %, minimum	2.8	4.32	4.38	4.32	4.23
Solid Non Fat %, minimum	8.5	14.92	15.14	12.35	15.93
Titratable Acidity	not ≥100	29	32	33	32
Phosphatase enzyme	Absent	Absent	Absent	Absent	Absent

Furthermore, as per the microbiological safety indications, yoghurt needs to meet the norms and regulations mentioned in Table 4.

Table 4. Microbiological characteristics of yoghurt.

Indicator		GOST standards	T_0	T_1	T_2	T_3
The mass of the yoghurt (g) in which it is not allowed	*E. coli* group	0.1	-			
	S. aureus	1.0	1.0	-		
	pathogenic bacteria salmonella spp.	25	-			
L. monocytogenes		Not allowed	-			
Yeast count - CFU/g - (cm^3)		50	74	30	27	30
Mold counts CFU/g - (cm^3)		50	74	23	-	20

The results shown in Table 3 indicate that over the 30-day storage period, no harmful microorganisms or bacteria belonging to the Escherichia coli group were found in either the control or experimental samples. In contrast to the experimental samples, staphylococci were detected in the control samples; they were still within the anticipated range, though. The experimental samples had significantly lower yeast contents (30, 27, and 30 CFU/g, respectively) than the control sample, which had a yeast level significantly higher (74 CFU/g) than allowed by GOST (50 CFU/g). The samples that were treated with stevia powder.

4 Conclusion

In conclusion, we can say that our unconventionally prepared yoghurt with vegetable stevia is in demand and recommended for production as a dietary product for diabetics, the elderly, and children. In addition, we should emphasize the high economic efficiency of the technology we offer. Analysis of the samples showed that a liquid mass had formed in sample 1, which did not give the result we expected. Sample 2 gave a homogeneous, thick, viscous mass, and sample 3 gave exactly what we expected: a homogeneous mass with the same viscosity. The taste and smell became specific and white.

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