Production technology and nutritional value of combined yogurt for dietary nutrition

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Abstract*: Milk and milk products are in steady demand and included in the daily human diet. This paper describes the technology and the nutritional and biological value of the combined yogurt for dietary nutrition. The pumpkin puree and oat flour are used as functional vegetable ingredients in the yogurt formulation. Developed yogurt contains 2.8% of protein, 2.0% of fat and 15% of carbohydrates. The protein of yogurt consists of all essential and nonessential amino acids with high level of isoleucine (2.27 g/100g), leucine (3.45 g/100g), valine (2.46 g/100g), proline (3.91 g/100g) and glutamic acid (7.30 g/100g). Among fatty acids the larger parts occupies caprylic (27.45%), capric (20.13%) and lauric (20.15%) acids. The yogurt has a sufficient amount of the important vitamins, such as A, E, D, C and B group.

***Index Terms*: yogurt, oat flour, pumpkin puree, technology, nutritive value**

I. INTRODUCTION

The most important strategic task of the food industry is to meet the needs of all categories of the population in high-quality, biologically complete and safe food products. The unfavorable environmental situation in the cities leads to the need to create functional dairy products enriched with various fillers that enrich the product with proteins, minerals, vitamins [1, 2].

In recent years, the deficit of food proteins of animal origin in Kazakhstan is aggravated by the general decline in the effective demand of the population. Around 20-25% of all milk is used for production of milk products. Due to modern equipment and production technology and high nutritional and biological value, the production of skimmed milk products and their consumption is constantly growing [3, 4].

Milk and dairy products occupy a significant place in the diets of the population, being a supplier of a large number of essential components of nutrition. Currently, the market of this group of products is sufficiently developed and saturated with a large number of types, varieties and names. Among these products, an important place is occupied by milk and sour-milk drinks, traditionally popular among the population of all ages [5, 6].

One of the representatives of fermented dairy products, through which scientists solve vital problems, is yogurt. This product has been known for a long time, it is a Bulgarian national drink. Yogurt production is constantly expanding and growing, in this regard, the development of technology and research of food safety of yogurt is an urgent problem [7].

Yogurt increases the overall resistance of the body, improves the immune system, as it contains enzymes that remove harmful substances and toxins from the body. It contains vitamins B2 and B12, helps to restore the beneficial intestinal microflora destroyed by antibiotics [8].

Factors shaping the quality of yoghurts:

-Consumer properties (appearance, consistency, smell and taste);

-Nutritional value of the product;

- Harmless (the product should not contain harmful substances to humans).

Yogurt can be defined as a fermented dairy product, produced mainly with the participation of two types of bacteria:

- streptococcusthermophilus
- Lactobacillus bulgaricus.

Yoghurt is produced by introducing starter into the milk, under the action of which protein coagulation occurs and the formation of a spatial structure of milk proteins with inclusions of milk fat and moisture [9, 10].

The purpose of this work is to develop a technology for the production of yogurt with the addition of plant components and study its nutritional and biological value.

II. MATERIALS AND METHODS

For the preparation of yogurt, whole cow's milk is used, grain and vegetable fillers, flavor additive and vitamin C are introduced, pasteurization, homogenization and cooling of the mixture to the fermentation temperature, introduction of starter, fermentation, cooling, mixing the curd, packing. As a starter, a direct-acting starter YC-X 16 is used. Oatmeal is used as a grain filler, pumpkin puree is used as a vegetable filler. Ascorbic acid is necessary to provide many processes in the body – the eruption and growth of teeth, the formation of blood cells, ensuring the body's resistance to disease.

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Promotes more rapid healing of postoperative wounds and bone fractures. Vitamin C is necessary for the proper growth and development of the child's body, increases resistance to disease. The daily rate of vitamin C for adults is 60 mcg, for children 30 – 70 mg. Table 1 shows the formulation of yogurt.

Table 1 – Yogurt formulation

Ingredient	Content, %
Cow's milk with 2,5 % of fat	73
Pumpkin puree	15
Oat flour	2
Starter culture	0.03
Sugar	10
Vitamin C	0.039

Milk of the 1st grade is used for production, with acidity not higher than 20 T, without any mechanical contamination. The milk is heated to a temperature of 30-40 0C, cleaned and then normalized to a fat content of 2.5 %. 15 % solution of oatmeal on milk – a suspension of oatmeal – is prepared. Then it is introduced it into the normalized milk. The mixture is homogenized at a temperature of 60-65 0C and a pressure of 10-15 MPa and then pasteurized at a temperature of 87-92 0C for 10-15 minutes. The pasteurized mixture is cooled to a temperature of 35-37 0C and fermented with a starter of direct fermentation YC –X 16 Thermophilik Yoghurt Culture at the rate of 1 starter pack per 500 liters of fermenting mixture.

Next, pumpkin puree is made and fermentation is carried out at a temperature of 40-42 0C for 4-6 hours until the acidity of the clot reaches 70 0T. At the end of fermentation sugar and vitamin C, pre-diluted in a small amount of boiled water are introduced.

The finished product is mixed, cooled in a tank to 14 0C, and poured into consumer containers. The product is stored at a temperature no higher than 4 0C no more than 36 hours from the date of manufacture of the product. Figure 1 shows the technological scheme of yogurt production.

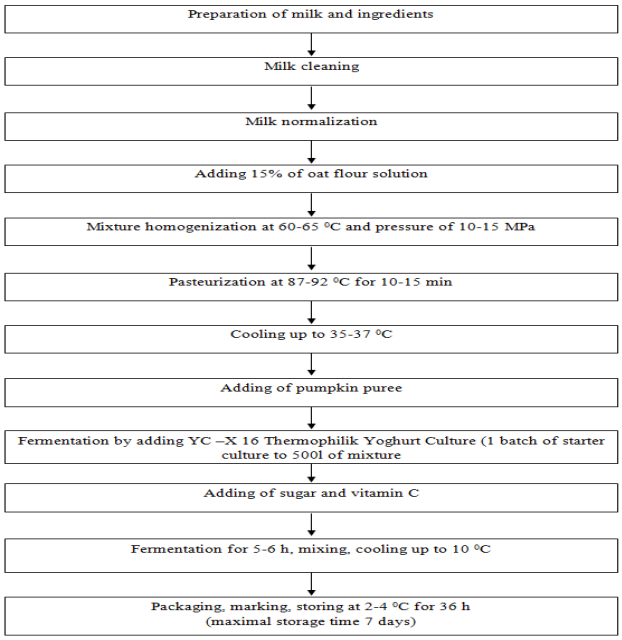

Figure 1: Technological scheme of yogurt production

III. RESULTS AND DISCUSSION

The implementation of most of the requirements laid down in the basis of the process of development of formulations and technology of special dairy-based products for dietary nutrition has allowed to obtain new products that differ in nutritional, biological and energy value. To ensure the normal functioning of the body, the food must include substances which are called essential nutritional factors. Their chemical structures, which are not synthesized by the enzyme systems of the body, are necessary for the normal flow of metabolism. These include essential amino acids, vitamins, some fatty acids, minerals and trace elements [11].

Carbohydrates by chemical structure are divided into simple sugars and polysaccharides, and depending on the participation in metabolism, can be divided into digestible and indigestible. Non-digestible carbohydrates include a group of "rough" dietary fibers: cellulose, hemicellulose; "soft" dietary fibers: pectin, gums, dextrans, as well as phytic acid and lignin (aromatic polymer of non-carbohydrate nature) [12].

The nutritional value of yogurt was studied, the results of the study showed: the mass fraction of protein – 2, 8 %, the mass fraction of fat – 2 %, the mass fraction of carbohydrates – 15 %, the mass fraction of ash – 0.65 %, the mass fraction of pectin – 0.257 %; the energy value of combined yogurt is 90 kcal.

Protein quality indicators are associated with the evaluation of amino acid composition of products. Table 2 shows the indicators of essential amino acids of yogurt.

Table 2 – Essential amino acids concentration in yogurt

Amino acid	Concentration, g in 100g of protein		Amino acid score, %	Level of satisfaction, %
	Ideal protein	Yogurt		
Valine	5,0	2,46	49,2	49,2
Isoleucine	4,0	2,27	56,75	56,75
Leucine	7,0	3,45	49,2	49,2
Lysine	5,5	2,91	52,9	52,9
Methionine	3,5	0,87	24,55	24,85
Threonine	4,0	1,66	41,5	41,5
Tryptophan	1,0	0,56	56,0	56,0
Phenylalanine	6,0	1,77	29,5	29,5

The content of non-essential amino acids in 100 g of yogurt is given in table 3.

Table 3 – Non-essential concentration in yogurt, g/100g of protein

Amino acid	Content, g
Alanine	1.32
Arginine	1.44
Asparagine acid	2.74
Histidine	1.1892
Glycine	0.8376
Glutamic	7.3044
Proline	3.91
Serine	2.18
Tyrosine	1.86
Cystine	0.42

Proteins are the most valuable and essential components of food. Getting into the body, they are broken down under the influence of enzymes to

amino acids, some of which breaks down into organic keto acids; proteins and substances of protein nature. Eight amino acids are not synthesized by the body and are therefore called essential [13]. These are isoleucine, leucine, lysine, methionine, phenylalanine, tryptophan, threonine and valine. It is known that fats (lipids) not only provide the energy value of the product, but also are a necessary component of many cellular structures, especially membranes, perform various biochemical and physiological functions, participate in the absorption of some nutrients [14]. Fats are a source of essential vitamins and other biologically active substances. Theoretically, the composition of free fatty acids in the dairy-vegetable product is calculated in table 4.

Table 4 – Fatty acid composition of yogurt, %

Fatty acid	Code	Content, %
Caprylic	$C_{8:0}$	27,450
Capric	$C_{10:0}$	20,130
Lauric	$C_{12:0}$	20,150
Myristic	$C_{14:0}$	6,890
Myristoleic	$C_{14:1}$	0,610
Palmitic	$C_{16:0}$	6,120
Stearic	$C_{18:0}$	1,010
Oleic	$C_{18:1}$	3,698

The results of studies of the amount of vitamins in the dairy-vegetable product are shown in table 5.

Table 5 – Vitamin concentration in yogurt, mg/%

Vitamin	Content
A (retinol), (mg/l)	0.4
E (α-, β-, γ-, δ– tocopherols)	1.4
C (ascorbic acid)	20.0
B_1 (thiamine)	0.43
B_2 (riboflavin), g/l	0.68

Analysis of the experimental data given in table 5 shows that the product has a sufficient amount of the important vitamins, such as A, E, D, C and B group.

IV. CONCLUSION

The current stage of manufacturing functional milk products is aimed at developing new formulations by adding new types of raw materials, various functional ingredients, as well as applying new technological solutions to improve the quality of the finished product. Analysis of the data shows that the combined yogurt contains the whole complex of useful biologically active substances: amino acids, fatty acids and vitamins. The resulting fermented milk product can be recommended for daily and dietary nutrition.

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