ТЕХНОЛОГІЇ ХІМІЧНОЇ, ХАРЧОВОЇ ТА ЛЕГКОЇ ПРОМИСЛОВОСТІ

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NEW METHODS OF MILK AND DAIRY PRODUCTS P ROCESSING AND HEALTH EFFECTS

The purpose of this article is to analyze the technology of fermented dairy products, which is among the production technologies of milk and dairy products. As is well known, milk and dairy products are among the most important nutrients for growing, developing and leading a healthy lifestyle. In order to make the most of the important human qualities of milk, a number of technologies are used to increase its durability, protect the health of consumers and obtain various dairy products. Thanks to these rapidly developing production technologies from the past to the present, it has become possible to obtain more standard and high-quality milk and dairy products.

The article examines milk and its composition, the importance of milk and dairy products for human health, the development of milk and dairy products, the main technologies of milk production, research in the field of fermented milk technology, written scientific works and articles on milk and dairy products. The information contained in the portals of the engaged enterprises was used. The article examines milk and its composition, the importance of milk and dairy products for human health, the development of milk and dairy products, the main technologies of milk production, research in the field of fermented milk technology, written scientific works and articles on milk and dairy products. The information contained in the portals of the engaged enterprises was used.

The technologies used in the processing of milk and dairy products affect both the quality and consumption of these products, as well as the health of producers. Recently, new technologies used in the processing of milk and dairy products are considered important in terms of the quality of the products obtained. The article examines the features of these technologies, the processing process and the specifics of the products obtained. This is important for both researchers and consumers interested in dairy processing.

As a result, it is noted that in recent years there has been a significant increase in interest in the impact of milk and dairy products on human health. Today, such products are called functional, that is, products that have an impact on health in addition to their nutritional value.

It is emphasized that the technologies used to preserve the nutritional value of milk and clean it from bacteria harmful to human health are gradually developing. This increases the consumption of milk and dairy products and maximizes their health benefits.

Keywords: *milk and dairy products, pasteurized milk production technologies, fermented milk products.*

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НОВІ МЕТОДИ ПЕРЕРОБКИ МОЛОКА ТА МОЛОЧНИХ ПРОДУКТІВ І ОЗДОРОВЧИЙ ВПЛИВ

Метою цієї статті є аналіз технології кисломолочних продуктів, що відноситься до технологій виробництва молока та молочних продуктів. Як відомо, молоко та молочні продукти є одними з найважливіших поживних речовин для зростання, розвитку та ведення здорового способу життя. Щоб максимально використати важливі для людини якості молока, застосовують низку технологій, що дозволяють підвищити її довговічність, захистити здоров'я споживачів та отримати різноманітні молочні продукти. Завдяки цим технологіям виробництва, що швидко розвиваються, з минулого в даний час стало можливим отримувати більш стандартне і якісне молоко і молочні продукти.

У статті розглядаються молоко та його склад, значення молока та молочних продуктів для здоров'я людини, розробка молока та молочних продуктів, основні технології виробництва молока, дослідження в галузі кисломолочної технології, написані наукові роботи та статті про молоко та молочні продукти. Використовувалась інформація, що міститься на порталах залучених підприємств.

Технології, що використовуються при переробці молока та молочних продуктів, впливають як на якість та споживання цих продуктів, так і на здоров'я виробників. Останнім часом важливими з точки зору якості продуктів вважаються нові технології, що застосовуються при переробці молока і молочних продуктів. У статті розглядаються особливості цих технологій, процес обробки та специфіка одержуваних продуктів. Це важливо як дослідників, так споживачів, зацікавлених у переробці молочних продуктів.

В результаті зазначається, що останніми роками значно зріс інтерес до впливу молока та молочних продуктів на здоров'я людини. Сьогодні такі продукти називають функціональними, тобто продуктами, що впливають на здоров'я, крім своєї харчової цінності.

Наголошується, що технології, які застосовуються для збереження харчової цінності молока та його очищення від шкідливих для здоров'я людини бактерій, поступово розвиваються. Це збільшує споживання молока та молочних продуктів і максимізує їхню користь для здоров'я людини.

Ключові слова: молоко та молочні продукти, технології виробництва пастеризованого молока, кисломолочні продукти.

Introduction (Relevance of the topic) milk; It is a very rich source of vital nutrients such as protein, fat, lactose, vitamins, minerals, enzymes, hormones and immunoglobulin. Dairy products can be consumed not only to

meet the nutritional needs of consumers, but also for their role in preventing various ailments such as obesity, osteoporosis, dental caries, poor gastrointestinal health, cardiovascular diseases, hypertension, and colorectal cancer. Leading nutritionists consider milk and dairy products an important part of a balanced diet. In this study, the technological features of the production of milk and dairy products, the production of fermented milk products are emphasized.

Analysis of existing literature; Health is one of the most important criteria in food selection in developed countries. Diet significantly influences an individual's risk of obesity, cardiovascular disease, cancer, and other lifestyle-related diseases. [1; 2;]. Whether milk or fermented milk products have long been an important part of the human diet, fermented milk products are known to have various therapeutic properties.

Milk is a porcelain-white food with a unique taste and odor, which is secreted in the mammary glands to feed the newborn babies of female mammals and contains all the nutrients needed by the baby in the required proportions.

Milk contains most of the essential nutrients found separately in other foods. It is an important source to meet the body's need for Ca, P and B2 vitamins. It is also a good source of high-value protein, especially essential amino acids. In addition, it also contributes to the meeting of vitamin A and vitamin B1. One liter of milk provides 685 kilocalories of energy [3, p. 3].

In order to preserve these properties of milk, which is a basic food in terms of essential nutrients, especially protein, mineral substances and vitamins, as well as protective properties, raw milk should be milked, cooled and stored from the breast in accordance with the rule and correctly.

Milk is named according to the organism from which it is obtained. For example, cow's milk, sheep's milk, breast milk. However, when milk is mentioned in the food sector, cow's milk is generally understood.

The milk yield of dairy animals and the proportions of the substances in its composition also vary with the effect of the breed. For this reason, crossbreeding studies between animal breeds are carried out to develop dairy animals with high milk yield and rich milk composition. Table 1 contains the composition of the milk of various humans and a number of animals. As can be seen from this table, sheep and buffalo milk differ from other milks in terms of solid content and fat content.

Table 1

Milk content of humans and some animals (%).

Type of milk	Water	Solid substance	Oil	Protein	Lactose	Ash
Human milk	88.,00	12.00	3.3	1.84	6.5	0.36
Cow's milk	87.25	12.75	3.7	3.60	4.7	0.75
Sheep's milk	81.70	18.30	6.3	6.20	4.9	0.90
Goat's milk	86.05	13.35	4.2	3.90	4.4	0.85
Buffalo milk	82.55	17.55	8.0	5.80	4.2	0.75

Source: Food technology.2013: 9.

Production of Pasteurized and Sterilized Drinking Milk. The term pasteurization is used for certain heat treatments. The term derives from the name of French scientist Louis Pasteur, who in the 1864s found that wine had to be heated to 50-60ºC to be stable. The first reliable commercial pasteurizers were introduced in 1922. The process developed rapidly in the following years and became an important position in the dairy industry.

Sterilized drinking milk is the drinking milk obtained by the sterilization process in hermetically sealed opaque packages and the destruction of all microorganisms and their spores that cause deterioration.

According to the food codex of a number of countries, pasteurization; It is made to reduce the number of all vegetative forms of pathogenic microorganisms in milk, a large part of other microorganisms, extending the shelf life of milk, resulting in minimal physical, chemical and sensory changes, and for at least 15 seconds at 72ºC or 30 minutes at 63ºC or other equivalent heat treatment carried out under conditions [4, p.17].

According to the same communiqué, pasteurized drinking milk refers to drinking milk that is obtained by completely destroying the vegetative forms of pathogenic microorganisms and a large part of other microorganisms by applying pasteurization without harming the natural and biological properties of raw milk and cooled to a temperature not exceeding 6ºC in a short time after pasteurization.

The purposes of pasteurization are:

- Destroying vegetative forms of all unhealthy bacteria in milk, in other words making milk safe for human consumption;

- Prolonging the durability period by providing a certain reduction in terms of other microorganisms without spoiling the flavor of milk;

While these two purposes are quite different from each other, in practice they are highly interrelated.

Pasteurization is carried out by a number of methods:

1. Long-term pasteurization at low temperature. 1.Long-term pasteurization at low temperature. The pasteurization temperature is controlled with a thermometer and when the temperature of the milk in the tank reaches the desired temperature, it is kept at this temperature for a certain period of time. The heat treatment norms applied in this process are 30-32 minutes at 62-65ºC.

2. Short-term-ultra pasteurization at high temperature. In this method, milk is heated up to 72-75ºC and kept at this temperature for at least 15-20 seconds. In this method, heat exchangers operating according to the continuous flow system are used. Heat exchangers can be plated or tubular. Heat exchangers can be plated or tubular.

3. Pasteurization with plate heat exchangers. Plate heat exchangers are the most commonly used type in the pasteurization of milk. The plates are made of stainless steel and their thickness varies between 0.25-1.25 mm. The surfaces of the plates have a corrugated shape. With such a design, it is possible to transmit the heat to the milk at the most appropriate level.

4. Plate pasteurization with hot water heating. Here, pre-pasteurized milk is preheated to approximately 58ºC. Then it is sent to the separator and cleaned. The oil ratio is standardized and homogenized if necessary. The milk coming out of the heating section is sent to the holding pipe by means of a pump, where it is kept for the desired time.

5. Vacuum steam heated pasteurization.

Sterilization method is the hermetic packaged product, which destroys all microorganisms and spores that will cause deterioration under normal storage conditions, in order to obtain a commercially sterile product that can be stored at room temperature, in a suitable time-temperature combination such as at least 13 minutes at 115ºC or 3 minutes at 121ºC, It is a long-term heat treatment at high temperature.

Sterilization methods applied in the production of long-lasting drinking milk can be grouped under two groups: Classic sterilization. Sterilization of milk with the classical method is done by heating at 110-120°C for 20-40 minutes. Sterilization of milk with the classical method is done by heating at 110-120°C for 20-40 minutes. Pressures above atmospheric pressure are required for sterilization of milk in an autoclave above 100°C [4, p. 23].

Sterilization in an autoclave (batch). All heat treatments at temperatures above 100ºC are carried out in closed systems called autoclaves, operating at a pressure above atmospheric pressure. Steam or water is used as a heating medium in autoclaves. If water is used as the heating medium, that is, if the sterilization process is carried out in water, temperatures above 100ºC are achieved by heating this water with steam and trapping the steam in the autoclave in the form of saturated steam.

Sterilization in steam cabinets. Cabinets used for sterilization are designed to be resistant to pressure. Steam is given directly into the cabinet by the steam pipes located under the perforated cabinet floor, and the milk is heated by the steam. The condensed steam is removed from the cabinet with the discharge pipe.

The volitional process of long-life milk. UHT is an acronym consisting of the initials of the English words "Ultra High Temperature" (UHT). UHT milk means milk that has been heat treated at ultra-high temperature. The principle of this method is to increase the temperature of the milk to a very high temperature (135° C-140° C) and to keep it at this temperature for a very short time (2-5 seconds) to destroy the microorganisms and spores in the milk [5, p.10]. The temperature-time values used in the UHT method ensure that all microorganisms that cause milk spoilage are killed. With this application, the substances (enzymes) that cause deterioration in the milk are also controlled and the milk becomes almost sterile. However, heat treatment alone is not sufficient for UHT sterilized milk to last longer than pasteurized milk. After this application, the milk is filled in sterile packages under completely sterile conditions.

On the other hand, it is not possible to process all raw milk into UHT milk. Raw milk with very high microbiological quality should be used in UHT milk production [6, p. 99-100]. Therefore, UHT milk, which is obtained by heat treatment of high-quality raw milk with the least change in its nutritive and natural qualities, and whose production is completed by filling it in boxes under sterile conditions after sterilization, without allowing any microorganism contamination, lasts longer because there is no decomposition factor left in it.

One of the methods used to obtain long-lasting milk is the indirect UHT method. In the indirect UHT method, the milk is homogenized as a rule after preheating. The heating of milk to high temperatures is carried out in heat exchangers. After sterilization, the milk is sent to the deaerator under vacuum in order to remove the undesirable aroma substances and gases formed in it. In some UHT facilities that operate indirectly, the sterilized milk is sent to the expansion vessel after sterilization, where its temperature is reduced from 138ºC to 112ºC in a very short time. The hot water in the system should be circulated throughout the system for 30 minutes and the surfaces that will come into contact with the milk should be sterilized before starting the work. Raw milk, taken from the balance tank by pump, passes through the first part of the sterilization ring and goes to the regeneration section, where preheating is performed. Preheating is done in two stages. In the first stage, the temperature is increased to 65ºC. The milk heated to 65ºC is sent to the homogenizer with the help of a by-pass and after the homogenization process, it comes to the second stage with pressure and the preheating process is completed.

The preheated milk is sent to the sterilization department. Here, it is brought to the sterilization temperature of 135-150 ºC with the help of steam in the plate heat exchanger and kept at this temperature for a few seconds. The milk coming from the plate heater comes to the regeneration section and pre-cooling is done. The main cooling is carried out with cold water in a plate cooler.

Milk sterilized by direct or indirect method and cooled to filling temperature (20ºC) is sent either directly to the aseptic packaging machine or into sterile containers for storage. Sterile containers, which are resistant to a certain pressure and equipped with special auxiliary equipment, are double-walled and designed as cylindrical and curved on both sides.

Storage containers can be placed vertically or horizontally. It is sterilized at 35ºC for 45 minutes before use. The pipes that enter the tank and take the product to the packaging machine are also sterilized at the same time. Then, the surfaces are cooled with the help of cold water passing between the double walls. Pressurized sterile air is supplied to remove the condensate water and after the tank surfaces reach 20ºC, the product is taken inside [7, p.291].

No protective additives are used in dairy products sterilized by UHT technique. In the production of commercial drinking milk (pasteurization, UHT), there is no significant change in the basic nutrients (protein, fat, carbohydrate) of the milk, while losses occur in some water-soluble vitamins. These are negligible compared to the boiling process. These are negligible compared to the boiling process.

Fermented products such as yogurt and kefir can be easily produced using UHT milk.

Production of fermented dairy products. The concept of fermentation is a phenomenon that generally covers many complex processes that result in biochemical reactions performed by microorganisms, and as a result, energy is obtained through the oxidation of organic components (such as carbohydrates). Anaerobic microorganisms, which do not use oxygen, produce a series of flavor and aroma compounds as fermentation products while continuing their vital activities by using sugars. In addition, they convert sugars into ethanol, lactic acid and hydrogen.

Fermentation, which has an important place in food technology, is an important unit of biotechnology with the production of alcohol and acid from sugars under anaerobic conditions.

Fermentation shares a history with human history in dairy products. While humans benefited from the animals around them, fermented products formed important dairy products as their main source. This mechanism, which forms an integral part of natural life and was discovered by chance, forms the basis of the fermented milk products sector, which is an industrial area today.

As a result of fermenting milk using various starter cultures, products with different taste, aroma and structure are obtained and these products are called fermented milk products. There are more than 400 yoghurt and similar and fermented milk products known under different names in the world, which basically show similar characteristics.

Fermented dairy products:

- products produced by lactic acid fermentation;
- products produced by yeast-lactic acid fermentation;
- it can be classified as products produced by mold-lactic acid fermentation.

The main fermented dairy products can be listed as yoghurt, yoghurt derivative fermented dairy products, buttermilk, kefir, kumiss.

When we say fermented dairy products, the following definitions are understood [8, p.4]:

- Fermented milk product: Dairy products, which are produced by the fermentation of milk by suitable microorganisms and lowering the pH value in a way that will cause or not cause coagulation, and that contain microorganisms in sufficient numbers, live and actively;
- Yoghurt: Fermented milk product that specifically uses symbiotic cultures of Streptococcus thermophilus and Lactobacillus delbrueckii subsp. bulgaricus for fermentation;
- Acidophilus milk: Fermented dairy product in which a specific culture of Lactobacillus acidophilus is used for fermentation;
- Kefir: It is a starter culture product containing fermented kefir grains or fermenting yeasts (Saccharomycesunisporus, Saccharomyces cerevisiae and Saccharomyces exiguus) with different strains of Lactobacillus kefir, Leuconostoc, Lactococcus and Acetobacter genera and yeasts that ferment lactose (Kluyveromyces marxianus) and do not. Kefir is a diet dairy product fermented with a mixture of alcohol and lactic acid. Its yeast contains kefir mushrooms, lactic acid yeast streptococci and milk yeast. The milk is pasteurized, cooled, and up to 5% of bacterial working yeast is added. Store at 18-24^{0}C for 8-16 hours. The acidity increases to 75-800T during this period. The product is cooled to 8-11^{0}C and stored for 12-36 hours for yeast development. Kefir is made of 2.5%, 3.2% and 6% fat and fat-free. It contains 0.2-0.6% ethyl alcohol [9, p.240].
- Kumiss: Fermented milk product using specifically Lactobacillus delbrueckii subsp. bulgaricus and Kluyveromyces marxianus cultures for fermentation;
- Buttermilk: Fermented milk product prepared by adding water in yogurt or adding cultures of Streptococcus thermophilus and Lactobacillusdelbrueckii subsp. bulgaricus to milk whose dry matter is adjusted;
- Concentrated fermented dairy products: Fermented dairy products such as strained yoghurt or bag yoghurt, winter yoghurt, labneh, salted yoghurt, kurut, whose protein ratio is increased to at least 5.6% before or after fermentation;
- Powdered/dried fermented dairy products: Fermented dairy products such as yoghurt powder with a moisture content of less than 5%;
- Assorted fermented dairy products: Up to 50% by weight of sugar and/or sweetener, fruits and vegetables and their juices, purees, pulps and preparations and preserves thereof, cereals, honey, chocolate, nuts, coffee, spices and other counterfeit and adulteration composite dairy product containing non-dairy ingredients such as non-dairy flavorings;
- Fermented dairy product heat-treated after fermentation: A dairy product whose fermentation has been stopped by heat treatment.

There are many health benefits associated with the consumption of fermented dairy products. Many studies have shown that some fermented milk products have antimicrobial, antimutagenic, anticarcinogenic, antihypertension properties and have benefits on mineral metabolism, reduce food allergy symptoms and LDL cholesterol levels. It is known that dairy products are the main carriers of probiotic microorganisms, and there are many clinical studies showing the health effects of probiotic strains. Based on these findings, it can be said that probiotic dairy products can have positive physiological effects on humans, but more research is needed on such products [10, p.122].

It has been clinically shown that some diseases related to the gastrointestinal system such as lactose intolerance, diarrhea, colon cancer, inflammatory bowel disease and other bacterial infections can be prevented by excessive consumption of yogurt [11, p.261].

In recent years, there has been an increasing interest in preventive health services compared to disease curative approaches all over the world. Consuming food produced with probiotic microorganisms is becoming more and more common. Probiotics can be defined as live microbial food supplements that benefit the host by improving the microbial balance of the gut. Whether living microorganisms are essential for specific health benefits remains unclear [2, p.303]. But among the most promising health effects of probiotics are improving acute diarrhea in children, reducing the risk of respiratory infections, alleviating infant milk allergy, and alleviating irritable bowel syndrome. Probiotics exert their beneficial effects on health by normalizing the host's microbiota, inhibiting pathogens, interacting with the host's immune system, and maintaining their own metabolic activities. The possible health benefits associated with consuming probiotic foods have been shown in many studies [12, p.49].

Results: In recent years, interest in the effects of milk and dairy products on human health has increased considerably. Today, such products are called functional, that is, foods that have an impact on health beyond their nutritional value.

Technologies applied to protect the nutritional value of milk and to purify it from harmful bacteria for human health are gradually developing. This increases the consumption of milk and dairy products and maximizes their benefits for human health.

Milk is a rich source of nutritious compounds that can be enriched and/or modified to provide the best benefit to consumers. It has been shown by many studies that the products produced as a result of fermentation with milk lactic acid bacteria (LAB) have many benefits for health as well as protecting milk. Today, the interest in preventive health practices has increased. In this respect, it is thought that especially dairy products fermented by probiotic microorganisms stimulate the immune system by improving the human microbiota.

Today, despite all scientific research, the effects of fermented milk products and accompanying microorganisms on human health are still not fully understood. It is thought that a clearer understanding of the effects of fermented milk products on human health will make an important contribution to preventive health practices.

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