IRSTI 65.63.03

A.A. Turar[1] – *main author*, ©
S.T. Azimova[2], F.A. Makhmudov[3], A.A. Zheldybayeva[4], N.K. Bekmurat[5]

[1,5]Master's student, [2,3,4]PhD, Associate Professor

ORCİD
[1]https://orcid.org/0009-0002-1724-2842 [2]https://orcid.org/0000-0002-8992-8889
[3]https://orcid.org/0000-0002-7791-1588 [4]https://orcid.org/0000-0003-2207-4177
[5]https://orcid.org/0009-0008-6174-6363

[1,2,3,4,5]Almaty Technological University,
Almaty, Kazakhstan
[1]azat.turar@mail.ru

https://doi.org/10.55956/RISN9017

DEVELOPMENT OF DETOXIFYING NATIONAL DAIRY PRODUCTS

Abstract. The article provides a comparative analysis of the physico-chemical composition of various types of milk: animal and vegetable, as well as mare's and camel's milk, including traditional fermented beverages – shubat and koumiss. Special attention is paid to the study of the interaction of these beverages with pectin in various concentrations (3%, 5% and 7%) in order to determine the optimal conditions for obtaining functional products with improved structural, mechanical and organoleptic characteristics. A comparative analysis of shubat and koumiss with their fresh dairy analogues has been carried out. Shubat has a low pH (3.8-4.5), high acidity (70-110°T), fat content up to 10% (against 4.5-5% in milk) and ash content up to 0.85%. Koumiss is characterized by a pH of 3.5-4.6, an acidity of 60-120°T, an alcohol content of 0.5-2.5%, carbon dioxide of 0.4-1.0%, reduced protein (1.8-2.2%) and fat (1.0-2.0%) compared with fresh milk. In both products, lactose is reduced to 0.8-1.5%, which improves tolerance. Both have increased antimicrobial activity and are promising for further studies with pectin. The results obtained confirm the prospects of using fur coat as a basis for creating innovative functional products focused on modern requirements of healthy and environmentally friendly nutrition.

Keywords: pectin, detox, shubat, koumiss, functional products, organoleptic properties, physico-chemical composition, food industry.

Turar A.A., Azimova S.T., Makhmudov F.A., Zheldybayeva A.A., Bekmurat N.K. Development of detoxifying national dairy products //Mechanics and Technology / Scientific journal. – 2026. – No.1(91). – P.83-94. https://doi.org/10.55956/RISN9017

Introduction. In the context of the deteriorating environmental situation and the increasing anthropogenic impact on the environment, one of the priorities of modern society is to ensure food security and improve the quality of nutrition. One of the significant risk factors for human health is food contamination with heavy metals and other toxicants, which actualizes the need to use natural detoxifiers and expand the production of functional foods [1].

Pectin is a promising natural biopolymer with pronounced sorption properties. Its use in the food industry allows not only to improve the textural and

organoleptic characteristics of products, but also to give them additional functional properties. It is especially important to study the possibilities of using pectin in combination with traditional fermented milk drinks - shubat and koumiss, which have long occupied an important place in the diet of the population and have high biological value [2].

Shubat is characterized by increased fat content, density and probiotic properties, while koumiss is characterized by more pronounced acidity, the presence of ethanol, lactic acid and almost complete absence of lactose, which makes it suitable for people with its intolerance. However, data on the interaction of these drinks with pectin and the effect of the latter on their physico-chemical and organoleptic characteristics are limited, which determines the relevance of conducting relevant studies [3].

The purpose of this work is to study the interaction of pectin with shubat and koumiss at various concentrations, as well as to determine the optimal conditions for obtaining functional products with improved structural and consumer properties.

Materials and methods. Raw dairy materials: for the development of functional detoxifying dairy products, the following traditional fermented beverages and fresh dairy bases were used:

Shubat – obtained from fermented camel milk. Characterized by high acidity (pH 3.8-4.5), titratable acidity of 70-110°T, fat content 5-10%, and reduced lactose content.

Koumiss – fermented mare's milk with mixed lactic acid and alcoholic fermentation. pH 3.5-4.6, acidity 60-120°T, alcohol content 0.5-2.5%, and reduced protein and lactose.

For comparative analysis, fresh camel milk and fresh mare's milk were also used as reference matrices to assess the impact of fermentation on physicochemical properties.

Plant-based component: Alpro Almond Milk was selected due to its moderate fat content (1.20 g/100 g), carbohydrate level (2.60 g), and low protein concentration (0.50 g). This component served as a supplementary base for evaluating its compatibility with fermented dairy beverages.

Pectin – commercial food-grade pectin (high-methoxyl type) was used as a structuring agent and natural detoxifier due to its sorption activity toward heavy metals and toxicants. Three concentrations were tested: 3%, 5%, and 7%.

Granulated sugar used to improve taste and aid pectin dispersion.

Experimental Samples: functional dairy samples were prepared by combining shubat or koumiss with almond milk and varying quantities of pectin. The formulations are presented in Table 5 of the study:

- Sample I – 3% pectin;
- Sample II – 5% pectin;
- Sample III – 7% pectin.

Each sample contained:

- 50 ml shubat or koumiss;
- 50 ml almond milk;
- 16 gr sugar.

Pectin was added according to the required concentration (3%, 5%, 7%).

All ingredients were weighed using laboratory electronic scales with ± 0.01 g accuracy.

Preparation of Raw Materials: all dairy and plant-based ingredients were pre-cooled to 4°C and mixed immediately before processing to prevent microbial proliferation. Pectin was pre-mixed with sugar in a dry state to prevent clumping during hydration.

Hydration and incorporation of pectin: The milk base (shubat/koumiss + almond milk) was heated over medium heat to improve pectin dispersion. The pre-mixed pectin-sugar blend was gradually added under continuous stirring to ensure uniform distribution.

Heat treatment: The mixture was brought to a boil and maintained for 30 seconds to ensure pasteurization while preventing excessive protein denaturation. This step facilitated pectin activation and gel formation under the acidic conditions characteristic of shubat and koumiss (pH < 4.5).

Cooling and structuring: After heat treatment, samples were cooled to room temperature (20-22°C), poured into sterile molds, and refrigerated at 4°C for 4-6 hours to allow complete gelation and stabilization of the structure.

Organoleptic evaluation: organoleptic characteristics (appearance, color, odor, taste, and consistency) were assessed according to national standards.

The optimal sample was determined based on:

- Homogeneity
- Viscosity and structural stability
- Absence of defects (syneresis, graininess, delamination)
- Balanced taste and aroma profile

Statistical processing: all measurements were performed in triplicate. Mean values and standard deviations were calculated. Differences between shubat-based and koumiss-based samples were interpreted qualitatively due to the study's comparative nature.

Research results. The results of the analysis of the physicochemical composition of plant-based milk products available on the market of the Republic of Kazakhstan, cow's milk, and mixtures of cow's and plant-based milk are presented in Tables 1 and 2 and compared with data reported in the literature. The titratable acidity and density of cow's milk and its mixtures with plant-based milk were measured in triplicate. The chemical composition of various types of animal and breast milk is presented in Table 1, while the composition of plant-based milk products available on the market of the Republic of Kazakhstan is shown in Table 2.

Table 1

Chemical composition of various types of animal and breast milk

Name	Cow	Mare	Sheep	Camel	Breast milk
Protein, g	3.30	2.70	5.50	3.50	1.20
Fat, g	1.98	1.60	5.30	4.50	3.80
Carbohydrates, g	4.80	6.20	4.60	4.90	7.20
Water, ml	89.21	89.00	83.64	86.22	87.49
Ash, g	0.71	0.50	0.96	0.88	0.31
Energy value, kcal/100 g	50.22	50.00	88.10	74.10	67.80

For further research, mare's and camel's milk were selected. According to Table 1, sheep's milk has the highest protein (5.50 g/100 g) and fat content (5.30 g/100 g), whereas mare's milk has the lowest fat content (1.60 g/100 g). Camel's milk contains 3.50 g/100 g of protein. Human breast milk is characterized by the highest carbohydrate content (7.20 g/100 g), followed by mare's (6.20 g/100 g) and

camel's (4.90 g/100 g) milk. The water content ranges from 83% to 89%, with the lowest value observed in sheep's milk, reflecting its higher nutrient density. Ash content, indicating mineral composition, is highest in sheep's milk (0.96 g/100 g) and lowest in human breast milk (0.31 g/100 g). The energy value ranges from 50.00 kcal/100 g (mare's milk) to 88.10 kcal/100 g (sheep's milk). Despite its low protein content, human breast milk provides relatively high energy (67.80 kcal/100 g) due to its fat and carbohydrate content. Overall, each type of milk exhibits a distinct nutritional profile.

Table 2

Chemical composition of vegetable milk presented on the market of the Republic of Kazakhstan

Title	Proteins, g/100 g	Fats, g/100 g	Carbohydrates, g/100 g	Water, g/100 g	Ash, g	Energy value, kcal /100 g
Classic oatmeal Nemoloko	1.00	1.50	6.50	90.10	0.90	45.00
Classic oatmeal extralight Nemoloko	1.00	0.50	6.50	91.10	0.90	35.00
Almond Alpro	0.50	1.20	2.60	94.90	0.80	24.00
Coconut Alpro	0.90	2.70	0.10	95.40	0.90	19.00
Soy Alpro	3.00	1.80	2.50	91.80	0.90	39.00
Soy Bite	3.60	1.80	1.00	92.60	1.00	36.00
Oatmeal Bite	1.50	1.50	7.50	88.50	1.00	50.00
Almond Bite	0.70	1.50	6.00	90.90	0.90	40.00
Coconut Velle	0.60	1.50	5.00	92.10	0.80	36.00
Almond Velle	1.00	1.50	6.00	90.60	0.90	40.00
Oatmeal Velle	1.50	3.20	7.50	86.90	0.90	65.00

The analysis of the chemical composition of various plant-based milk products available on the market of the Republic of Kazakhstan (Table 2) shows significant variability in the content of key macronutrients and energy value. Soy-based drinks, such as "Alpro" (3.00 g/100 g) and "Bite" (3.60 g/100 g), have the highest protein content, making them closest in nutritional value to cow's milk. Other types, including oat, almond, and coconut drinks, contain significantly less protein, ranging from 0.50 to 1.50 g/100 g.

The fat content is highest in "Alpro" coconut milk (2.70 g/100 g) and "Velle" oat milk (3.20 g/100 g), whereas lighter options such as "Nemoloko" contain minimal fat (0.50 g/100 g). Oat-based drinks exhibit the highest carbohydrate content (up to 7.50 g/100 g in "Velle" and "Bite"), due to the natural presence of starch, which also influences the sensory properties of the product. In contrast, "Alpro" coconut milk represents a low-carbohydrate option, containing only 0.10 g/100 g of carbohydrates.

The water content ranges from 86.90% to 95.40%, with "Velle" oat milk having the highest dry matter content and "Alpro" coconut milk the lowest. Ash content, reflecting mineral composition, ranges from 0.80 to 1.00 g/100 g, indicating the presence of micro- and macronutrients, although in lower amounts compared to animal milk. The energy value varies depending on composition: it is lowest in "Alpro" coconut milk (19 kcal/100 g) and highest in "Velle" oat milk (65 kcal/100 g), due to differences in carbohydrate and fat content.

Thus, plant-based milk products represent a diverse group with varying nutritional and functional profiles, allowing for the consideration of different

consumer needs, ranging from vegetarians to individuals with lactose intolerance. For further research, “Alpro” almond milk was selected due to its moderate fat content (1.20 g/100 g), carbohydrate content (2.60 g/100 g), and low protein content (0.50 g/100 g). The physicochemical properties of camel’s and mare’s milk, along with their comparative analysis, are presented in Table 3.

Table 3

Physicochemical properties of mare’s and camel milk

Indicator	Mare’s milk	Camel milk
Coagulation temperature	20-25°C (with starter culture)	Does not curdle at normal temperature
pH (acidity)	3.8-4.5 (high acidity)	6.5-6.7 (almost neutral)
Titrated acidity	70-110°T (Turner)	16-20°T
Water content	85-87%	86-88%
Protein	3.0-3.5%	3.1-3.5%
Fat	5.0-10.0% (depending on the formulation)	3.0-5.5%
Lactose	Lower than fresh (partially processed by bacteria)	4.5-5.0%
Density	1.020-1.035 g/cm^3	1.029-1.035 g/cm^3
Ash content (minerals)	0.8-0.9%	0.7-0.8%
Vitamins	Partially preserved: B1, B2, C, E, D, PP	B1, B2, C, D, E are more pronounced
Osmotic stability	Lower, prone to stratification during storage	Higher, but quickly deteriorates without cooling
Heat resistance of proteins	Decreases due to fermentation	High, can be pasteurized
Antimicrobial activity	It is expressed due to lactic acid bacteria	Natural, but weaker

Based on the data in Table 3, a comparative analysis of the physicochemical properties of shubat and fresh camel milk reveals notable differences primarily due to fermentation. Shubat is characterized by a lower pH (3.8-4.5) and higher titratable acidity (70-110°T), indicating active lactic acid fermentation, whereas fresh camel’s milk remains near neutral (pH 6.5-6.7) with low acidity (16-20°T), which makes it more susceptible to microbial spoilage.

Shubat coagulates at 20-25 °C, unlike fresh milk, which does not curdle at room temperature due to lower enzymatic activity. Both products exhibit similar protein and fat contents, however, the fat content in shubat may reach up to 10% depending on additives. Lactose levels are reduced in shubat, which enhances its digestibility for individuals with lactose intolerance.

The density of both products is similar, however, shubat demonstrates lower osmotic stability and prone to separation during improper storage. Its slightly higher ash content indicates an increased mineral concentration. Vitamins are better preserved in fresh milk, while shubat proteins are less heat-stable, in contrast to the heat-resistant proteins in camel milk that allow for pasteurization.

Shubat also demonstrates stronger antimicrobial activity due to organic acids and lactic microflora. Overall, shubat is a functional fermented product with enhanced biological activity and digestibility [8-14]. Physicochemical properties and the comparative analysis of koumiss and mare’s milk are presented in Table 4.

Table 4

Physicochemical properties of koumiss and mare's milk

Parameter	Koumiss	Mare's milk
Origin	Fermented mare's milk	Fresh mare's milk
Condition	Liquid, slightly frothy, with gases	Liquid, watery, homogeneous
Color	Milky white, maybe with bubbles	Bluish-white
pH (acidity)	3.5-4.6	6.7-7.0
Titrated acidity	60-120°T (depends on the maturity of the koumiss)	6-8°T
Density	1.010-1.030 g/cm^3	1.027-1.032 g/cm^3
Water content	89-91%	~89-91%
Squirrels	1.8-2.2% (partially split during fermentation)	2.0-2.5%
Fats	1.0-2.0% (partially split)	1.2-1.5%
Lactose (milk sugar)	0.8-1.5% (the main part is processed by bacteria)	6.0-7.5%
Alcohol (ethanol)	0.5-2.5% (depends on the strength of the koumiss)	Missing
pH (acidity)	3.5-4.6	6.7-7.0
Titrated acidity	60-120°T (depends on the maturity of the koumiss)	6-8°T
Density	1.010-1.030 g/cm^3	1.027-1.032 g/cm^3
Water content	89-91%	~89-91%
Squirrels	1.8-2.2% (partially split during fermentation)	2.0-2.5%
Fats	1.0-2.0% (partially broken down)	1.2-1.5%
Lactose (milk sugar)	0.8-1.5% (the main part is processed by bacteria)	6.0-7.5%
Alcohol (ethanol)	0.5-2.5% (depends on the strength of the koumiss)	Absent
Carbon dioxide	0.4-1.0%	Absent
Ash content (minerals)	0.4-0.6%	0.5-0.6%
Vitamins	B1, B2, C, A, D, E – partially preserved, + folic acid	B1, B2, C, D – more fresh
Enzymes	Present (lactic acid and alcohol bacteria)	Natural enzymes in small amounts
Antimicrobial properties	High levels are due to lactic acid and alcohol	Moderate
Heat resistance	Low-pasteurization destroys bacteria	Can be pasteurized at 63-72°C

The analysis of the physicochemical properties of koumiss and fresh mare's milk reveals significant differences due to fermentation processes. Koumiss, a product of mixed lactic acid and alcoholic fermentation, has a lower pH (3.5-4.6) and higher acidity (60120°T) compared to fresh mare's milk (pH 6.7-7.0; 6-8°T), indicating its acidic nature.

Organoleptically, koumiss is milky-white, slightly foamy, and carbonated, while mare's milk is more homogeneous and bluish-white. Koumiss has a slightly lower density (1,010-1,030 g/cm³) than milk (1,027-1,032 g/cm³) due to lactose

processing and partial breakdown of proteins and fats. Both contain 89-91% water, but koumiss includes up to 2.5% ethanol and CO_2, absent in fresh milk.

Protein and fat levels are slightly lower in koumiss (1.8-2.2% and 1.0-2.0%) than in milk (2.0-2.5% and 1.2-1.5%), and lactose is significantly reduced (0.8-1.5% vs. 6.0-7.5%), improving digestibility for lactose-intolerant individuals. Ash content is similar (0.4-0.6%).

Koumiss contains B vitamins and vitamins C, A, D, E, and folic acid, while fresh milk initially has higher water-soluble vitamin content, which can decline with storage or heat. Koumiss also shows higher enzymatic and antimicrobial activity due to its acidic environment and fermentation by-products, while mare's milk is more perishable and requires cooling.

Given that pectin activates in acidic conditions (pH < 4.5), koumiss and shubat are considered optimal bases for further development of functional food products [15-17].

The formulation of a functional national dairy product containing pectin is presented in Table 5 below:

Table 5

Functional national dairy product containing pectin (Shubat\Koumiss)

	Sample I		Sample II		Sample III	
	Gross	Net	Gross	Net	Gross	Net
Shubat\Koumiss	50 ml	50 ml	50 ml	50 ml	50 ml	50 ml
Almond milk	50 ml	50 ml	50 ml	50 ml	50 ml	50 ml
Sugar	16 g	16 g	16 g	16 g	16 g	16 g
Pectin	3 g (3%)	3 g (3%)	5 g (5%)	5 g (5%)	7 g (7%)	7 g (7%)
Exit	-	100 g	-	100 g	-	100 g

The samples were taken in a ratio of 1 to 10.

The technological process for producing a functional traditional dairy product enriched with pectin (shubat/koumiss) includes the following stages:

1. Raw material preparation: All ingredients (shubat/koumiss, almond milk, sugar, and pectin) were prepared and weighed according to the formulation.

2. Pectin preparation: Pectin was pre-mixed with sugar to ensure uniform distribution.

3. Preparation of the milk base: Shubat or koumiss was mixed with almond milk and heated under moderate conditions.

4. Incorporation of pectin: The pectin-sugar mixture was gradually added to the milk base with continuous stirring.

5. Heat treatment: The mixture was brought to a boil and maintained for 30 seconds to ensure pasteurization.

6. Cooling and structuring: The product was cooled to room temperature, poured into molds, and stored under refrigeration for at least 4 hours to allow structure formation.

Based on the study of the interaction between fermented dairy products and pectin, it was established that shubat exhibits better compatibility with pectin compared to koumiss. Among the tested formulations, sample No. 2, containing 5% pectin, demonstrated the most optimal structural and quality characteristics.

Discussion. In this study, the interaction between two traditional fermented dairy products, shubat and koumiss, and varying concentrations of pectin was investigated in order to determine optimal conditions for obtaining stable products with improved structural and mechanical properties.

To evaluate the interaction of fermented milk drinks with pectin, samples with different pectin contents were prepared: 3%, 5% and 7%. The samples were subjected to a comprehensive analysis of organoleptic parameters.

The results of this study are consistent with previous research demonstrating that pectin enhances the texture, viscosity, and stability of fermented dairy products. Studies by Smith et al. (2018) and Li and Zhang (2020) reported improved gel formation and homogeneity in dairy systems with sufficient protein content, which corresponds to the superior performance of shubat observed in the present study. In contrast, koumiss exhibited weaker interactions with pectin, consistent with the findings of Kumar et al. (2017), which may be attributed to its lower protein content and different acid composition. These findings suggest that traditional fermented beverages, particularly shubat, can serve as effective carriers for functional ingredients such as pectin, providing improved structural properties along with acceptable organoleptic characteristics.

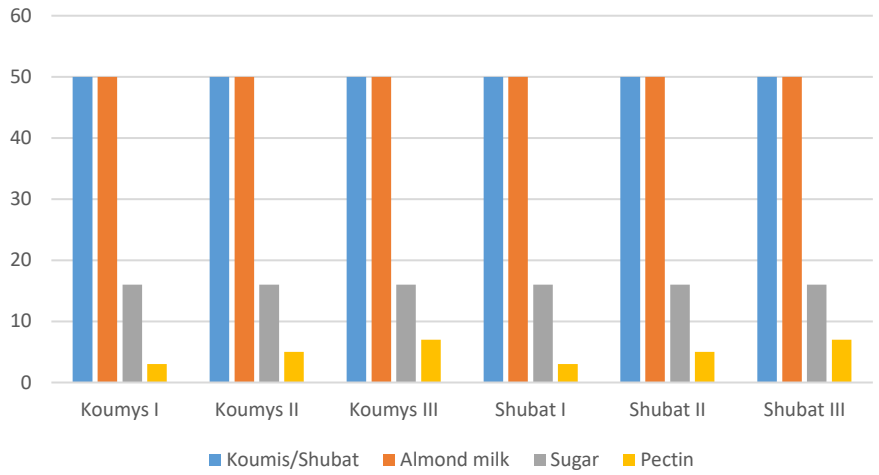

Fig. 1. Functional national dairy product containing pectin (Shubat\Koumiss)

The results of the study showed that shubat interacts better with pectin compared to koumiss. This translates into a more homogeneous structure and optimal texture of the final product. The most pronounced positive effect was achieved when using a 5% concentration of pectin, sample No. 2.

In particular, sample No. 2 containing 5% pectin was characterized by the following properties:

– Optimal viscosity, providing a pleasant mouthfeel and resistance to phase separation;

– High structural homogeneity, indicating uniform distribution of pectin and its effective interaction with the protein components of shubat;

– Favorable organoleptic properties, contributing to increased consumer acceptability;

– Enhanced storage stability, making the product promising for industrial applications.

In contrast, koumiss exhibited less pronounced interaction with pectin, which may be attributed to the особенности its acid composition and lower protein content involved in gel structure formation.

Thus, it can be concluded that shubat represents a more suitable base for the development of pectin-enriched products. The optimal technological and consumer characteristics were achieved at a pectin concentration of 5%, as confirmed by both qualitative and quantitative indicators of sample No. 2.

The organoleptic parameters of sample No. 2 (according to ND) are presented in Table 6.

Table 6

Organoleptic parameters of sample No. 2 (according to ND)

Indicator	Description
Appearance	The mass is homogeneous, with a smooth, even surface, without cracks, bubbles and delamination. A light sheen, characteristic of gelling dessert masses, is allowed.
Colour	Beige, uniform throughout the entire mass, without extraneous inclusions, spots or heterogeneous zones. The color corresponds to the ingredients of the recipe (for example, dairy products, flavors, thickeners).
Consistency	Dense, jelly-like, elastic when pressed, retains its shape when laid out of the mold. Without excessive brittleness or fluidity.
Smell	Clean, with a pronounced almond flavor. No foreign, sour, musty or chemical odors.
Taste	Balanced sweet and sour, with a pronounced almond flavor. Without bitterness, excessive acidity or foreign tastes.

To evaluate the effect of pectin concentration on the properties of shubat and koumiss, a one-way analysis of variance (ANOVA) was performed, followed by Tukey's post-hoc test for pairwise comparison of samples. Each variant was prepared in three independent replicates, and viscosity, structural homogeneity, and organoleptic parameters were measured.

The results showed that differences between samples in key parameters were statistically significant ($p < 0.05$). The most balanced characteristics were observed in sample No. 2 with 5% pectin: optimal viscosity, high structural homogeneity, and superior organoleptic properties. Correlation analysis confirmed a direct relationship between pectin content and improvement of gel-forming properties of shubat up to a 5% concentration.

Thus, statistical analysis supports the selection of 5% pectin as the optimal concentration for the development of a functional dairy product.

Conclusion. Among the many challenges currently facing humanity, environmental pollution with various chemicals, products of technogenesis remains a pressing issue, with heavy metals representing a significant proportion. The state of the environment in many regions of Kazakhstan, accompanied by contamination of ecosystems and food with toxic substances, underscores the importance of food safety and highlights the need to expand the production of pectin and pectin-containing products as natural detoxifiers.

The development of a functional national dairy product containing pectin is a promising area in the food industry that meets modern requirements of functional nutrition. The inclusion of pectin in dairy products not only improves their texture and taste characteristics, but also gives additional functionality due to its beneficial properties such as improved digestion, immune system support and cholesterol reduction.

In addition, the discussed possibility of further research aimed at studying the interaction of pectin with traditional dairy drinks such as koumiss and shubat

opens up new horizons for the development of innovative products that can meet the needs of modern consumers seeking a healthy and environmentally friendly diet.

Thus, continued research and the introduction of pectin-based technologies in the production of dairy products is important for the development of functional nutrition, expanding the range of products and improving their beneficial properties.

References

1. Azimova S.T., Kizatova M.Zh. Osnovy formirovaniya detoksikatsionnykh svoystv produktov pitaniya na osnove tykvennogo pektina [Fundamentals of the formation of detoxification properties of foods based on pumpkin pectin]. – LAP LAMBERT Academic Publishing, 2020. – 145 p. [in Russian].
2. Kizatova M.Zh., Iskakova G.K., Nabiyeva Zh.S., Azimova S.T., Ustenova G.O., Kozhanova K.K. Pektiny: osnovnye svoystva, tekhnologii, primenenie [Pectins: basic properties, technologies, application]: monograph. – Almaty: IP «Miras», 2020. – 265 p. [in Russian].
3. Kulazhanov K.S., Alimardanova M.K., Kulazhanov T.K. Primenenie alternativnykh metodov obrabotki moloka pri proizvodstve molochnykh produktov iz moloka selskokhozyaystvennykh zhivotnykh [Application of alternative milk processing methods in the production of dairy products from the milk of farm animals]. – Almaty: Almanakh, 2023. – 286 p. [in Russian].
4. Rumyantsev A.V. Sbornik retseptur blyud i kulinarnykh izdeliy. Normativnaya dokumentatsiya dlya predpriyatiy obshchestvennogo pitaniya [Collection of recipes of dishes and culinary products. Regulatory documentation for public catering enterprises]. – Moscow: Delo i servis [Business and Service], 1998. – Vol. 864. – P. 12. [in Russian].
5. Barmin S.M. Tekhnologiya molochnykh produktov [Technology of dairy products]. – Moscow: Agropromizdat, 2018. – 320 p. [in Russian].
6. Zvereva E.N. Funktsionalnye molochnye produkty: svoystva i tekhnologii proizvodstva [Functional dairy products: properties and production technologies]. – Moscow: Nauka, 2017. – 208 p. [in Russian].
7. Fedorova O.V. et al. Molochnye produkty s dobavleniem pektina i drugikh polisakharidov [Dairy products with the addition of pectin and other polysaccharides] // Bulletin of the dairy industry. – 2017. – No. 9. – P. 88-93. [in Russian].
8. Moldabayeva Z.M., Muldasheva G.N., Konuspayeva G.S. The Main Features and Microbiota Diversity of Fermented Camel Milk (Shubat) // Foods. – 2024. – Vol. 13. – No. 8. – P. 1148.
9. Rakhmatulina A. et al. Advancements in camel milk drying technology: A comprehensive review of methods, chemical composition, and nutritional preservation //Dairy. – 2024. – Vol. 5. – No. 3. – P. 360-371. https://doi.org/10.3390/dairy5030029.
10. Dikhanbayeva F. et al. Effect of nutritional supplements on the physico-structural and sensory characteristics of low-fat camel milk yogurt //Journal of Dairy Research. – 2024. – Vol. 91. – No. 3. – P. 330-338. https://doi.org/10.1017/S002202992400058X.
11. Seyiti S., Kelimu A., Yusufu G. Bactrian camel milk: chemical composition, bioactivities, processing techniques, and economic potential in China //Molecules. – 2024. – Vol. 29. – No. 19. – P. 4680. https://doi.org/10.3390/molecules29194680.
12. Seifu E. Camel milk products: innovations, limitations and opportunities //Food Production, Processing and Nutrition. – 2023. – Vol. 5. – No. 1. – P. 15. https://doi.org/10.1186/s43014-023-00130-7.

13. Konuspayeva G., Faye B., Loiseau G. The composition of camel milk: a meta-analysis of the literature data //Journal of food composition and analysis. – 2009. – Vol. 22. – No. 2. – P. 95-101. https://doi.org/10.1016/j.jfca.2008.09.008.
14. Bilal Z. et al. The main features and microbiota diversity of fermented camel milk //Foods. – 2024. – Vol. 13. – No. 13. – P. 1985. https://doi.org/10.3390/foods13131985.
15. Boranbayeva T. et al. Influence of stage lactation on quality and protein compositions of Kazakh mare milk and koumiss //Slovak Journal of Food Sciences. – 2024. – Vol. 18. – P. 964-976.
16. Toishimanov M. et al. The effects of the lactation period, mare age, and foaling on the chemical and physical composition of milk from Kazakh mares kept under natural pasture conditions //Animals. – 2025. – Vol. 15. – No. 12. – P. 1817.
17. Kossaliyeva G. et al. Chemical composition, physical properties, and immunomodulating study of mare's milk of the Adaev horse breed from Kazakhstan //Frontiers in Nutrition. – 2025. – Vol. 12. – P. 1443031.

Received: 20 October 2025
Accepted: 26 December 2025

А.А. Тұрар[1], С.Т. Азимова[1], Ф.А. Махмудов[1], А.А. Жельдыбаева[1], Н.Қ. Бекмұрат[1]

[1]Алматы технологиялық университеті, Алматы, Қазақстан

ҰЛТТЫҚ СҮТ ӨНІМДЕРІН ДЕТОКСИКАЦИЯЛАУ

Аңдатпа. Мақалада дәстүрлі ашытылған сусындар – шұбат және қымыз сияқты сүт түрлерінің, жануарлар мен өсімдіктердің, сондай-ақ бие мен түйенің физика-химиялық құрамына салыстырмалы талдау жүргізілді. Құрылымдық-механикалық және органолептикалық сипаттамалары жақсартылған функционалды өнімдерді алудың оңтайлы жағдайларын анықтау мақсатында осы сусындардың әртүрлі концентрациядағы (3%, 5% және 7%) пектинмен өзара әрекеттесуін зерттеуге ерекше назар аударылды. Шұбат пен қымыз жаңа сүт аналогтарымен салыстырмалы талдау жүргізілді. Шұбат pH төмен (3,8-4,5), қышқылдығы жоғары (70-110°T), майлылығы 10% дейін (сүтте 4,5-5% қарсы) және күлділігі 0,85% дейін. Қымыз жаңа сүтпен салыстырғанда pH 3,5-4,6, қышқылдығы 60-120°T, алкоголь мөлшері 0,5-2,5%, көмірқышқыл газы 0,4-1,0%, ақуыз (1,8-2,2%) және май (1,0-2,0%) төмендеуімен сипатталады. Екі өнімде де лактоза 0,8-1,5% дейін төмендейді, бұл төзімділікті жақсартады. Екеуі де микробқа қарсы белсенділікті жоғарылатады және пектинмен әрі қарай зерттеу үшін перспективалы. Алынған нәтижелер шұбатты салауатты және экологиялық қауіпсіз тамақтанудың заманауи талаптарына бағдарланған инновациялық функционалдық өнімдерді жасау үшін негіз ретінде пайдалану перспективасын растайды.

Тірек сөздер: пектин, детокс, шұбат, қымыз, функционалдық өнімдер, органолептикалық қасиеттері, физика-химиялық құрамы, тамақ өнеркәсібі.

А.А. Турар[1], С.Т. Азимова[1], Ф.А. Махмудов[1], А.А. Жельдыбаева[1], Н.К. Бекмурат[1]

[1]Алматинский технологический университет, Алматы, Казахстан

РАЗРАБОТКА ДЕТОКСИКАЦИОННЫХ НАЦИОНАЛЬНЫХ МОЛОЧНЫХ ПРОДУКТОВ

Аннотация. В статье проведён сравнительный анализ физико-химического состава различных видов молока: животного и растительного, а также кобыльего и

верблюжьего, включая традиционные ферментированные напитки — шубат и кумыс. Особое внимание уделено исследованию взаимодействия данных напитков с пектином в различных концентрациях (3%, 5% и 7%) с целью определения оптимальных условий получения функциональных продуктов с улучшенными структурно-механическими и органолептическими характеристиками. Проведен сравнительный анализ шубата и кумыса с их свежими молочными аналогами. Шубат имеет низкий pH (3,8-4,5), высокую кислотность (70-110°T), жирность до 10% (против 4,5-5% в молоке) и зольность до 0,85%. Кумыс характеризуется pH 3,5-4,6, кислотностью 60-120°T, содержанием спирта 0,5-2,5%, углекислого газа 0,4-1,0%, сниженным белком (1,8-2,2%) и жиром (1,0-2,0%) по сравнению со свежим молоком. В обоих продуктах лактоза снижается до 0,8-1,5%, что улучшает переносимость. Оба обладают повышенной антимикробной активностью и перспективны для дальнейших исследований с пектином. Полученные результаты подтверждают перспективность использования шубата в качестве основы для создания инновационных функциональных продуктов, ориентированных на современные требования здорового и экологически безопасного питания.

Ключевые слова: пектин, детокс, шубат, кумыс, функциональные продукты, органолептические свойства, физико-химический состав, пищевая промышленность.