

ABSTRACT

of the thesis of Kozhanov Zhassulan on the topic: «Development of modern technology of functional food products from mare's milk» for the degree of Doctor of Philosophy PhD in specialty 6D080200 – «Technology of Livestock Production»

The relevance of the topic. Human health is largely determined by the quality of nutrition. With the growing prevalence of chronic diseases, population aging, environmental degradation, and the decline in immune status, the development of functional and specialized food products becomes particularly relevant. Such products, in addition to meeting the body's basic nutritional needs, contribute to disease prevention, health improvement, and increased resistance. Functional beverages and foods of high biological value can play a key role in public health and nutrition systems.

Mare's milk is a unique raw material with high biological value. Research shows that mare's milk is characterized by a low content of casein and a high proportion of whey proteins, which ensures good digestibility even in individuals with weakened digestion. Moreover, mare's milk contains biologically active components such as lactoferrin, lysozyme, immunoglobulins, vitamins, and minerals, which exhibit antibacterial, immunomodulatory, and general health-promoting properties.

Traditionally, in Kazakhstan and other Central Asian countries, mare's milk has been used for the production of kumis, which has long been applied in folk medicine for respiratory diseases, metabolic disorders, and weakened immunity. Modern scientific studies confirm that fermented and cultured products derived from mare's milk contain a wide variety of lactic acid bacteria that may exert probiotic effects.

Today, there is a growing demand for functional food products that meet modern requirements for a healthy lifestyle, disease prevention, and improved quality of life. The development of new food products based on mare's milk will expand the domestic market, reduce dependence on imported functional beverages, and strengthen the country's food security. For the elderly, children, and individuals with weakened health, products made from mare's milk can serve as a valuable source of easily digestible proteins, vitamins, probiotic cultures, and phyto-components.

In this regard, the development of food production technologies using mare's milk appears to be a highly relevant direction in creating functional foods that can promote public health and provide particular benefits for groups with increased nutritional needs.

The purpose and objectives of the research

Research Aim: The aim of this study is to develop a modern technology for producing a functional food product based on mare's milk, designed to promote health and enhance the nutritional value of the diet for various population groups.

Research Objectives:

1. To evaluate the breeding and productive qualities of two lines of Kazakh Jabe-type horses.

2. To study the physicochemical parameters of mare's milk depending on the season.

3. To determine the amino acid, mineral, and vitamin composition of mare's milk.

4. To investigate the functional and technological properties as well as the buffering capacity of mare's milk as a raw material for food product development.

5. To develop a formulation for a functional product based on mare's milk and to optimize filtration and pasteurization regimes during processing.

6. To conduct organoleptic and physicochemical evaluation of the final product.

7. To study the nutritional and energy value of the product, its shelf life, antioxidant activity, and immunobiological properties.

Scientific novelty of research. For the first time, a comprehensive assessment of the breeding and productive qualities of two lines of Kazakh Jabe-type horses has been carried out from the perspective of the potential use of their milk productivity for the development of functional products. New data were obtained on the seasonal variability of the physicochemical parameters of mare's milk. The amino acid profile, as well as the mineral and vitamin composition of mare's milk, were refined. For the first time, the functional and technological properties and the buffering capacity of mare's milk were investigated in the context of its application in the food industry, and their specific features relevant to the development of stable products were identified. An original formulation of a functional food product (bio-cocktail) based on mare's milk with the use of probiotic cultures and phyto-additives was developed, and optimal technological regimes of filtration and pasteurization were substantiated. New experimental data were obtained on the organoleptic, physicochemical, and rheological characteristics of the final product. For the first time, the nutritional, energy, and biological value of the developed product were studied, along with the determination of its shelf life and the identification of immunobiological properties confirming its functional purpose.

Patents of the Republic of Kazakhstan obtained for utility models and breeding achievements:

1. "Method for selecting horses of the Arda 17-00 line of Kazakh Jabe-type horses", Patent No. 9219;

The theoretical and practical significance of the work. The results obtained complement and expand scientific knowledge on the chemical composition, functional-technological, and biological properties of mare's milk of the Kazakh Jabe-type breed. For the first time, the patterns of seasonal variability in the physicochemical parameters and buffering capacity of mare's milk have been established. Data on the amino acid, mineral, and vitamin composition provide a basis for an in-depth study of the role of mare's milk in therapeutic and preventive nutrition. The scientifically substantiated formulation and optimal technological modes for processing mare's milk form the theoretical foundation for further research in the field of animal product processing. A technology has been developed

for producing a functional biococktail based on mare's milk with probiotic cultures and phytoadditives, suitable for industrial application. The proposed technological regimes of filtration and pasteurization ensure the preservation of biologically valuable components of mare's milk and enhance the stability of the final product. The established organoleptic and physicochemical parameters enable producers to objectively assess the quality and competitiveness of the product.

Methodology and research methods. The methodological foundation of the dissertation is based on the works of domestic and foreign scholars in the fields of biotechnology, food and dairy industries, as well as functional and specialized nutrition. The study employed the principles of system analysis, comparative evaluation, and an integrated approach to the investigation of the chemical composition and functional-technological properties of both raw materials and the final product.

The main provisions submitted for defense:

- Scientific justification of the chemical composition, physicochemical, and functional-technological properties of mare's milk of the Kazakh Jabe-type breed, identified in relation to seasonal factors.

- Data on the amino acid, mineral, and vitamin composition of mare's milk, confirming its high biological value and potential for use in functional nutrition.

- Scientifically substantiated formulation and technological parameters for producing a product (biococktail) based on mare's milk with probiotic cultures and phytoadditives.

- Results of organoleptic, physicochemical, rheological, and microbiological evaluation of the final product, confirming its stability, safety, and high consumer properties.

- Obtained data on the energy and biological value of the developed product, as well as identified immunobiological properties, confirming its feasibility for therapeutic and preventive nutrition.

The degree of reliability and approbation of the results.

Publication of research results. Based on the materials of the dissertation, 6 publications were published, including

1 in a journal with a high impact factor:

- Impact of functional foods on improving the health of the Kazakh population // *Advancements in Life Sciences*. – 2024. – Vol. 10. – №. 4. – P. 555-562. URL: <https://als-journal.com/submission/index.php/ALS/article/viewFile/1844/1286>

4 articles - in scientific publications recommended by the Committee for Control in the Field of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan:

- Selection and breeding work with kazakh horse type Zhabe in peasant farms of Kazakhstan // *Вестник науки Казахского агротехнического университета им. С.Сейфуллина (междисциплинарный)*. - 2022. - №3 (114). –Ч.2. – P.181-191// [https://doi.org/10.51452/kazatu.2022.3\(114\).1171](https://doi.org/10.51452/kazatu.2022.3(114).1171)

- Производственные показатели создаваемой заводской линии казахских лошадей типа жабе в условиях центрального Казахстана // *Журнал Вестник*

Кызылординского университета имени Коркыт Ата, № 3 (1) 2022 г. С 292-300//<https://doi.org/10.52081/bkaku.2022.v62.i3.104> // ISSN 1607-2782

- Разработка технологии функционального продукта питания на основе кобыльего молока с оптимизацией режимов фильтрации и пастеризации // Исследования, результаты. №4(108) 2025 г, ISSN 2304-3334. Раздел: Животноводство и Ветеринария. С. 107-121// <https://doi.org/10.37884/4-2025/12>

- Физико-химический состав кобыльего молока в зависимости от сезона и его значение для функционального питания // Наука и образование Том 4 №4 (81) 2025 г. С. 63-73// <https://doi.org/10.52578/2305-9397-2025-4-4-63-73>

1 protection document:

– Patent of the Republic of Kazakhstan for a utility model entitled “Method for Selection of Horses of the Arda 17-00 Line of Kazakh Horses of the Zhabe Type” // Application No. 2024/0068.2 dated January 18, 2024. Patent No. 9219 dated June 7, 2024. // <https://gosreestr.kazpatent.kz/Utilitymodel/Details?docNumber=390166>

Structure and scope of the dissertation.

The dissertation consists of an introduction, literature review, materials and methods of research, results of the author’s own investigations, conclusion, recommendations for production, references, and appendices. The dissertation comprises 122 pages, and 138 pages including appendices, in computer-typed format. The work contains 29 tables and 20 figures. The bibliography includes 195 references.