

**АУЫЛ ШАРУАШЫЛЫҒЫ, ВЕТЕРИНАРИЯ ҒЫЛЫМДАРЫ  
ЖӘНЕ ТАМАҚ ӨНІМДЕРІН ҚАЙТА ӨНДЕУ**UDC 641.1:796.062  
МРНТИ 65.63.33DOI: <https://doi.org/10.37788/2023-2/159-164>**N.B. Gavrilova<sup>1</sup>, N.L. Chernopolskaya<sup>1\*</sup>, Ye.B. Nikitin<sup>2</sup>**<sup>1</sup>Omsk State Agrarian University named after P.A. Stolypin, Russia<sup>2</sup>Innovative University of Eurasia, Kazakhstan\*(e-mail: [nl.chernopolskaya@omgau.org](mailto:nl.chernopolskaya@omgau.org))**An innovative approach to the development of biotechnology of specialized products  
for the nutrition of athletes****Annotation**

*Main problem:* the article substantiates the relevance of the development and production of specialized food products for athletes and the population involved in sports, fitness as part of a healthy lifestyle.

*Purpose:* development of specialized food products with a general health-improving character, intended for the population involved in sports, fitness and experiencing increased physical exertion.

*Methods:* the obtained results were statistically processed using the methods of correlation and regression analysis and standard software packages "Statistica 6.0". Measurements of chemical, microbiological, organoleptic parameters were carried out using standard methods and modern instruments: an analyzer, an analytical analyzer electrophoresis cell, a high-performance liquid chromatograph, and others.

*Results and their significance:* a scientific concept for the creation of fermented specialized milk-based food products for sports nutrition was formulated; biotechnologies for specialized food products for athletes were developed. For the practical implementation of the results of analytical and experimental studies, packages of regulatory and technical documentation for the production of new products have been developed, which have been tested in the production conditions of existing enterprises in the dairy industry.

*Key words:* specialized nutrition, probiotics, antioxidants, fermented food product, sports nutrition.

**Introduction**

All over the world, there is an increase in the interest of the population in a healthy lifestyle. Specialized nutrition, which includes sports nutrition, is of interest not only to professional athletes, but also amateurs, as well as visitors of fitness clubs [1]. Scientists have found that only cow's milk has a positive effect on exercise performance and restoration of muscle function. Nevertheless, significant positive effects of cow's milk consumption as a source of protein, carbohydrates, calcium on the performance and muscle recovery of athletes have been found [2].

An analysis of the scientific technical literature indicates that at present, the development and production of food products for athletes is dominated by a targeted nature, that is, the composition of the products used depends on the type of sport that the athlete is involved in and the loads he or she carries out. Experimental testing of such products is also carried out on groups of athletes selected according to the general principle of requirements determined by the characteristics of the sport. As part of a healthy lifestyle program, it must be taken into account that a person who goes in for professional or amateur sports must be healthy, physically resilient, his body must be resistant to stressful situations, have immunity to unfavorable environmental factors, nervous stress. It must have a healthy microbiota capable of withstanding varying levels of nutrient intake during training and competition periods [3, 4, 5].

The purpose of the article is to provide a scientific justification for the development of specialized food products with a general health-improving character, intended for the population involved in sports, fitness and experiencing increased physical activity.

### Materials and methods

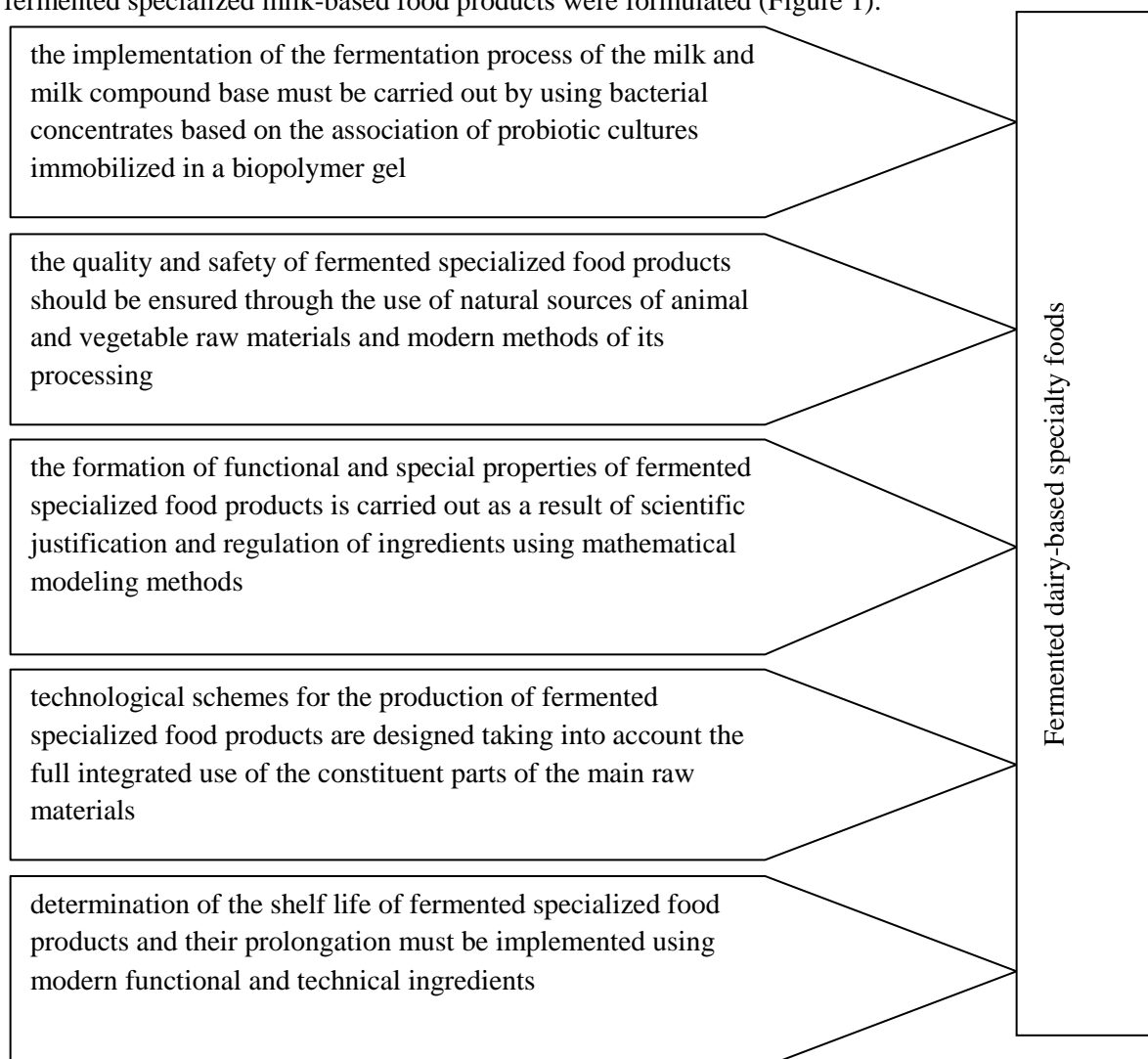
The studies were carried out in the laboratories of the Department of Food and Food Biotechnology of the Federal State Budgetary Educational Institution of Higher Education Omsk State Agrarian University.

Raw cow's milk according to GOST 31449-2013 were defined as objects of study; association of probiotic cultures of lactic acid bacteria *Lactobacillus acidophilus*, *Streptococcus thermophilus* and bifidobacteria - *Bifidobacterium bifidum*, *Bifidobacterium longum*; biopolymers: gelatin and pectin according to the current regulatory documentation.

The studies were carried out by generally accepted standard of chemical, microbiological, organoleptic methods. The repetition of experiments is three to five times. Mathematical and statistical processing of experimental data was carried out using the program "Statistica-6.0". Measurements of chemical, microbiological, organoleptic parameters were carried out using standard methods and modern instruments.

### Results

As a result of theoretical and experimental studies, a scientific concept for the creation of fermented specialized milk-based food products were formulated (Figure 1).



Picture 1 - The concept of creating fermented specialized milk-based food products

According to the concept, at the initial stage, the type of the main milk raw material and the technological operations to prepare it for processing are determined, including such as lactose hydrolysis to reduce its amount, whey hydrolysis to obtain whey hydrolyzate with an increased amount of essential amino acids, ultrafiltration of cow's or skim milk to increase the concentration of proteins in the milk base, etc.

The next stage is devoted to the main technological operation of the production of specialized food products - the fermentation process, the purpose of which is not only to change the physical state of the milk protein, but also to enrich the specialized fermented dairy products with probiotic microflora. To achieve this goal, a biologically active component has been developed based on associations of starter (probiotic) cultures immobilized in a gel of biopolymers of plant and animal origin, which help to increase the digestibility of the product, as well as the preservation of the volume of viable cells of probiotic cultures that meets the requirements of GOST R 55577-2013 "Products food specialized and functional. Information about the distinctive features and effectiveness not only during the entire shelf life of the product, but also when it enters the gastrointestinal tract of the consumer, the novelty of which is protected by a patent [6].

On the basis of mathematical modeling of a set of experimental data, the main thermodynamic parameters of the fermentation process with the above-mentioned biologically active component were established. An important factor in the creation of specialized food products is the determination of the type and quantity of specialized and technically necessary ingredients, including prebiotics, stabilizers, components that increase muscle mass and the ability to achieve high sports performance, as well as the nutritional and biological value of new products.

For the practical implementation of the results of analytical and experimental studies, packages of regulatory and technical documentation have been developed for the production of new food products for athletes, which have been tested in the production conditions of existing enterprises in the dairy industry (Table 1).

Table 1 - Innovative technologies of products for nutrition of athletes

Name of technology product	Normative document	Authors
Biologically active components (BAC) based on associations of starter (probiotic) cultures immobilized in biopolymer gel	СТО 004175-91-032-2019	N.L. Chernopolskaya
Special purpose bioproduct	СТО 71063300-011-2019	N.L. Chernopolskaya, N.B. Gavrilova
Protein bioproduct "ProteinMilk"	СТО 56438524-021-2019	N.L. Chernopolskaya, N.B. Gavrilova

Based on the results of the development of biotechnologies and formulations of specialized food products for sports nutrition, the main indicators are determined according to which diets are compiled using specialized food products: biological and energy value.

The amino acid composition of the proteins of fermented products for the nutrition of athletes is shown in Figure 2. The nutritional and energy value of the products is presented in Table 2.

All products are enriched with probiotic microflora in an amount - lactic acid bacteria not less than  $1 \cdot 10^8$  CFU/g and bifidobacteria not less than  $1 \cdot 10^7$  CFU/g, propionic acid bacteria not less than  $1 \cdot 10^7$  CFU/g.

Table 2 - Nutritional and energy value of fermented foods for athletes

Name of product	Mass fraction, %			Energy value	
	fat	proteins	carbohydrates	kcall	kJ
Specialized nutrition product for athletes	4,10	4,10	16,65	119,9	520,36
Protein bioproduct "ProteinMilk" (without filler)	7,11	31,02	5,01	208,1	870,73

The data shown in Figure 2 and Table 2 are used to compile the diets of athletes, taking into account the energy value of specialized food products. The range of new products is developed based on the results of a study of the needs of different age groups, labor costs and physical activity.

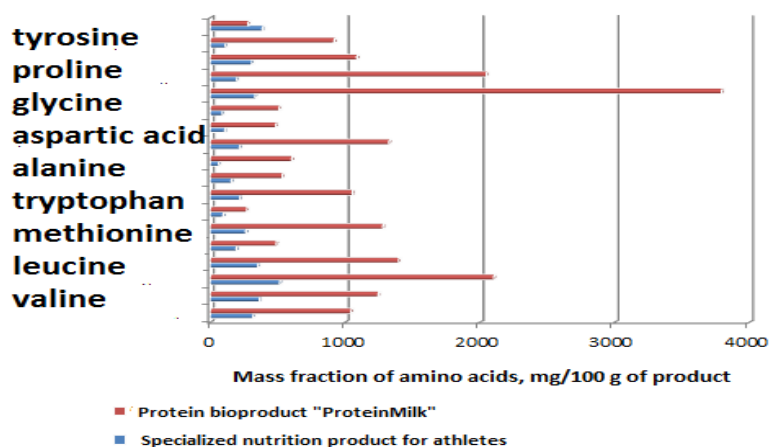


Figure 2 - Amino acid composition of proteins of fermented foods for athletes

### Conclusion

The obtained research results indicate that the developed fermented products are of high nutritional value, enriched with probiotic microflora, which makes it possible to recommend them for regular use in the nutrition of athletes.

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### **Спортшылардың тамақтануына арналған мамандандырылған өнімдердің биотехнологиясын әзірлеудегі инновациялық тәсіл**

Мақалада салауатты өмір салтын ұйымдастыру шеңберінде спортпен, фитнеспен айналысатын халықтың тиісті физикалық жай-күйін қолдау мәселесін шешуге бағытталған спортшылардың тамақтануы үшін мамандандырылған тамақ өнімдерін әзірлеу және өндіру жөніндегі бағыттың өзектілігі негізделген. Мақаланың мақсаты - спортпен, фитнеспен айналысатын және дене шынықтырумен айналысатын халыққа арналған жалпы сауықтыру сипатындағы мамандандырылған тамақ өнімдерін әзірлеу. Алынған нәтижелер корреляциялық және регрессиялық талдау әдістерін және "Statistica 6.0" стандартты бағдарламалық пакеттерін пайдалана отырып статистикалық түрде өңделеді. Химиялық, микробиологиялық, органолептикалық көрсеткіштерді өлшеу стандартты әдістер мен заманауи құралдарды қолдана отырып жүргізілді: анализатор, аналитикалық анализатордың электрофорезіне арналған ұяшық, жоғары тиімді сұйық хроматограф және басқалар.

Спорттық тамақтану үшін сүт негізіндегі ашытылған мамандандырылған тамақ өнімдерін жасаудың ғылыми тұжырымдамасы тұжырымдалды, спортшылардың тамақтануы үшін мамандандырылған тамақ өнімдерінің биотехнологиясы жасалды. Аналитикалық және эксперименттік зерттеулердің нәтижелерін іс жүзінде іске асыру үшін жаңа өнімдерді өндіруге арналған нормативтік және техникалық құжаттама пакеттері әзірленді, олар жұмыс істеп тұрған сүт саласы кәсіпорындарының өндірістік жағдайларында сынақтан өткізілді.

Түйін сөздер: мамандандырылған тамақтану, пробиотиктер, антиоксиданттар, ашытылған тамақ өнімдері, спорттық тамақтану.

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### **Инновационный подход к разработке биотехнологии специализированных продуктов для питания спортсменов**

В статье обоснована актуальность разработки и производства специализированной пищевой продукции для спортсменов и населения, занимающегося спортом, фитнесом в рамках организации здорового образа жизни. Цель статьи - разработка специализированных продуктов питания с общеоздоравливающим характером, предназначенных для населения, занимающегося спортом, фитнесом и испытывающие повышенные физические нагрузки. Полученные результаты статистически обработаны с использованием методов корреляционного и регрессионного анализа и стандартных пакетов программ «Statistica 6.0».

Измерения химических, микробиологических, органолептических показателей проводились с применением стандартных методов и современных приборов: анализатора, ячейки для электрофореза аналитического анализатора, высокоэффективного жидкостного хроматографа и других.

Сформулирована научная концепция создания ферментированных специализированных пищевых продуктов на молочной основе для спортивного питания, разработаны биотехнологии специализированных пищевых продуктов для питания спортсменов. Для практической реализации результатов аналитических и экспериментальных исследований разработаны пакеты нормативной и технической документации для производства новых продуктов, которые апробированы в производственных условиях действующих предприятий молочной отрасли.

Ключевые слова: специализированное питание, пробиотики, антиоксиданты, ферментированный пищевой продукт, спортивное питание.

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