



KAPITEL 7 / CHAPTER 7⁷
RATIONALE FOR THE DEVELOPMENT OF LACTOSE-FREE
VEGETABLE CREAMS FOR MILITARY PERSONNEL

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Introduction

A number of dairy and sour-milk items, in particular, various types of cream, milk, yogurt, kefir, require established storage conditions and terms, and are also overlooked by military personnel who, for certain reasons, do not consume or have stopped consuming milk and related products. At the same time, there are alternatives to traditional ones in the diets of the armies of NATO countries, for example, dairy products of lactose-free and non-animal origin, products with reduced cholesterol, sugar-free, fortified with vitamins, coffee without caffeine, which creates the possibility of choosing a product that is more comfortable for consumption and avoid loss of certain nutrients.

The genetic and metabolic characteristics of military personnel of each country reflect the characteristics of the population. Among the global trends, there is an increase in demand for alternative milk products, in particular, substitutes for dairy products of plant origin, the growth of which is associated with, among other things, the development of personalized nutrition, the need to prevent metabolic and allergic diseases, and lactose intolerance by consumers [1].

That is why it is considered relevant to develop and offer drinks from available raw materials as important components of the diets of military personnel, which can be consumed in the conditions of field kitchens, which will have new qualities and create an alternative to traditional positions for people with special preferences and metabolism.

7.1. Consumption of dairy products in the regions of the world.

Despite the fact that milk is a perishable product that must be processed soon after

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collection, most dairy products are consumed fresh, including in the form of fermented milk and pasteurized products. Fresh dairy consumption per capita is projected to increase by an average of 1.4% per year over the next decade, slightly faster than in the past decade. The key drivers for this can be the markets of India, Pakistan and Africa, where there is a strong growth in demand [2].

The proportion of consumed processed dairy products, especially cheese, is expected to be closely related to income, the level of urbanization of the population, the characteristics of local dietary preferences, cultural and ethnic differences, and dietary restrictions.

Consumer choices can be influenced by information about the results of scientific studies that highlight the health benefits of milk fat consumption. At the same time, however, the U.S. Dietary Guidelines indicate the appropriateness and health benefits of low-fat, low-fat, and lactose-free dairy products. Also, these changes may reflect growing consumer preferences for less processed foods, and possibly increased interest in home cooking.

The largest share of cheese consumption, the second largest dairy product, is in Europe and North America, where per capita consumption is expected to continue to rise. Cheese consumption will also increase in regions where it has not traditionally been part of national diets. In Southeast Asia, urbanization and rising incomes have led to a shift in emphasis to eating outside the home, including fast food, particularly burgers and pizza. It's worth noting that the pandemic has not only increased the use of online ordering and takeout in these regions, but has also increased consumers' focus on foods they perceive to be healthier or healthier. These changes in the eating behavior of consumers contributed to the development of the dairy sector [2].

In Asia, butter is not only the most consumed processed dairy product. It accounts for almost half of all processed dairy consumption in terms of dry matter, but it also has the largest projected growth in consumption. In Africa, the majority of processed dairy products are cheese and whole milk powder (WMP). However, during the next decade, skimmed milk powder (SMP) is expected to have the highest consumption figures [2].



Although some regions have been self-sufficient, such as India and Pakistan, total consumption of dairy products in Africa, Southeast Asia is expected to grow faster than production and lead to increased imports of dairy products. As the liquid milk trade has a high volume/value ratio, demand growth is expected to be met by milk powder. The dominant use of SMP and WMP will continue to be in the manufacturing sector, especially in confectionery, infant formula and bakery products. A certain proportion of dairy products, especially SMP and whey powder, is used in animal feed. China imports and uses both products for animal feed [2].

Thus, the level of consumption of milk and dairy products per capita, in terms of dry matter, will remain high, will differ significantly in the countries of the world and will depend on the level of income of the population, regional characteristics and the level of awareness of consumers regarding the safety of production and consumption of dairy products.

7.2. Alternative milk products and their effects.

Improvements in production and animal welfare are expected to contribute to the production and consumption of plant-based dairy substitutes in the liquid market, especially in Europe, East Asia, Oceania and North America, albeit in small volumes [2]. Total sales of plant-based milk grew by 20% in 2020, with annual revenue growth double that of traditional milk. Plant-based milk accounted for 15% of retail milk sales in US dollars in 2020, and 40% of households purchased plant-based milk. As the growth rate of the plant substitutes segment is high in some regions, there is increasing interest in their environmental impact, health benefits, and the feasibility of further research into their long-term impact on dairy production requirements [3]. Among the global trends, there is an increase in demand for alternative milk products, in particular, plant-based dairy substitutes and lactose-free dairy products. Important factors in the growth of the role of plant substitutes in the fresh dairy sector are consumer metabolic diseases, allergies, lactose intolerance, and consumer interest in a vegan diet [4].



The role of plant-based dairy substitutes such as soy, almond, rice and oat drinks in the liquid milk sector has increased in many regions of the world, particularly in North America, Europe and East Asia. The spectrum of substitutions extends beyond more traditional options and includes various types of nuts, legumes and other crops, which contributes to the development of relevant research areas and is reflected in the scientific literature.

An analysis of the sources in which the results of the evaluation of the effects of leguminous crops on human health are given shows the overall positive impact of this food component, although individual resources demonstrate the ambiguity of such conclusions. According to the National Osteoporosis Foundation (USA) regarding the effect of animal and vegetable proteins on the mineral density of bone tissue, the effects of soy protein as more useful have not been proven [5].

At the same time, epidemiological studies show that women who consume foods with a high content of soy, that is, proteins of vegetable origin, have a lower risk of developing osteoporosis than women who follow a typical Western diet. Researchers have shown that soy protein supplements enriched with isoflavones reduce bone resorption in postmenopausal and perimenopausal women [6].

In addition, the importance of soy isoflavones in the prevention of osteoporosis in humans, the effective dosing of soy isoflavones, as well as the significant effect of soy isoflavones on bone mineral density according to menopause status, type of supplementation, dose of isoflavone, and duration of exposure are argued. An analysis of the effects of soy and isoflavones on human health, conducted as an overall review of 114 meta-analyses and systematic reviews of randomized and observational studies, showed a reduction in the risk of cancer, cardiovascular, gynecological, metabolic, musculoskeletal, endocrine, neurological and kidney diseases, especially in perimenopausal women. An adverse relationship was found for stomach cancer with frequent consumption of miso soup. Soy consumption was inversely associated with the risks of developing type 2 diabetes mellitus (T2DM) and cardiovascular disease, and certain amounts of soy products were beneficial for the prevention of T2DM and cardiovascular disease [7]. According to the results of a meta-analysis on the positive



effect of legumes (beans/lentils/peas/soybeans, with the exception of peanuts and legume products/protein/powder/flour) on the development of multifactorial pathology in healthy adults, positive effects of the diet on total cholesterol (average difference - 0.22 mmol/l), low-density lipoprotein cholesterol (-0.19 mmol/l), fasting glucose (-0.19 mmol/l) and HOMA-IR (-0.30). The protective effect of legumes against risk factors supports the recommendation of consuming legumes as part of diverse and healthy dietary patterns for the prevention of cardiovascular diseases and T2DM. At the same time, it was found that feeding individuals with a soy-based formula in childhood is associated with a possible increase in the risk of fibroids identified by ultrasound in adulthood [8]. Thus, the results obtained and analyzed by various authors, on the one hand, support the consumption of legumes, and, in particular, soybeans, as part of a healthy diet, on the other hand, they require further research taking into account the genetic characteristics of the population of each country.

It should be noted that the results of scientific research cannot but influence the processes of production and use of such categories of products, especially since legumes are components of the food culture of various countries and ethnic groups. At the same time, the role of popular substitutes such as almond and soy drinks is sometimes questioned, as more and more consumers consider production factors to be a disadvantage, which include, in addition to greenhouse gas emissions, water use and deforestation [9].

It is also a concern for lactose-intolerant consumers who do not prefer plant-based substitutes as certain lactose-free dairy products become available to them. In addition, different types of plant milks try to reproduce the organoleptic properties of dairy products, but often do not match the nutrient profile of dairy products [9].

Thus, overall positive effects of plant substitutes on human health are noted, but uncertainty remains regarding their long-term impact on the economics of the dairy sector.



7.3. Development, production and consumption of dairy and alternative products in Ukraine.

Proposals for the production of dairy products with plant components are presented in Ukraine by a number of projects. For example, the authors of the development [36-38] of an analogue of traditional sour cream - sour cream with vegetable oils, in the composition of which blended oil 50% (sunflower + linseed oil) is used as a fat phase in the form of a food emulsion stabilized by an emulsifying complex containing sodium caseinate, also provide data on the analysis of product quality and safety indicators.

The authors argue that the prospects for improving the technologies of milk-containing fermented milk products are related to the improvement of the bacterial balance in the human body after consuming such products. In addition, the use of vegetable oils as fats of non-dairy origin in the technology of milk-containing products allows to increase the content of polyunsaturated fatty acids while balancing the fatty acid composition of finished products. The results of determining the content of polyunsaturated fatty acids in sour cream with vegetable oils with a fat content of 20% demonstrate an increased content of omega-3 and omega-6 fatty acids - 2.13% and 10.88%, respectively, compared to sour cream obtained by traditional technology.

In terms of nutritional value, an increase in protein by 3.5 times, organic acids by 4.5 times, beta-carotene by 2.6 times, the need for sodium, potassium and iron - by 40%, magnesium, calcium and phosphorus - from 15 to 30% Microbiological studies have proven that the oil mixture, enriched with dry food products and sesame seeds, differs in purity with the specified preservation. The optimized combination of ingredients allows to ensure the quality of the oil mixture during 8 days of storage under the following conditions: $t = 0-8\text{ }^{\circ}\text{C}$ and relative humidity of 75%.

Thus, Ukraine continues to have significant volumes of production and consumption of fresh dairy products and develops alternative projects, in connection with which it is relevant to consider the genetic features and preferences of the population, in particular, lactose tolerance and the association of features of lactose



metabolism with the development of multifactorial pathology and promising directions warning.

7.4. Development of lactose-free vegetable creams for coffee drinks.

It should be noted that today there is a trend towards the use of milk and cream analogues. At the same time, there is a shortage of polyunsaturated fatty acids (PUFA) in the diet of the population of Ukraine [10].

That is why the use of new cream-type products with a high content of PUFAs and a balanced fatty acid composition in coffee drinks is an urgent task.

Food emulsion can serve as a semi-finished product for use in coffee drinks with the aim of increasing their nutritional value and simultaneously improving the organoleptic and physico-chemical quality indicators of the finished product.

Due to the quality indicators, the food emulsion can be used both independently in the composition of coffee drinks to increase the nutritional value in terms of PUFA content, and as a semi-finished product to obtain liquid vegetable fat-containing products with flavoring substances, which should be tested experimentally.

Study of the quality indicators of new lactose-free products for inclusion in the diets of military personnel.

Quality indicators of lactose-free vegetable creams for coffee drinks are presented in Tables 1-3.

According to Table 1, lactose-free vegetable creams of different fat content are characterized by approximate normative organoleptic quality indicators to creams obtained from raw milk.

It should be noted that all samples of lactose-free vegetable cream have a somewhat empty aftertaste due to the use of sodium caseinate in their composition.

**Table 1** - Organoleptic indicators of lactose-free vegetable creams for coffee drinks

Indicator	Mass fraction of fat, %				
	10.0	20.0	30.0	40.0	50.0
Consistency and appearance	Uniform, glossy surface		Uniform, moderately thick, glossy surface		
Taste and smell	The taste is somewhat empty, without extraneous tastes and smells				
Color	White, uniform throughout the mass			White, with a cream shade	Tsreami, uniform throught the mass

Table 2 - Physico-chemical indicators of the quality of lactose-free vegetable creams for coffee drinks

Indicator	Mass fraction of fat, %				
	10.0	20.0	30.0	40.0	50.0
Mass fraction of protein, %	4.75±0.13	3.75±0.12	3.0±0.1	2,0±0.08	1.0±0.003
Mass fraction of lactose, %	< 0.01				
Acidity, °T	14.0±0.4			14.5±0.41	15.0±0.5

Table 3 - Microbiological indicators of the quality of lactose-free vegetable creams for coffee drinks

Indicator	Mass fraction of fat, %					The norm is DSTU 7519:2014
	10.0	20.0	30.0	40.0	50.0	
KMAFAnM, KUO/g	1·10 ³			1·10 ⁴		Not more 1·10 ⁵
BGKP, CFU/g, in 0.1 g	Not detected					Not allowed
Pathogenic microorganisms, including salmonella in 25 g						



Conclusions

The genetic and metabolic features of the population of each country are also represented in military personnel. Improving the rations of military personnel in Ukraine is a dynamic process that needs development, the introduction of modern technological solutions, in particular, in the direction of creating alternative projects to traditional milk.

In the course of research, a technology was proposed and the composition of lactose-free cream enriched with polyunsaturated fatty acids, in liquid, pasty and dry form, was proposed as additional products for different rations and conditions of use in the Armed Forces of Ukraine.