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## ПОКАЗНИКИ ЯКОСТІ МОЛОЧНО-РОСЛИННИХ ФАРШІВ НА ОСНОВІ КОНЦЕНТРАТУ ЗІ СКОЛОТИН

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## QUALITY INDEX OF MILK-VEGETABLE MINCED WITH BUTTERMILK CONCENTRATE

**Мета.** Визначити комплекс даних, що характеризує якість розроблених молочно-рослинних фаршів.

**Методи.** Інструментальні методи - для визначення хімічного складу.

**Результати.** Вивчено якісні показники молочно-рослинних фаршів на основі концентрату зі сколотин. Визначено харчову цінність розроблених продуктів, кількісний та якісний склад білків, мінеральних речовин та вітамінів. Розраховано амінокислотний скор дослідних зразків, визначено ступінь перетравлення і відносну біологічну цінність молочно-рослинних фаршів на основі концентрату зі сколотин.

**Наукова новизна.** Вперше отримано комплекс даних, що характеризують якість розроблених молочно-рослинних фаршів на основі концентрату зі сколотин і доводять їх підвищену харчову та біологічну цінність.

**Практична значущість.** Отримані результати підтверджують високу якість молочно-морквяного, молочно-гарбузового та молочно-кабачкового фаршів у порівнянні з фаршем із нежирного кислого сиру. Встановлено, що розроблені фарші є перспективною сировиною для виробництва кулінарної продукції, що дозволить розширити асортимент продуктів з підвищеною харчовою та біологічною цінністю.

**Ключові слова:** *молочно-рослинні фарші, концентрат зі сколотин, харчова цінність, біологічна цінність, якісні показники*

**Постановка проблеми.** Providing the population with biologically valuable nutrition product is the priority of social and economic development of Ukraine.

One of the promising areas of the solution of the problem is the creation of a complex nutrition product composition by combining dairy and vegetable material, which provides the possibility of mutual enrichment of received products with essential ingredients and regulation of their composition in accordance with the basic principles of sensible nutrition [1].

It is known that 60...65% of the daily requirement of protein should be satisfied by products of animal origin due to the fact that they contain more essential amino acids and easier to digest than proteins of plants [2]. However, plant proteins are more common in nature and constitute 68,0...80,0% of the total consumption of all proteins, but most of them are limited by the content of lysine, isoleucine, sulphur-containing amino acids. Substitution of materials of animal origin by vegetable origin reduces calorie value of food, enriches products with vitamins, most of which are powerful antioxidants, dietary fiber, minerals, organic acids, which facilitates the absorption of calcium, phosphorus, iron and other functional ingredients whose presence is necessary for normal functioning of the human body [3]. What is more, note very important physiological phenomenon: when combining heterogeneous origin of protein in the food rations, their digestibility almost always improves [4].

**Аналіз останніх досліджень і публікацій.** Theoretical and practical basics of nutrition products with adjustable composition and properties contained in the works of local and foreign scientists: O.O. Grinchenka, A.M. Dorohovych, P.A. Karpenko, M.B. Kolesnikov, V.N. Korzun, G.M. Lysyuk, L.P. Babe, L.M. Mostovaya, N.Y. Orlova, M.I. Ordinary, P.P. Pivovarova, N.V. Prytul'ska et al.

Analysis of international experience as well as trends in the domestic dairy industry proves that it is appropriate to use dairy protein concentrates, including dairy protein concentrate (DPC) with buttermilk for creation of a complex nutrition product composition.

DPC with buttermilk is a product with a homogeneous, soft, with suit texture and it has clean taste and odor characteristic of dairy products, the color from white to white with cream shade.

DPC proteins with buttermilk contain in its composition (except of casein) whey proteins, whose part is 26% from weight of protein. Studies have shown [5] that level of all essential amino acids in DPC proteins with buttermilk exceeds the standard of WHO/FAO indicating the high biological value of the product. DPC with buttermilk is a good source of vital minerals and water-soluble vitamins [5].

Therefore, DPC with buttermilk is a promising material for the production of complex composition products, which was taken into account when conducting further research.

The scientific school of Professor G.V. Deynychenka in Ukraine developed several technologies of semi-finished products and nutrition products based on or using concentrate from buttermilk during recent years. [6, 7]. But today their range is not wide enough, and there is no technology of dairy and vegetable-based semi-finished products. Therefore, scientific reasoning and development of competitive technologies technology of dairy and vegetable-based semi-finished products is an urgent task, the solution of which will expand the range of products with improved nutritional and biological value and to obtain products with desired functional properties.

Based on the data obtained during the experiments, taking into account the information contained in the scientific and technical literature, we have developed technology to produce dairy and vegetable-based semi-finished products. Developed technologies include the use of concentrate from buttermilk as a main component, and also the introduction of the semi-vegetable puree of carrots, pumpkins and zucchini, egg, wheat flour, sugar.

Technology features, specificity of prescription components and perspectives of further use of technologies developed by dairy and vegetable-based semi-finished products in food identified the need to study their quality indexes.

**Формування цілей статті.** The aim of this work is to study the quality indexes of dairy and vegetable-based semi-finished products on basis of protein concentrate from buttermilk.

**Виклад основного матеріалу дослідження.** Nutrition products quality is a set of properties that characterize the nutritional and biological value, functionality and technology, health and safety indexes of the product as well as degree of their intensity [8].

Characteristics semi-finished minced sour crude are chosen for control in establishing of quality indexes of the developed semi-finished products. The content of the nutrients in dairy and vegetable-based semi-finished products and the reference sample are shown in Table 1.

Table 1 – The chemical composition of dairy and vegetable-based semi-finished products, % ( $\bar{X} \pm m$ )

Index	Control	Semi-finished products		
		milky and carrot	milky and pumpkin	zucchini and milky
solids	30,5	35,77±1,1	36,82±1,1	31,55±1,1
white	17,2	14,06±0,5	13,99±0,5	15,79±0,6
fat	1,00	1,82±0,07	1,81±0,08	1,80±0,07
Carbohydrates, including				
mono - and disaccharides	10,0	14,28±0,5	13,94±0,6	3,99±0,12
starch	1,10	2,41±0,10	2,75±0,10	5,42±0,14
cellulose	-	0,17±0,01	0,17±0,01	0,05±0,01
pectin	-	0,37±0,01	1,63±0,05	0,58±0,03
ash	1,10	1,62±0,07	1,52±0,06	1,65±0,06
Caloric, kkal/100h	109,0	129±4,9	133±5,0	97,73±3,7

Analysis of the data Table 1 indicates that the developed products exceed the reference sample according to the contents of most nutrients. Thus, according to the content of solids milky and carrot semi-finished product exceeds the control by 5,27%, semi-finished milk pumpkin - by 6,32%, semi-finished milk zucchini - by 2,05%.

It is found (Table 1), that the defined semi-finished products exceed control in fat by 0,80...0,82%. This is due to the use of DPC with buttermilk formula, the content of fat in which is 1,34%, against 0,60% in fatless sour crude.

Due to the replacement of part of materials of animal origin to vegetable one and added sugar, developed semi-finished products (milky and carrot, milky and pumpkin) exceed control at the content of mono-and disaccharides by 4,28%, and 3,94% respectively.

It is known [9] that soluble fibre, especially pectin, has a positive effect on digestion and cholesterol metabolism in humans. It should be noted that the pectin content was 0,37%, 1,63% and 0,58% respectively in developed semi-finished products (milky and carrot, milky and pumpkin, zucchini and milky).

Data in the Table. 1 show that the replacement materials, which contain protein to materials for vegetable, puree resulted in a decrease of 8,20...18,66% of proteins in developed products. However, analysis of the quality of the proteins (Table 2) shows that there was identified and quantified 18 amino acids including all essential in he developed semi-finished products.

As it is seen form from the Table 2, proteins of dairy and vegetable-based semi-finished products have particularly high content of leucine (8,48...8,54% of the total amino acid and 22,39...22,67% of the essential amino acids), lysine (respectively 6,79...6,83% and 17,84...18,03%), valine (respectively 6,55...6.58% and 17,36...17,40%).

Table 2 – Amino acid composition of proteins in semi-finished dairy and vegetable products, ( $\bar{X} \pm m$ ,  $m \leq 0,05$ )

Name amino acids	Control	Semi-finished products		
		milky and carrot	milky and pumpkin	zucchini and milky
Essential:	7,067	5,190	5,179	5,845
valine	1,021	0,901	0,900	1,017
isoleucine	0,838	0,663	0,662	0,751
leucine	1,555	1,162	1,163	1,325
lysine	1,208	0,930	0,934	1,043
methionine	0,472	0,337	0,337	0,374
threonine	0,789	0,598	0,598	0,671
tryptophan	0,258	0,153	0,153	0,171
phenylalanine	0,926	0,433	0,433	0,493
Nonessential:	9,988	8,505	8,491	9,679
alanine	0,618	0,388	0,384	0,433
arginine	0,728	0,444	0,446	0,498
aspartic acid	1,155	1,322	1,316	1,472
histidine	0,534	0,334	0,334	0,378
glycine	0,343	0,201	0,200	0,230
glutamic acid	2,978	2,841	2,830	3,269
proline	1,522	0,664	0,663	0,780
serine	0,984	1,489	1,491	1,686
tyrosine	1,018	0,583	0,588	0,660
cystine	0,108	0,240	0,239	0,273
Total	17,055	13,695	13,670	15,524

As for nonessential amino-acids in dairy and vegetable-based semi-finished products, there is a high maintenance aspartic (9,48...9,65% of the total amino acids), glutamine (20,70...21,05%) acids and serine (10,86...10,91%), which is typical for dairy products.

Calculation of essential amino acids in products and its comparison with the standard data of the FAO/WHO showed that there is no proteins within limiting amino acids in dairy and vegetable-based semi-finished products, levels of all essential amino acids exceeds standard of FAO/WHO, which indicates a high biological value of products.

On the one side, the biological value of the product is defined by matched speedy settlement of essential amino acids to standard of FAO/WHO, but on the other side, it is defined by the degree of hydrolizability of proteins by enzymes digestive track.

Information about the extent of digestibility and relative biological value (RBV) of developed semi-finished products is presented in Table 3.

Table 3 – The degree of digestion and relative biological value of dairy and vegetable semi-finished products, ( $\bar{X} \pm m$ )

Name of products	The extent of digestibility,			RBV
	pepsin	trypsin	total	
Kazein control	5,05±0,14	25,38±0,79	30,43±0,94	100
Semi-finished products				
milky and carrot	6,00±0,19	23,2±0,63	29,20±0,85	142±3,8
milky and pumpkin	5,93±0,17	22,7±0,73	28,63±0,89	143±4,5
zucchini and milky	5,89±0,21	22,4±0,60	28,29±0,76	141±3,4

According to the data in Table. 3, proteins developed by dairy and vegetable semi-finished products are characterized by a high degree of digestion and superior control (casein) in terms RBV of 1,41...1,43.

Adding vegetable material to composition of semi-finished products helps to enrich products with minerals.

The results of the research have showed that according to the contents of all ashy mineral elements, developed semi-finished products exceed control. However, for assessing the nutritional value the proportion of these elements is more important than the absolute content of these elements in the developed products. According to the formula of a balanced diet from FAO / WHO, the best ratio is Ca: P: Mg - 1:1,5:0,5. This ratio equals to semi-finished dairy and carrot product - 1:1,52:0,33 dairy and pumpkin product - 1:1,53:0,31, dairy and zucchini product - 1:1,47:0,28 . It does not exactly correspond to the formula of balanced diet, as the content magnesium is a bit lowered. However, this level of magnesium content is typical for milk and dairy products. For example, in the reference sample, this ratio is 1:1,64:0,21.

The results of study of vitamin content of the examined products have shown that the developed semi-finished products significantly exceed the control level at the content of B vitamins,  $\beta$ -carotene, vitamin E, C, E, A. For example, the content of vitamin B<sub>1</sub> in developed semi-finished products compared with a control sample was increased by 9,8...11,2 times, vitamin B<sub>2</sub> - by 7,58...8,54 times, and vitamin B<sub>6</sub> - by 26,8 to 24,2 ... again. In developed semi-finished products: dairy and carrot, dairy and pumpkin, and dairy and zucchini the contents of  $\beta$ -carotene is 2,71, 9,63 and 0,13 mg/100g, vitamin C – 2,80, 3,27 and 3,51 mg / 100 g% respectively.

The main safety indicators of dairy and vegetable-based semi-finished products and reasonable parameters for their storage have been defined. It was found that the optimal parameters for storing semi-finished products under which all technological properties are kept high are when the temperature is 0...2°C, relative humidity is 80...85%, storage time - 10 days. It was determined developed semi-finished products do not exceed the maximum allowable concentrations and meet regulatory documents according to the toxicological and radiological indicators.

**Висновки.** The article examines quality index of milk and vegetable-based semi-finished products on basis of protein concentrates from buttermilk. Nutrition and relative biological value, basic safety indexes of developed semi-finished products is defined in the article.

The results of the search have showed that developed semi-finished products exceed the control as for the content of major dietary nutrients.

It was found that there is no limiting amino acids in content of proteins of semi-finished products the level of all essential amino acids exceeds the standard of FAO / WHO.

The basic parameters of safety of dairy and vegetable-based semi-finished products are studied and reasonable parameters for storage are indicated.

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### Реферат

**Цель.** Определить комплекс данных, характеризующий качество разработанных молочно-растительных фаршей.

**Методы.** Инструментальные методы - для определения химического состава.

**Результаты.** Изучены качественные показатели молочно-растительных фаршей на основе концентрата из пахты. Определены пищевая ценность разработанных продуктов, количественный и качественный состав белков, минеральных веществ и витаминов. Рассчитан аминокислотный скор опытных образцов, определены степень переваривания и относительная биологическая ценность молочно-растительных фаршей на основе концентрата из пахты.

**Научная новизна.** Впервые получен комплекс данных, который характеризует качество разработанных молочно-растительных фаршей на основе концентрата из пахты и доказывает их повышенную пищевую и биологическую ценность.

**Практическая значимость.** Полученные результаты подтверждают высокое качество молочно-морковного, молочно-тыквенного и молочно-кабачкового фаршей по сравнению с фаршем из нежирного кислого творога. Установлено, что разработанные фарши являются перспективным сырьем для производства кулинарной продукции, что позволит расширить ассортимент продуктов с повышенной пищевой и биологической ценностью.

**Ключевые слова:** *молочно-растительные фарши, концентрат из пахты, пищевая ценность, биологическая ценность, показатели качества*

### Summary

**Purpose.** Define a set of data on the quality of the developed milk-vegetable minced with buttermilk concentrate.

**Methodology.** Instrumental methods - to determine the chemical composition.

**Findings.** The qualitative indicators of milk-vegetable minced with buttermilk concentrate. Determined the nutritional value of products developed by quantitative and qualitative composition of proteins, minerals and vitamins. Calculated amino fast prototypes, defined relative degree of digestion and biological value of milk-vegetable minced with buttermilk concentrate.

**Originality.** Received first set of data on the quality of the developed of milk-vegetable minced with buttermilk concentrate and bring their increased nutritional and biological value.

**Practical value.** The results confirm the high quality milk-carrot minced, milk-pumpkin minced, milk-zucchini minced in comparison with low-fat sour minced cheese. Established minced developed a promising feedstock for the production of culinary products that will expand the range of products with high nutritional and biological value.

**Key words:** milk-vegetable minced, concentrate from buttermilk, *nutritional value*, biological value, quality indicators

Рекомендовано до публікації ...