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# ВИВЧЕННЯ БІОЛОГІЧНОЇ ЦІННОСТІ СТРУКТУРОВАНОГО ПРОДУКТУ З СИРУ КИСЛОМОЛОЧНОГО, ВИГОТОВЛЕНОГО З ВИКОРИСТАННЯМ КОНЦЕНТРАТУ ПОДРІБНЕНИХ ЯДЕР НАСІННЯ СОНЯШНИКА

*Розроблено технологію нового структурованого продукту на основі сиру з молока знежиреного, з використанням концентрату ядра з насіння соняшнику, — перспективного виду сировини, використання якого в технології дозволило поліпшити харчову та біологічну цінність нового продукту.*

*Під час дослідження нами вивчена засвоюваність білкової складової нового продукту і отримано позитивні результати.*

**Ключові слова:** *структурований продукт, концентрат ядра насіння соняшнику, біологічна цінність білка, засвоєння білків in vitro.*

## 1. Introduction

The present state of development of the food industry challenge the specialists to develop and apply efficient and competitive technologies of a wider range of higher quality and nutritional value food products with improved consumer characteristics.

In the market economy, the consumer demand controls the development of the assortment of marketed foods. The problem of satisfying the consumer demand in foods of high nutritional and biological value is of drastic importance at the present stage of the new technological development marked by the availability of a significant unused raw material potential.

## 2. Analysis of literature data

The literary data analysis about the structure of modern man diet indicative of the deficiency of essential diet components consumption is wide-spread, including animal origin proteins which are the sources of essential amino acids. The demand on the animal origin proteins is satisfied only on 80 % [1]. Modern conceptions of importance of these matters in the diet affirm that the milk protein plays the fundamental role among them. The tendency of fat content reducing and protein content increasing in milk and dairy products is explained by this fact. The consumption of low fat dairy products increased in the last decades almost in all countries of the world. Different flavour and aromatic additives are used for the low fat dairy products taste improvement [2].

The most important task of new products elaboration is the creation of such assortment of dairy products, which would satisfy consumers' requirements, and also would effectively use in the man's diet all component parts of milk.

The elaboration of the new competitive resource-saving technologies of multicomponents dairy products and in particular, with the use of curd, has important bearing on the present economic situation.

Lipatov N. N., Rogovoy I. A., Hramtsov A. G., Molochnikov V. V., Zaharova N. P., Pokrovskiy A. A., Shaternikov M. N. and others developed theoretical basics of the creation of products on milk basis with complex raw material composition [3].

Milk proteins have high biological value, helpful functional properties, which improve quality of food products. They help rationally balance all food proteins, including vegetable proteins.

Curd is one of the richest sources of complete protein. Man's organism almost completely assimilates curd protein. The high biological value of proteins is conditioned by composition, essential amino acids balance and good assimilability in living organism. The colloid state of proteins determines their easy availability and digestibility by proteases. Curd contains vitamins A and B, calcium and phosphorus. Curd has the antisclerotic action; it is widely used in the diet of patients with atherosclerosis, obesity, diabetes, cardiovascular and liver diseases, after burns and bones fractures.

In the man's organism proteins plays the role of plastic material, which is used for the cells and tissues construction, active biological matters, enzymes and hormones formation, that allows to use curd for the prophylaxis and treatment of atherosclerosis and some liver and kidney diseases [4].

The products on the milk base which have complex raw material composition together with traditional dairy products distributed in many countries. It is caused by the possibility of dairy products chemical composition control in accordance with the modern requirements of nutrition science and also with the economy of main milk raw material [5].

At present milk processing enterprises produce the wide assortment of multi components dairy products including curd, cultured milk drinks, cheeses and other with various fillers. Their use expands the assortment, improves organoleptic indices and enriches products by valuable ingredients.

The multi components products elaboration is directed on creation of the products with the specified chemical composition and control of lipid, carbohydrate, mineral and vitamin composition.

During the creation of products on the basis of curd, raw material of animal and vegetable origin combines in composition. It allows to use the high-quality protein product rationally and also to improve its nutritional value in whole.

One of such types of raw material is the sunflower seed kernel. It has exceptionally high biological value. It is considered that the sunflower seed kernel protein differs from the standard – egg protein less than other types of vegetable proteins. The processing of the food protein from sunflower seeds presently does not have the industrial value [6]. We firstly got the food protein concentrate by the separation of oil from pure kernel by the method of the cold pressing at the temperature of 50 °C [7].

### 3. The purpose and tasks of the study

The purpose of the work is to determine the effect of concentrate peanut kernels and corn flour to change the number of physical and chemical properties of soft cheese product and their relationship with sensory, structural and mechanical properties of a new product.

To achieve the goal, we needed to examine the amino acid composition of the protein of the new product and compare it with milk and low-fat cottage cheese.

Investigate the enzymatic activity of digestive enzymes in vitro with respect to structured protein products based on fat-free yogurt. Get justification improvement in food and biological value of the product.

### 4. Recent investigations

The technology of the structured product on the basis of curd with the use of sunflower seed kernel concentrate was elaborated at the Kharkov state university of food technology and trade.

The aim of these researches is the examination of the new product biological value indices.

The standard methods of research are used in this research paper.

**4.1. Materials and methods.** Amino acid composition of proteins was determined on the amino acid analyzer T 339 M (Czechoslovakia). The biological value indices were determined by calculation methods [8], and the digestibility of proteins in vitro by protease of gastrointestinal tract was determined by experimental method of A. Pokrovskiy and N. Ertanov [9].

Hydrolysis products accumulation was determined by Lowry's color reaction and expressed in terms of standard units (mg of tyrosine to 1 g of protein) [10].

**4.2. The results and their discussion new structured product on the basis of milk skimmed curd with use of the sunflower seed kernel concentrate was elaborated.** Total amino acid contain of the structured product on the base of curd, milk skimmed curd and Sunflower seed kernel concentrate are presented in the Table 1.

From the table 1 data, the total amount of essential and nonessential amino acids in 100 g of structured product on the base of curd is lower than in the milk skimmed curd. It is stipulated by lower content of protein in it. Leucine, lysine, valine, isoleucine prevail among essential amino acids. Use of the new product will allow enriching diets with glutaminic and asparaginic acid, glycine, arginine, and proline.

Table 1

Amino acid contain of the structured product and its components

Amino acids	Amino acids contain, mg in 100 g of the product		
	Milk skimmed curd	Sunflower seed kernel concentrate	Structured product on the base of curd
Valine	994	2494	734
Isoleucine	999	1783	707
Leucine	1853	3193	1270
Lysine	1451	1824	967
Methionine	481	1002	377
Threonine	802	2274	582
Tryptophan	188	866	147
Phenylalanine	928	2438	666
<b>Essential amino acid contain</b>	7696	15874	5450
Alanine	438	2204	542
Arginine	813	4329	855
Asparaginic acid	1007	4339	968
Histidine	558	1344	399
Glycine	262	2646	849
Glutaminic acid	3304	9824	2528
Poline	2003	2775	1627
Serine	828	2035	620
Tyrosine	941	1398	581
Cystine	154	1017	133
<b>Nonessential amino acid contain</b>	10308	32911	9102
<b>Total amino acid contain</b>	18004	48785	14552

The computational values of amino acids score, distinction factor of amino acids (DFAA), biological value (BV) and utility factor of protein (U) of the structured product and its components are presented in the Table 2.

Table 2

Biological value indices of proteins of the structured product and its components

Amino acids	FAO/WHO demands mg/g of protein	Milk skimmed curd		Sunflower seed kernel concentrate		Structured product on the base of curd	
		Amino acids, mg in 1 g of protein	Amino acids score, %	Amino acids, mg in 1 g of protein	Amino acids score, %	Amino acids, mg in 1 g of protein	Amino acids score, %
Lysine	55	80,6	145,5	37,4	68,0	66,6	121,1
Threonine	40	44,5	111,3	46,6	116,5	40,0	100,0
Valine	50	55,2	110,4	51,1	102,2	50,4	100,8
Methionine + cystine	35	35,3	100,9	39,3	112,3	35,2	100,6
Isoleucine	40	55,5	138,8	36,5	91,3	48,6	121,5
Leucine	70	102,9	147,0	65,5	93,6	87,3	124,7
Phenylalanine + tyrosine	60	103,8	173,0	78,7	131,2	85,7	142,8
Tryptophan	10	10,4	104,0	17,8	178,0	10,1	101,0
DFAA, %	—	28,0		43,6		14,1	
BV, %	—	72,0		56,4		85,9	
U	—	0,74		0,65		0,85	

From the Table 2 data we can see that the structured product protein hasn't limitation amino acids. Therefore, the addition of sunflower seed kernel concentrate in its composition in the amount of 5,1 % improves the indices of protein biological value.

The results of amino acids composition balance determination of structured product on the base of curd (to threonine) are presented in the Table 3.

The obtained results confirm the improvement of amino acid composition balance of new product protein structure compared with milk skimmed curd.

Table 3

Amino acid composition balance of the structured product and its components

Amino acids	Standard scale	Amino acids balance (to threonine), reference units		
		Milk skimmed curd	Sunflower seed kernel concentrate	Structured product on the base of curd
Threonine	1,0	1,0	1,0	1,0
Lysine	1,1	1,81	0,8	1,67
Valine	1,5	1,24	1,10	1,26
Methionine	0,7	0,6	0,44	0,65
Isoleucine	1,4	1,25	0,78	1,22
Leucine	1,7	2,31	1,40	2,20
Phenylalanine	1,1	1,16	1,06	1,14
Tryptophan	0,25	0,23	0,38	0,25

The research results of enzymatic activity of digestive enzymes in vitro of structured product proteins on the base of curd are presented in the Table 4.

As we can see from the analysis of Table 4 data, the digestibility of structured product proteins compared with control sample proteins increases on the stages of pepsinolysis and tripsinolysis. Probably, it connects with the technology of the structured product which includes the stage of curd grinding till the size of high dispersed particles. It provides protein activity to the gastrointestinal tract enzymes.

Table 4

The research results of enzymatic activity of digestive enzyme in vitro of structured product proteins on the base of curd

Samples	The amount of soluble products of protein hydrolysis, mg of tyrosine to 1 g of product protein		
	Pepsinolysis	Tripsinolysis	Pepsinolysis + tripsinolysis
Pilot sample 1 (structured product)	70,1	56,2	126,3
Control sample 2 (curd)	56,3	52,4	108,7

## 5. Conclusions

So, in this paper we determined the effect of concentrate peanut kernels and corn flour, to change the physical and chemical properties of the cheese product.

Texture and sensory characteristics of new product is improved.

By adding protein peanut kernels improved amino acid composition of the new protein product in comparison with non-fat milk and cheese.

Digestive enzymes *in vitro* showed good digestion of protein curd structured.

New structured product on the basis of cheese using concentrate kernel of sunflower seeds has a high nutritional and biological value.

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## ИЗУЧЕНИЕ БИОЛОГИЧЕСКОЙ ЦЕННОСТИ СТРУКТУРИРОВАННОГО ПРОДУКТА ИЗ СЫРА МЯГКОГО, ИЗГОТОВЛЕННОГО С КОНЦЕНТРАТОМ ИЗМЕЛЬЧЕННЫХ ЯДЕР СЕМЯН ПОДСОЛНЕЧНИКА

Разработана технология нового структурированного продукта на основе творога из обезжиренного молока, с использованием концентрата ядра из семян подсолнечника, — перспективного вида сырья, использование которого в технологии позволило улучшить пищевую и биологическую ценность нового продукта. В ходе исследования нами изучена усвояемость белковой составляющей нового продукта и получены позитивные результаты.

**Ключевые слова:** структурированный продукт, концентрат ядра семян подсолнечника, биологическая ценность белка, усвоение белков *in vitro*.

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