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Development of domestic nutrition additives

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Abstract
This paper discusses the create a qualitatively new domestic lizotsim-contained natural biological corrector (NBC) with an effective use of its technology in the production of meat and dairy products competitive directional.

Keywords: natural biological corrector lizotsim-containing protein product; pectin-containing plant material; amino acid material; preventive effect.

Desarrollo de aditivos nutricionales domésticos

Resumen
Este trabajo analiza la creación de un nuevo corrector biológico natural interno, producto de la proteína que contiene lizotsim (NBC), con un uso efectivo de la tecnología en la producción de carne y productos lácteos direccionales.

Palabras clave: corrector biológico natural; producto de la proteína que contiene lizotsim; material vegetal que contiene pectina; material de ácido amino; efecto preventivo.

1. Introduction

One of the most actual problems of modern time is the preservation of human health that is largely determined by its nutritional status. Abnormalities in the structure of nutrition on the background of a complex biochemical and environmental conditions lead to the emergence and progression of a number of nutrition-related diseases [1-2].

The problem of contamination of the biosphere establishes a vital challenge-seeking means of health improvement of the population. This should be considered a fundamentally new approach to the construction of healthy food of the XXI century.

For regions with adverse environmental conditions is particularly relevant general preventive approach.

Global trends in nutrition associated with the creation of a product range of preventive, contributing to the improvement of health in daily use as part of their diet. The high popularity of these products, according to the patent search, especially actual in developed countries such as USA, Japan and European Union countries. After all, foreign and domestic research found that increased erratic background radiation, entering the body of toxins, radioisotopes cause substantial alterations of protein, minerals, vitamins and other metabolic processes in the human body, but also lead to serious violations of the most important of his life hematopoietic system and digestive system [3-4].

In search of solution to the problem, scientists have come to the conclusion that the development of biotechnology, allowing to obtain from natural sources of biologically active substances are often deficient in the diet of adults and children, but necessary for the regulation of the functions of organs and systems of the human body.

Through the application of new, modern biotechnological approaches such products should contain small amounts of those nutrients or regulatory substances of animal and plant

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origin that are most deficient in a part of the daily diet of the organism, and may be a model of a balanced diet. It is necessary to take into account that the ingredient composition of the enriched complexes is best to use local raw materials, as it is at the genetic level mark in one degree or another body [5].

In the Republic of Kazakhstan the using of domestic production of a new generation of dietary supplements is virtually nonexistent. The market is full of imported products.

In this regard, the need for a scientific and technical basis for the production of domestic dietary supplement of natural origin is obvious [6-12].

Scientific and practical substantiation and resolution of these issues are considered in this scientific article.

The purpose of research is to create a qualitatively new domestic lizotsim-contained natural biological corrector (NBC) with an effective use of its technology in the production of meat and dairy products competitive directional.

There are the following tasks for the solution of this goal:

1. Investigate and justify the component composition of the NBC, which regulates preventive effect;
2. Determine the quality indicators and safety performance of the NBC.

2 Method

During the implementing the work there were used lizotsim-contained product obtained from chicken eggs and plant material (amaranth, pectin, rose hips, pumpkins, beta-carotene, kelp).

In the experiment there was involved the research of complex qualitative and safety indicators, used standard and original methods to get information about the composition and properties of the objects of research.

There were used the following methods:

Determination of lizotsim activity was carried out in terms of the activity of lizotsim using the reference strain micrococcus - *M. lysodeikticus* (strain 2665 SCI named after Tarasevich, Moscow).

Determination of minerals accelerated by using magnesium acetate.

The mass concentration of calcium and phosphorus were determined by atomic absorption spectrometry.

The amino acid composition was determined in hydrolysates of whole product with an automatic amino acid analyzer AAA-339.

For the determination of the bacteriostatic and bactericidal activity of the NBC there was used the photonephelometrical method. In our work, we take into account the change in the optical density of the culture medium with microorganisms and nutrient medium with the test NBC containing material and microbes immediately after connection and after 0-, 2-, 4- and 24-hour incubation. Pure cultures of *E. coli* and *S. aureus*, each individually plated on IPA and grown in an incubator at a temperature of 37^0C for 24 hours. Then, it was rinsed with sterile isotonic sodium chloride solution, and standardized to a content of 1 ml of 2 billion. microbial bodies. From this slurry was seeded on BCH tubes and grown hours in an oven at the above temperature.

There were used standard methods of microbiological parameters studies in accordance with GOST 9959-81; GOST 10.444-85; GOST 9958-81, GOST 9225-84, GOST 10444.11-89, GOST 10444.5-85 and GOST 30425, GOST RS0480-93.

Determination of sodium chloride was carried out in accordance with GOST 9957-73.

Vitamin content was determined by infrared spectroscopy instrument IK-4500 and method of high effective liquid chromatography on the chromatograph "MiLiChrome". According to the procedure that was developed by I.E. Mitin, N.A. Golubkina, there was determined the water soluble vitamins.

Determination of carbohydrates was performed by refractometerical method.

There was conducted research of indicators of ecological safety of the product to toxic elements:

- Mass fraction of mercury in accordance with GOST 26927;
- Mass fraction of iron in accordance with GOST 26928;
- Mass fraction of arsenic in accordance with GOST 26930;
- Mass fraction of copper in accordance with GOST 26931;
- Mass fraction of lead in accordance with GOST 269 322;
- Mass fraction of cadmium in accordance with GOST 26933;
- Mass fraction of zinc in accordance with GOST 26934.
- on hormones:
- Radionuclides for NRB-96.

The results obtained in this work were subjected to statistical processing. There were uses the absolute and relative values (extensive parameters). Evaluation of reliability of statistics carried out by means of arithmetic and geometric quantities (M), average error (m), ratio t according to Student, the level of probability of the confidence interval P. The association between the phenomena determined by the conformity ratio - criteria $\chi 2$.

3 Results

According to the actual issue of the NBC, we justified the choice of raw materials and component composition in its modeling, which consists of natural ingredients that are highly effective adaptogen, immunomodulator and biocorrector. The basis was the content therein in an optimum ratio of all necessary for the construction of essential protein molecule and nonessential amino acids, vitamins (B2, B6, C and D), and full-digestible mineral elements (calcium, phosphorous, magnesium, iron, etc).

During of the construction composite NBC used lizotsim-containing protein product, plant material (amaranth), pectin, rosehip, whey powder, a calcium product (kaltsid).

There was used lizotsim-containing protein product

derived from chicken eggs, which is the supplier of the protein simultaneously possesses unique antimicrobial properties, regulates the gut microflora. The action of lizotsim as a food preservative, due to the high antimicrobial activity to a wide range of microorganisms that pose a threat to human health, for example *Listeriaytogenes*, *Clostridium botulinum*, *Pseudomonas – aeroginosa*, *Staphylocoecus*, butyric acid bacteria, yeast and some other toxins.

Essential indicators on the quality of the finished product have all the ingredients of its prescription, but of particular importance and urgency of now acquires the quality of raw materials used in production. The quality of food is determined by a complex of characteristics, and above all, nutritional value, uniting biological and energy value, organoleptic and hygiene, microbiological and safety performance.

It was taken into account that the newly created products must meet the medical and biological requirements for food products functionality.

According to the concept of balanced nutrition for normal human life it is necessary not only to the intake of the necessary amounts of nutrients, but also the provision of certain relationships between them.

We modified the method of producing a protein product of hen egg lizotsim with high activity. To do this, in the technology of egg white after mixing and filtering operations included additional treatment, which obtained an innovative patent №22561 Committee on Intellectual Property Rights MJ RK.

Lizotsim retains its activity in said composition providing lysing action against Gram-positive and certain Gram-negative microorganisms. The introduction of the NBC Amaranth pectin plant raw material makes it possible to give the product dietary properties, as pectic substance capable of adsorbing various compounds.

There was conducted the analysis of plants (Table 1) with a purpose to obtain protein-vitamin complex (proteins, polysaccharides, flavonoids, amarantina etc.), from the amaranth leaves and then introducing it into the NBC.

By analyzing the relative performance of protein, amino acids, lipids, micro- macronutrients plants (amaranth, rice, corn, wheat and beans), as shown in Table 1 the energy value of 100 g in Amaranth is 439.0 kcal, which indicates a high complex score in relation to other plants.

Thus, the presence of plants (amaranth) allows you to enrich the composition of the NSC easily digestible protein, balanced in essential amino acids, vitamins, flavonoids, micro and macro. The presence of pectin helps recycling of heavy metals due to the presence of free carboxyl group (-COOH) is formed with metal ions few dissociating resistant compound chelates, which prevents the occurrence of heavy metals into the body. Amaranth flavonoid compounds have antioxidant activity, catalyzing the oxidation processes.

The composition of the NBC includes whey proteins, which provide an additional source of essential amino acids and are recognized by immune carriers and antiseptic properties, which are able to glue the microorganisms and other foreign cells. Carbohydrate composition similar to that of whey milk. The principal carbohydrate is lactose - milk sugar a unique view, is not found anywhere in nature except in the milk. The whey from the milk pass vitamins, and water soluble to a greater extent than oil-soluble. Of the organic acids, it contains lactic, citric and volatile fatty - acetic, formic. Including the composite structure of the NSC kaltsid, we have provided the content of easily digestible compounds of calcium and phosphorus, which will significantly affect the metabolism, given that minerals are the basis of many of the structural and functional units of the body. Functions of minerals in the body are very diverse. They are involved in such dramatic reactions, like breathing, enzymatic and catholic decomposition and synthesis, muscle contraction, etc. With the ability to tightly bind to proteins, organic acids, calcium performs plastic role in the formation of tissue structures, maintaining their biocapacity, assimilation of nutrients, excretion of metabolic products and neuromuscular activity.

Table 1.
Analysis of plants

Indicators	**Vegetable raw materials**				
	Amaranth	**Rice**	**Corn**	**Wheat**	**Beans**
Protein, %	**15,5-23**	**7,60**	**7,68**	**13,00**	**21,48**
Amino acids, mg/100 g.					
Triptophan	1,50	1,20	0,70	1,20	0,00
Lizin	8,00	3,80	2,90	2,20	5,00
Gistidin	2,50	2,10	2,60	2,20	3,10
Arginin	10,0	6,90	4,20	3,80	6,20
Trionin	3,60	3,80	3,80	2,90	3,90
Valine	4,30	6,10	4,60	4,50	5,00
Methionine	4,20	2,20	1,40	1,60	1,20
Izoleitsin	3,70	4,10	4,00	3,90	4,50
Leitsin	5,70	8,20	12,5	7,70	8,10
Fenilalanin	7,70	5,00	4,70	5,30	5,40
Lipids, %	7,31	2,20	5,00	1,70	1,93
Ash, %	3,61	3,40	1,65	1,50	4,61
Calcium, %	0,14	0,02	0,01	0,02	0,15
Phosphorus, %	0,54	1,18	0,27	0,41	0,41
Magnium, %	0,22	0,08	0,13	0,10	0,19
Potassium, %	0,57	0,12	0,48	0,40	1,30
Natrium, %	0,12	0,01	0,01	0,01	0,20
Copper, ppm	6,00	4,00	4,00	4,20	10,0
Manganese, ppm	12,0	7,00	7,00	28,0	8,00
Zinc, ppm	21,0	24,0	24,0	41,0	32,0
Energy value, kcal / 100g	439,0	364,0	361,0	354,0	361,0

Source: The authors.

The implementing of pectin formulations rosehip in the NBC structure enriches it as a source of B vitamins and vitamin C. In addition, pectin depressing effect on the growth of enterobacteria opportunistic contributing to the restoration of normal intestinal microflora.

Thus, components that are used in modeling complex of NBC allow to obtain a product having a predetermined correcting properties (anemia, calcium or compatibility and gastrointestinal disease). Further it was needed to determine what quantities appropriate to include in the formulation ingredients to subject to the requirements of the chemical composition of the final product and the content of the individual ingredients to provide the minimum (maximum) optimization criteria based biocapacity.

Table 2.
Optimized formulations model NBC

The composition of the NBC	The ratio of components in the formulations of embodiments%		
	NBC -1	NBC -2	NBC -3
Lizotsim-containing protein product	50,0	38,0	25
Vegetable raw materials (amaranth)	8,0	10	15
Whey (dry)	40,0	50	58,0
Calcium-containing product (kaltsid)	1,5	1,5	1,5
Rosehip dry	0,5	0,5	0,5
Total	100,0	100,0	100,0

Source: The authors.

Table 3.
The amino acid composition of the NBC

Essential amino acids	Quantity of amino acids, mg for 100g of product		
	Recipes of NBC		
	NBC -1	NBC -2	NBC -3
Valine	22,9±0,12	17,3±0,08	11,9±0,08
Izoleitsin	25,3±0,12	15,3±0,05	13,5±0,08
Leitsin	44,5±0,21	22,3±0,08	24,8±0,09
Lizin	33,1±0,15	16,0±0,07	17,9±0,08
Methionine	12,4±0,08	10,1±0,04	4,2±0,03
Threonine	83,0±0,23	11,7±0,05	41,9±0,14
Tryptophan	61,4±0,18	58,5±0,03	31,7±0,08
Phenylalanine	16,2±0,11	15,9±0,09	7,3±0,08
Nonessential amino acids, limited			
Cistine	9,2±0,06	6,2±0,05	4,4±0,04
Thirosine	13,2±0,08	6,8±0,05	7,8±0,05
Scor of limited amino acids			
Metionin+Cistine	13,4±0,08	13,8±0,08	11,9±0,08
Valine	9,9±0,07	10,3±0,07	11,0±0,04

Source: The authors.

The formulating of the problem have been identified to solve the most important stages: selection criteria, study the list of ingredients, the collection of their characteristics and justification of restrictions on formulating.

Purpose of optimization of the formulations of the NBC is to get the product, balanced mineral composition, biological value recommended for children and adults with diseases caused by calcium deficiency, gastrointestinal diseases, anemia.As a result, the mathematical modeling of recipes found the optimal ratio between the ingredients in the formulations NBC-1, NBC-2, NBC-3 are shown in Table 2.

As a result of solving the problem have been several variants of model formulations NBC, which determine the expected values of the chemical composition and the value of the finished product.

There was studied the amino acid composition of the NBC, the results of which are shown in Table 3.

Analyzing the data of the table it can be concluded that the NBC proteins contain a complete set of essential amino acids, which is quick for limiting amino acids is at least 82%.

There are three types of formulations NBC also studied the chemical composition (mineral and vitamin).

Analysis of the chemical composition of the NBC of the table shows that the mineral composition of 100 g NBC provides the need for minerals by 30% of the daily rate of 100%.

Because the mineral composition of the NBC-1 provides nearly 100% of the body's need for phosphorus, 60% - calcium, magnesium. High levels of these minerals will allow to fill the shortage of calcium and phosphorus when entering it in the diet.

Most calcium, iron and magnesium contained in NBC-2. The presence of high magnesium content creates the most favorable conditions for the absorption of iron. NBC-2 contains the most balanced composition of calcium to phosphorus ratio of 1: 1, which best promotes the absorption of calcium.

Vitamin composition of all three variants of the NBC for certain types of essential vitamins, 50-60% provides the body's need.

Based on an analysis of data on the ratio of essential amino acids, minerals and vitamins from the three options presented by the NBC, preference is given to an embodiment of the NBC-2, the results of which are shown in Table 4.

Based on the formulations developed models held production of pilot batches of the c under experimental conditions.

NBC produced according to our biotech production, which is as follows: the reception and evaluation of the quality of raw materials, which comprises mixing the components in the specified ratio, technological processing of raw materials and packaging,

Production of the NBC at the existing processing plants do not require any special technological equipment.

As raw materials used: eggs, vegetable raw materials (amaranth), whey powder, a calcium product (kaltsid), hips (krio powder).

In the process of developing lizotsim-containing materials carefully conducted acceptance and sanitize surfaces of eggs. Then the eggs are separated into yolk and white. The separated protein was subjected to a sensory evaluation, filtering and mixing. The protein was then coagulated by adding thereto lactic or citric acid to pH 4-5 and sodium chloride in an amount of 0.2-0.5% by weight of protein. The resulting mass was heat-treated in an oven at a temperature of 55-60^{0}C for 35-40 minutes.

As a result of the drying of the protein mass becomes soft fine-grained, white with a touch of lemon, with a sour taste and smell characteristic of the product.

Develop powdery mass was cooled to ambient room temperature (20-25^{0}C).

Amaranth leaves sort, culled damaged, rotten, then dried in a drying equipment with forced ventilation at a temperature of 25-30^{0}C or in air. The dried leaves were ground to a powder. Since kaltsid, krio powder and rose hips are ready-to-use forms, the preparatory process steps are not required.

All of the components included in the NSC was thoroughly mixed for 2-3 minutes, packed and packaged. No contraindications.

Thus, on the basis of theoretical and experimental researches the science-based formulations and biotechnology production of new food additives - natural biological corrector (NBC) for the prophylaxis of iron, calcium deficiency and diseases of the gastrointestinal tract.

Table 4.
Chemical composition of natural biological corrector

Chemical composition of NBC-2	Units of measurable	Lizotsim-containing protein product		Milk serum		Amaranth	
		Quantity in 100 gr.	Quantity of NBC	Quantity in 100 gr.	Quantity of NBC	Quantity in 100 gr.	Quantity of NBC
Proteins	%	82,4	31,3	7,8	3,9	15,0	1,5
Fats		-	-	1,1	0,6	4,1	0,4
Carbohydrates		-	-	73,3	36,7	2,1	0,2
Calcium	Mg	74,8	28,4	1100,0	550,0	140,0	14,0
Phosphorus		1340,0	509,0	1200,0	600,0	540,0	54,0
Potassium		1067,0	405,5	1400,0	700,0	570,0	57,0
Natrium		1297,0	492,9	1100,0	550	120,0	12,0
Magnese		71,0	27,0	150,0	75,0	220,0	22,0
Ferrum		1,1	0,4	1,5	0,8	-	-
Vitamin B_2	Mg	-	-	1,8	0,9	0,24	0,02
Vitamin C	Mg	-	-	5,0	2,5	21,6	2,2
Vitamin D	Mg	-	-	-	-	-	-
Vitamin B_6	Mg	-	-	-	-	-	-
Energy value	Kcal	102,0	38,7	346,0	173,0	439,0	43,9

Source: The authors.

Continue Table 4.

Chemical composition of NBC-2	Units of measurable	Calcium-containing product		Rosehip dry (Krio powder)		Quantity of NBC in 100 gr.	Quantity in 100 gr. of product
		Quantity in 100 gr.	Quantity of NBC	Quantity in 100 gr.	Quantity of NBC		
Proteins	%	2,1	0,03	4,0	0,02	36,75	2,9
Fats		-	-	-	-	-	-
Carbohydrates		-	-	60,0	0,3	37,6	3,0
Calcium	Mg	37300,0	559,5	66,0	0,3	1152,2	92,2
Phosphorus		166,0	2,5	20,0	0,1	1165,8	93,3
Potassium		93,1	1,4	58,0	0,3	1164,2	93,1
Natrium		130,8	1,0	13,0	0,1	1056,9	84,5
Magnese		412,9	4,1	20,0	0,1	128,2	10,3
Ferrum		-	-	28,5	0,1	1,3	0,10
Vitamin B_2	Mg	1,2	0,01	2,84	0,01	0,94	0,07
Vitamin C	Mg	30,0	0,5	1200,0	6,0	11,2	0,89
Vitamin D	Mg	50,0	0,8	-	-	0,8	0,06
Vitamin B_6	Mg	1,3	0,01	-	-	1,6	0,12
Energy value	Kcal	85,2	1,3	253,0	1,3	258,2	20,7

Source: The authors.

The analysis has been chosen are the ingredients that make up the formulation, in accordance with modern concepts of nutrition with the simulation recipes NSC.

The biotechnology a composite NBC achieves its high level of quality (Table 5).

Reduced consistent with lower acid numbers developed by the NBC and determines, among other factors, its greater stability to oxidative damage and other negative processes occurring during storage.

It was found that the prototypes of NBC after generation and storage throughout the month 1,3,6 comply with San PIN number 2: 3.1078 - 01 in terms of the number of mesophyllic aerobic and facultative anaerobic organisms (not more than 5 × 104 COE/g).

The change in product quality and sanitary and hygienic safety during storage has important microbiological stability. In this regard, studies were conducted to determine the amount mesophyllic aerobic and facultative anaerobic microorganisms (QMAFAnM) and the presence of coliform (CGB), childbirth Salmonella, Clostridium и Staphilococcus.

Table 5.
The safety and quality of NBC

Indicators	Received	Regulated by SanPin 2.3.2.1078-01
Organoleptic characteristics		
Appearance, texture	The bulk homogeneous powder. Allowed the presence of small lumps, easy break under mechanical stress	
Color, taste, smell	Color milky white uniform throughout the mass of the powder. Taste sweet, odorless.	
Physical and chemical parameters		
Moisture content,%	3,50±0,05	No more than 5
Solubility, sec	48±5	No more than 60
The acidity of the recovered product pH	6,6 – 6,8	–
Microbiological parameters		
KMAFAnM, CFU/г	$1,5\times10^2$	No more than 5×10^4
Content of yeasts and molds in 1.0 g of BAP, CFU	Not found	No more than 20
Coliform bacteria in 1.0 g	Not found	Not allowed
S. aureus in 0,1 г BAP	Not found	Not allowed
Pathogenic microorganisms, including Salmonella in 25.0 g of BAP	Not found	Not allowed

Source: The authors.

Table 6.
The sanitary-chemical and radiological safety parameters of NBC

Indicators	Content in HBC, mg/kg	MPC on toxic elements, mg/kg
Toxic elements:		
Lead	0,02	0,10
Cadmium	0,01	0,05
Quicksilver	Not found	0,05
Copper	Not found	1,00
Arsenic	Not found	0,10
Zinc	Not found	10,0
Pesticides:		
HCH (sum of isomers)	0,005	0,200
Heptachlor	Not found	Not allowed
DDT and metabolites	Not found	0,2
Micotoxins:		
Aflatoxin Bi	Not found	0,0050
Zearolenon	Not found	1,00
Radiological parameters		
Parameter	Content in HBC, Bk/kg	Allowed level, Bk/kg
Caesium – 137 / Strontium-90	3,6±0,04 1,0±0,01	200,0 100,0

Source: The authors.

The results of microbiological studies suggest that the use of the ingredients of the component composition of the NBC does not lead to a decrease in sanitary conditions, and the number of microorganisms complies with the microbiological criteria for assessing the purity of NBC during the storage period.

The evaluation results of the NBC sanitary and chemical safety are given in Table 6.

It should be noted that the sanitary-chemical and radiological characteristics of the NSC are normal.

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