MEDICAL AND BIOLOGICAL ASPECTS OF DEVELOPMENT OF CURATIVE AND PREVENTIVE PRODUCT CORRECTING DEFICIENCY OF CALCIUM AND IODINE IN THE ORGANISM

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Background

People of elderly age, especially those suffering from diabetes often have osteoporosis associated with increased brittleness of bones. Calcium has an important role in nutrition of people of this category. High content of Ca in "Tsygapan"- a biogenic preparation from the horns of reindeer - allows to use it as a mineral additive which enriches the meat product with this important macroelement, helps in normalization of the ratio Ca : P and thus provides optimum conditions for calcium assimilation in the organism. (2,3).

It is well known that iodine is necessary for normal functioning of human's organism. In Russian Federation about 100 mln. of people live in the areas with deficiency of natural iodine. . The regulated (0.75%) introduction of the biologically active additive (BAA) "Tsygapan" containing iodine in the amount 37500 mcg/100 g into the meat product allows to reach the level of this microelement in 100 g of product providing 25% of the daily requirement of the organism /2/. The presence of iodine in organic form in the additive provides a protective action on the thyroid in case of possible radiation and other damages.

Objectives

Studying the of biological value and carrying out clinical testing in the course of improvement of the composition, formulations and process technologies o of curative and preventive product (sausages "Severnye) with the BAA "Tsygapan" for prevention of diseases connected with calcium and iodine deficiencies.

Objects and methods of investigations

At the Chair of the ecology of man and the hygiene of the environment of Moscow Medical Academy named after I.M.Sechenov a medical and biological evaluation of samples of meat products for preventive nutrition was carried out under the guidance of Dr. of Sci. (Med.) Korolev A.A. Sample 1- sausages "Severnye" with 0.75% of Tsygapan was used as a control, sample 2 was produced according to the same formulation but did not contain biogenic preparation from the horns of reindeer.

Medical and biological evaluation was carried out according to internationally accepted recommendations (Sukhanov B.P., 1987, Korolev A.A., 1997) with the use of growth and mass, hematological and biochemical indices on model groups of animals: growing white male rats of Vistar line with the initial body mass 70 ±5 g during 28 days. Biological value was judged from the coefficient of protein efficiency (CPE) reflecting the mass gain of the body in g per 1 g of consumed protein /1/.

Blood of animals was subjected to hematological and biochemical investigations on the analyzer of the company Technicon". The efficiency of enrichment of experimental formulations was studied by means of the balance investigations, characterizing assimilation of calcium from enriched products /1/.

Laboratory animals were held during one day in individual exchange cages and received experimental feeds.

The excreted amounts of urine and feces were recorded in which by spectrophotometric method the assimilation of calcium was determined. The calculation of calcium assimilation was determined according to the formula:

$$DtrCa = (Ca_{urine} + Ca_{faeces} / Ca_{diets}) * 100\%$$

Clinical testing was carried out at the N.N. Priorov Central Institute of traumatology and orthopedics.

The determination of protein, fat and aminoacid composition was determined according to generally accepted method, the calculation of aminoacid balance - according to the method of N.N.Lipatov (4).

The determination of iodine was carried out by calorimetric method based on the interaction of iodine as extracted from the sample by solutions of sulfuric acid and sodium nitrate with the formation of a complex compound of violet staining and the determination of its amount by the value of optical density of the solution.

Results and discussion

Chemical indices and the indices of aminoacid balance of protein, (Table 1) suggest that sausages "Severnye" by their chemical composition correspond to the developed medical and biological requirements (MBR), possess a higher food and biological value as compared to sausages "Molochnye"

Table 1

Indices	Medical and biological requirements	Sausages "Severnye"	Sausages "Molochnye"
Protein, %	12-16	16.3	14.0
Fat, %	17-24	22.9	38.95
Protein : fat ratio	1:1.3 – 1.5	1 : 1.4	1 : 2.8
Calcium, mg%	150-250	175.0	35.0
Phosphorus. mg%	240-300	262.5	159.0
Calcium:phosphorus ratio	1.0:1.5	1.0:1.5	1.0 : 4.5
Iodine, mcg%	140-150	145.2	3.5
	Protein FDA/WHO	**Aminoacids, g/100 of protein**	
Valin	5.0	5.24	5.16
Isoleucin	4.0	4.50	4.43
Leucin	7.0	7.49	7.43
Lysin	5.5	6.05	5.94
Methionine + cystin	3.5	3.48	3.36
Threonine	4.0	3.93	4.09
Tryptophane	1.0	1.34	1.28
Phenylalanine + tyrozine	6.0	8.64	8.31
		Indices of aminoacid balance of protein	
Minimum score		0.98	0.96
Coefficient of utilization		0.87	0.86
Coefficient of comparable redundancy		5.26	5.43

Table 2 shows composition of elements of BAA "Tsygapan" compared to that of egg shell and bone powder, used for enrichment of meat products for children

Composition of elements

Minerals	"Tsygapan"	Egg shell	Bone powder
Macroelements (mg/100 g)			
Potassium (K)	68	83-93	20
Sodium (Na)	530	81.7 – 130.8	670
Calcium (Ca)	17494	33400-37300	27750
Magnesium (Mg)	680	406.3-412.9	1045
Sulfur (S)	-	674-1260	1000
Phosphorus (P)	8750	124-166	11400
Microelements (mcg/100 g)			
Iron (Fe)	24000	2800-4130	1930±9
Iodine (I)	37500	34-50	-
Cobalt (Co)	40	70-8-	
Manganese (Mn)	550	40-110	423±3
Copper (Cu)	20	92-150	615±5
Molybdenum (Mo)	250	28-36	-
Fluorine (F)	<1000	123-157	-
Chromium (Cr)	500	130-180	-
Zinc (Zn)	12000	400-670	3286± 21
Vitamins (mcg/100g)			
B_1	2500	0.65	- -
B_3	53.6	5.25	-
B_9	1.15 -	0.083	-
B_{12}	10	0.18	-
C	8800	-	-

Comparison of the data of the Table indicates that "Tsygapan" contains significant amounts of calcium, phosphorus, magnesium , organic iodine. iron, etc, and presents the optimally balanced complex of biologically active components on the whole which determine its pharmacological properties: immunomodulating, antioxidant, hemostimulating, radioprotective; its use increases the biological value of products that can be seen from the results of biological evaluation (Table 3).

Analysis of hematological indices confirms positive influence of experimental samples of products on hemopoietic function of animals. A higher value of the coefficient of efficiency of protein was marked.

Table 3. **Biological value of meat products. Hematological indices of blood of laboratory animals**

Indices	Group 1	Group 2 (control)
Consumption of protein, g	38.6 ±1.8	38.2 ± 1.6
Gain of body mass, g	119.66 ±8.25	110.78 ± 6.91
Coefficient of protein efficiency	3.1 ±0.7	2.9± 0.7
Erythrocytes, x 10^{12}/l	5.9 ±0.7	5.6 ± 0.5
Hemoglobin, g/l	161.3 ±1.4	152.6± 1..3

The carried out investigations have shown that calcium assimilation from the BAA "Tsygapan" is 65.7 ±7.3 and approaches by this index to such natural sources of calcium, as egg shell (79.2 ± 7.7%) and bone powder (74.3±9.1%).

The results of clinical testing of sausages "Severnye" with the patients having chronic osteomyelitis of bones of different localization indicated a moderate increase of calcium in the blood of patients and improvement of the picture of bones osteoporosis which allowed to recommend the sausages with BAA "Tsygapan" for prophylaxis of osteoporosis and other diseases associated with calcium deficiency. The studies on determination of iodine level in the product enriched with BAA "Tsygapan" pointed out to its reliable increase as compared to the control one (from 0.004 to 0.1945 mg/100g). Iodine losses during thermal treatment were 45-50%, and during storage (up to 8 days) did not exceed 1-2%.

Conclusions

Requirements concerning the composition and quality of sausages enriched with the BAA "Tsygapan" for curative and preventive nutrition of people suffering from locomotivity diseases associated with calcium deficiency in the organism, and also for prophylaxis of iodine deficiency states, taking into account specifics of physiological and metabolic processes at these pathologies, were substantiated. The results of medical and biological evaluation suggest that the introduction of BAA "Tsygapan" into the product made it possible to increase it biological value, improve hemopoietic function with high assimilability of calcium (57.9 ±5.7%). The indices of food and biological value and curative and preventive effect on patients with the disturbance of locomotory function and other diseases associated with calcium and iodine deficiency The product has the approval of Ministry of Health of Russia and has the positive hygiene certificate.

Pertinent literature

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