The use of minerals and bioactive substances in dietetic canned meats

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Nowadays for children and dietetic nutrition meat industry has developed canned meats with formulations using beef, creamery butter, starch or meal, salt, seasonings aextracts (celery, parsley, dill).
From the point of view of modern concepts on nutrition physiology meat is considered not only as an advantageous source of essential amino acids but also of vitamins and minerals /I/.
That is why a product made according to a such formulation has insufficient and non-optimum, by its ratio, content of macro- and microelements and vitamins.
In this connection investigations on canned meats mineral composition optimization due to components rich in them incorporation were done. Canned meats with 1,2 and 3% mineral powder from bone added were tested (table 1).

Table 1.

Canned meats chemical composition

Parametre	Control	Test samples with mineral additives,%		
		I	2	3
1	2	3	4	5
Content of				
Water, %	76.2 ± 2.16	77.7 ± 1.4	75.3 ± 2.05	75.2 ± 1.16
Protein,%	13.2 ± 0.21	14.5 ± 0.15	13.9 ± 0.11	13.9 ± 0.09
Ash,%	1.0 ± 0.01	1.6 ± 0.01	2.3 ± 0.01	3.2 ± 0.01
Fat,%	5.2 ± 0.01	4.8 ± 0.02	5.6 ± 0.01	6.0 ± 0.02
Ca, mg%	6.0 ± 0.01	446 ± 3.61	886 ± 7.94	1236 ± 10.68
P, mg%	110 ± 9.56	440 ± 6.44	770 ± 6.28	1100 ± 11.26
Ca : P ratio	0.054	1.01	1.16	1.2

As it is seen from the table mineral additives use possitively effect mineral composition, bringing Ca:P ratio nearer to the value corresponding to physiological norm.
For biological test 40 rats-weanlings, male, with the initial weight 57.2 g ± 2.7g were used. Rats were divided into 4 groups, 10 rats in each group, fed with control (group I) and test products with mineral additives (with 1% - group II, 2% - group III, 3% - group IV).
During test period some difference in appearence and behaviour of rats was found: test rats had more downy and white hair, and they were more mobile and active. Rats' survival for all groups was 100%.
Results of protein consumption investigation (Table 2) testify to the fact that this value for hgroup III and IV differes from the control one ($P \geqslant 0.02$). The same difference ($P \geqslant 0.05$) is seen for weight gain parametre.

Table 2.

Grow-weight parametres of canned meats biological value

Parametres	Groups			
	I	II	III	IV
1	control 2	3	test 4	samples 5
Protein consumption,g	16.64 ± 1.7	16.50 ± 0.7	19.24 ± 0.9	13.66 ± 1
Weight gain,g	63.40 ± 4.1	64.60 ± 5.1	71.40 ± 3.7	48.80 ± 3
Protein efficiency ratio (PER)	3.81	3.91	3.71	3.57

According to Protein efficiency ratio, reflecting weight gain per 1g of consumpted protein, a different regularity is observed. Particularly, despite the fact that parametres of protein consumption and weight gain for group III were maximum for all compared groups, protein efficiency ratio was a little bit lower as compared to the control one.
In total it is possible to point out that 1% and 2% level of mineral additives did not, practically, influence biological value of finished products, though for 1% level there was a tendency to that parametre increase and for 2% level - to decrease. At 3% level addition there was a pronounced tendency to protein efficiency ratio decrease.

Table 3.

Biochemical parametres of canned products biological value

Parametres	Groups			
	I	II	III	IV
	control	test samples		
1	2	3	4	5
Blood content of:				
Total protein, g%	7.64±0.2	7.42±0.1	7.36±0.1	7.51±0.3
Albumines, g%	3.80±0.09	3.64±0.09	3.7 ±0.10	3.62±0.12
Globulines, g%	3.84±0.07	3.78±0.14	3.66±0.14	3.89±0.08
Albumine/Globuline ratio				
Urea nitrogen, mg%	18.31±1.3	19.2±1.9	19.4±2.4	18.7±2.3
Cholesterol, mg%	111.9 ±7.8	92.3±6.3	90.7±5.0	94.9±7.1
Ca, mg%	9.0 ±0.31	9.8±0.19	10.7±0.25	10.6±0.31
P, mg%	10.1 ±0.41	9.7±0.26	9.4±0.17	9.1±0.14
Glucose, mg%	119.5 ±2.8	118.7±3.7	120.3±4.2	119.9±2.3

Blood biochemical investigation found positive influence of mineral additive on lipid and mineral exchange (Table 3). For all groups there was found a significant($P \geq 0.02$) decrease of cholesterol content in blood serum, in average by 17.8%, that testified to possible antisclerotic properties of such canned products. Ca concentration in blood increased by 15.0% ($P \geq 0.05$), and P content decreased by 7.0% ($P \geq 0.05$). Consequently, non-favourable, physiologically, Ca:P ratio maintained for control group rats and improved for test groups. There was no difference between test groups and control one in urea concentration, carbohydrates exchange and blood protein content.
Influence of mineral additive on bone system development (growth and mineralization) was determined with shinbone being an object (Table 4).

Table 4.

Data of thighbone analytical investigation of rats fed with test samples

(%)

Parametres	Groups			
	I	II	III	IV
1	2	3	4	5
Weight, mg	358.5±14.0	465.7±18.8	488.3±15.0	490.7±27.0
Content of, %				
Water	29.7±1.7	27.3±1.9	26.5±2.0	26.2±1.5
Fat	18.3±1.1.	17.9±1.4	17.1±0.9	17.0±1.4
Ca	13.1±0.44	15.6±0.67	16.8±0.79	16.2±1.0
P	7.7±0.28	6.2±0.45	6.7±0.51	6.0±0.24

Positive dynamics of shinbone weight and composition changes for test rats was found (Table 4). These changes did not depend on mineral additives level and were characterized with a slight decrease of water content, in average by 10.0%($P \geq 0.05$), of fat and P - by 18.2% ($P \geq 0.05$).
The degree of thighbones mineralization for rats fed with test products was 34.3% higher ($P \geq 0.05$) as compared to rats fed with control samples.
Thus, pure mineral additives incorporated into canned meats improved or normalized the parametres of protein, lipid-fat, mineral and carnohydrates exchange.

Liver and kidneys morphological test did not show negative effect of bone additives.
Mechanically deboned meat, obtained at pressing on a continuous machine "Behaiv", is another essential source of mineral components for canned products. MDM in contrast to desinewed meat contains bone particles and bone marrow characterized with a high content of hem pigments. Hem pigments concentrations is 5-times higher in bone marrow than in muscles Increased content of iron in a product will promote imparting antianemic properties to the product.
In view of strict fat content limiting for dietetic, products composition of bone used for mechanical deboning was investigated to determine the possibility of MDM addition to these products.
MDM of three bone compositions was studied: I variant - neck and back part, lumbar and sacral vertebrae; II - sawed ribs; III - breast part.
Taking into account the data given in table 5, and in view of sacral bone fat content up to 41.9% /2/ for further work the I variant was used for mechanical deboning but without sacral vertebrae.
Data on MDM amino acid scores are the following: isoleicine - 66, leicine - 105, lysine - 137, methionine, cystine - 18, phenilalanine+tyrosine - 112, tryptophan - 131, valin -85, treonine - 101. Amino acids scores calculation showed that biological and nutritional value of MDM is limited by sulphur-containing amino acids.

Table 5

Table 6.

Biological characteristics of canned meats for dietetic nutrition

Parametres	Canned meats	
	test for dietetic nutrition	control for childrens nutrition
Anabolic efficiency (PER), %	2.85 ± 0.01	2.16 ± 0.03
Biological value (BV), %	81.70 ± 2.5	74.33 ± 3.1
Protein utilization (PU), %	74.40 ± 2.1	63.50 ± 1.9
Blood urea nitrogen, mg	20.8 ± 0.9	29.3 ± 0.6

From data given in table 6 PER of the test group was by 33.3% higher as compared to the control one, that testify to a more efficient utilization of test product protein. BV and PU parametres are higher for the test sample by 8.9 and 17.2%, correspondingly.
Blood biological parametres investigation reveal that anabolytic processes (growth processes) are more intensive for the test group in comparison to the control. Urea nitrogen content decreases in blood by 31% show that test sample protein was more active in plastic processes, efficiently promoted weight gain, that was why concentration of final product of its decomposition in blood (urea) was lower.
Canned meats were tested in the Department of illed baby nutrition of the Institute of Nutrition of the USSR AMS on children with allergy to food and those after operation on intestine. Children readily consumed canned meats; symptoms of dyspepsia were not found; the results testified to their satisfactory tolerance.
Thus, there was determined advisability of meat dietetic products enrichment with bone mineral compounds in combination with bioactive complex of CO_2-extracts of grapes and granate husks.

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