

## DEVELOPMENT AND BIOLOGICAL EVALUATION OF MEAT PRODUCTS FOR SCHOOL PROGRAMMES

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For children rational nutrition high-quality products providing a balanced ratio of substances necessary for a growing organism are developed.

The work on substantiation of meat products recipe from beef, pork, liver, heart and other by-products allow not only to enlarge the assortment but also to impart dietetic properties to the developed products.

Computer use for recipe calculation provide the correspondence of products chemical composition to specially developed medico-biological requirements: protein level - 12-17%, fat level, as related to the purpose, - 63-148%. Products biological evaluation on growing white rats and blood biochemical components test show that protein efficiency ratio (PER) depends on ingredients composition and is in the range of 3.1-2.5. There are no negative changes in test animals blood.

The developed products are positively evaluated while testing at school.

One of the methods for biologically balanced products development is to work out multicomponent recipes with meat and by-products. Ready-to-cook frozen minced meats that can be used for pies and small pancakes filling or second dishes preparation and homogenised products (pate and creams) served as test samples as they are typical representatives of multicomponent products of varying degree of mincing, different type of packaging and field of application. Such product use for school programmes will allow not only to extend the assortment of high-protein products but also to utilise liver, lungs, spleen and other by-products that are the source of animal protein as well as the heme iron.

The aim of the work was to extend the assortment, to develop a production technology and to evaluate biologically high-quality products for school programmes and dietetic nutrition made using the modern methods of processing. Multicomponent systems were projected by a computer using a modified Simplex method providing products chemical composition adequacy and correspondence to medico-biological requirements.

PER-test reflecting test animals weight gain per 1 kg of protein consumed served as a biological value parameter. Test animals' blood composition studied using a biochemical analyser "Technicon" served as an additional characteristic that allow to judge on products protein biological value and its influence upon the exchange processes in organism.

Chemical and aminoacid composition, biological value and the results of products testing at schools were the criteria of evaluation that characterise the efficiency of the selected raw materials, recipe and technological parameters.

School-children of various age groups took part in the testing.

From the obtained recipes those chosen that determine the maximum necessary elements and quantitative advisability of individual ingredients use.

As related to the purpose according to the calculated chemical composition the developed products differed by protein level and had non-significant variations in protein:fat ration. A product with the ratio 1:0.5 was developed for children requiring the products with a lower fat level. The other recipes met the requirements of pediatricists to the products for healthy children and had the protein-fat ratio equal to 1:1.

The products were made only from hot or chilled high quality meat. A strict chemical and bacteriological control, guaranteeing the quality of finished products, was fulfilled. Cream contained beef and pork; pate - beef liver, brains and heart; minced meat - beef liver, heart and lungs, and besides dry milk, vegetables, animal and vegetable fat and other ingredients. Besides dietetic cream was made from ground meat, food additives, water, spleen, serum protein, bone meal at the following ratio to other basic recipe ingredients(%): 1 grade beef, semi-lean pork and beef spleen - up to 55%; serum protein, bone meal, carrot, apples and onion - up to 22-25; vegetable oil - no more than 3. Biological value of a product and its dietetic properties were provided by a more completed composition of amino acids, vitamins and minerals characteristic for spleen, serum protein and bone meal. Spleen dietetic properties are characterised by a significant level of full-value protein, by the presence of easy digestible iron and vitamins of group B, necessary for synthesis and haemoglobin content increase at celiac disease and anemia and for the improvement of stomach and small intestine functionality.

Chemical composition of test samples is given in Table 1. A calculated anionacid score for all developed products approximated 100.

As it is seen from Table 1 the chemical composition of the developed products corresponded to the calculated indices using the computer. Similar results were obtained for mineral content.

For biological test 50 weaned rats were used. The rats were divided into 5 groups fed with isonitrogenous, isocaloric, balanced by vitamins and minerals content ration (1 group - meat cream for children, 2 group - ready-to-eat minced meat for children, 3 group - dietetic minced meat, 4 group - pate for children, 5 group - (dietetic cream)).

There were not found any difference in appearance, behaviour and survival of compared rats.

Analysis of data on weight-gain parameters of tested products protein biological value (Table 2) did not show significant differences in its consumption. Maximum deviations were in the range of 10-15% as compared to the 1st group fed with minimum protein level.

PER is high for all products, though it is possible to point out that for meat products (creams) it was practically on the same level (in average 3.08) and for the animals of 2nd, 3rd and 4th groups, fed with the ration containing by-products (2, 3 groups - liver, heart, lungs, 4 - liver, heart, brains), it decreased by 22, 24 and 30% respectively.

When the test was over the animals were killed and their blood was analysed biochemically. The results are given in

Table 3. It is seen from the Table that there is no significant difference in protein, fat and carbohydrate exchange between the compared groups. There was cholesterol level decrease in test rats blood (2-4 groups). That allows to assume that the developed products possess anti-sclerotic action. Besides low level of urea nitrogen and uric acid in blood of the 1st group animals leads to the decrease of pyrinic exchange tension.

So, on the basis of the obtained data weight-gain parameters (PER) of test products and biochemical analysis of test animals did not show significant differences between samples.

Technological process of pate, creams and minced meats manufacturing included the following intensive methods of raw materials processing: steam-contact heating, standardising, daeration. Steam-contact heating in a steam-contact blancher promoted preservation of vitamins and other components that are being destroyed during long-term high-temperature heating. Besides it was a preparatory stage before standarising based on water-fat mixture extraction from pre-blanching meat raw material using the processes with screw supercharger and perforated separating zone. Thanks to that manual labour costs reduced at desinewing, and manufacturing was mechanised and automatised. Pressing was easily adjustable and provided elimination of extractable substances and rational, use of meat broth. Deaeration allowed to prolong product shelf-life and to stabilise its quality.

So, projecting of multicomponent food products, meeting medico-biological requirements to chemical composition and biological value, while using the modern methods for meat raw material processing (including by-products), allows to get high-quality valuable products for school programmes.

The developed products were successfully tested at school. Minced meats were used for dinner as fillings for small pies and pancakes. Pates and creams were used for lunch sandwiches. In total 300 children of 6-17 years old took part in the experiment. All the products were eaten with appetite.

## REFERENCES

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Table 1

Parameters	Ready-to-eat minced meat		Pate for children	Dietetic cream	Meat cream for children
	for child- ren	dietetic			
Moisture	66,8±0,94	70±0,66	69,0±0,98	74,9±0,86	74,7±0,65
Fat	14,8±0,01	11±0,01	11,8±0,02	6,4±0,01	6,3±0,02
Protein	16,5±0,02	17±0,03	13,1±0,01	12,8±0,03	12,6±0,01
Protein:Fat	1 : 0,9	1 : 0,6	1 : 0,9	1 : 0,85	1 : 0,5

Table 2

Parameters	Ready-to-eat minced meat		Pate for children	Dietetic cream	Meat cream for children
	for child- ren	dietetic			
1	2	3	4	5	6
Protein consumption, g	1,12±0,17	1,11±0,19	1,15±0,08	1,03±0,12	1,0±0,10
Weight gain, g/day	2,7±0,11	2,62±0,15	2,50±0,19	3,15±0,16	3,10±0,13
PER	2,4	2,35	2,17	3,06	3,10

Table 3

Level in blood serum	Ready-to-eat minced meat		Pate for children	Dietetic cream	Meat cream for children
	for child- ren	dietetic			
Total protein	6,71±0,2	6,61±0,16	6,55±0,19	7,00±0,20	7,11±0,35
Albumin, g%	3,75±0,16	3,69±0,18	3,41±0,14	3,72±0,23	3,80±0,26
Globulin, g%	3,22±0,2	3,21±0,2	3,14±0,15	3,28±0,20	3,30±0,20
A/G Ratio	1,10	1,09	1,08	1,13	1,15
Urea nitrogen, mg%	21,4±4,6	20,9±3,9	21,30±5,0	20,7±3,64	22,3±3,80
Glucose, mg	91,4±4,9	93,56±5,6	93,40±6,4	92,3±6,90	90,0±5,40
Cholesterol, mg%	87,8±4,76	86,6 ±6,0	85,8 ±4,20	91,0±4,20	88,9±4,80
Ca, mg%	8,3±1,0	8,48±0,8	8,90±0,13	8,4±0,27	8,5±0,23
P, mg%	10,0±0,2	9,9±0,3	10,12±0,14	9,6±0,30	10,0±0,16
Uric acid, mg%	2,25±0,2	2,36±0,18	2,51±0,14	2,3±0,2	2,1±0,15