

Design of composition and properties of special meat semi-prepared products

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At the present time a large part of the population live under the conditions of ecological crisis which adversely affects the health of people. In this connection it is very important to develop prophylactic measures, allowing to minimize the consequences of the foreign load and ensure functioning of the organism under conditions of long-term adaptation to negative factors of the environment. One of the actual ways for the solution of this problem is the development of the system, including a range of directions and among them the development of foods with prophylactic and protective properties.

Objective of the work

Development of biologically wholesome meat products enriched with metabolically functional additives for dietetic and curative prophylactic nutrition.

Objects and methods of investigations

Meat semi-prepared products enriched with food fibers – methylcellulose, laminaria and wheat brans. Methods of computer simulation.

Results and discussion

VNIIMP has developed a range of meat semi-prepared products (mincemeats) “Tagansky”, “Krestyansky”, “Piquant” and “Bodrost” for dietetic and curative and preventive nutrition.

The design of formulations of mentioned products was accomplished using the system of computer simulation of the balanced composition and quality evaluation of polycomponent food systems, allowing to develop foods with the required complex of properties predetermined by the level of adaption to the specifics of metabolism of consumers with different physical and physiological status /1, 2, 3/.

For the calculation information of mass fractions of such substances as protein, fat, carbohydrates, mineral substances, vitamins the following formula essentially being the equation of material balance was used:

S\_i^μ = ∑\_{i=1}^n x\_i S\_i / ∑\_{i=1}^n x\_i (1)

where: S\_i^μ - mass fraction of the specific macro- or micronutrient in the recipe mixture, fract. units, %; x\_i – mass fraction of the i-th component in the recipe mixture, fract. units, %; S\_i – mass fraction of macro- or micronutrient in the i-th component, fract. units, %.

In the determination of the required level of mass fractions of protein, lipids, mineral substances and vitamins in special meat products as the initial values were adopted the average values of daily requirements for adult people of regions suffered from accident at Chernobyl atomic electrical station and meeting the medical and biological requirements of quality of such products, according to which 100 g of such products should provide 20-25% of daily requirements of the organism in such nutrients /4/. The limiting value for mass fractions of proteins was not less than 12-13%, lipids – not more than 14%. In traditional ground semi-prepared foods the share of protein is not less than 10%, lipids – not more than 20%.

Results of calculation of composition of mincemeat are presented in the Table.

Chemical composition of special semi-prepared foods

Food substances	Units of measurement	Name of semi-prepared foods				
		Mincemeat Tagansky	Mincemeat Krestyansky	Mincement Piquant	Bodrost 1	Bodrost 2
Protein	g	18,2	16,2	16,4	13,5	13,0
Fat	g	13,3	13,0	12,9	13,2	9,2
Mineral substances						
Calcium	mg	13,2	11,7	7,5	16,0	16,7
Phosphorus	mg	190,3	190,5	166,4	151,0	142,0
Magnesium	mg	66,8	27,6	18,2	58,0	50,0
Iron	mg	2,9	2,9	2,5	5,9	5,2
Iodine	μg	6,6	4,9	5,5	79,5	78,4

As can be seen from the Table, special semi-prepared foods are the source of protein, fat, easily digestible iron, magnesium, iodine (recipe “Bodrost”). It should be noted that the selected correlation of components of the recipe of the mincemeat provides for the content of protein and fat in the ready product which meet the quality requirements of meat products for dietetic and curative nutrition. Inclusion of 100 g of special semi-prepared foods in the diet will meet the requirements of the irradiated organism in protein at 18-20%, which accounts for 50-60% according to the requirements of medical and biological requirements. Use of principles of enrichment in the development of recipe of mincemeat allowed to achieve the levels of iodine and magnesium in the product on the average 30-35%, iron – 21-37% of the daily requirements of the organism in these mineral substances.

The most important task in designing of combined foods is an increase of biological value of the composition as compared to that of the initial components, i.e. obtaining at the specific correlation of the components of the maximum possible score of the limiting indispensable aminoacid (IAC).

The balanced composition of aminoacids of the protein of the developed polycomponent semi-prepared foods was evaluated according to the following indices:

Minimum score of IAC as related to physiologically required norm (reference), fractional units.

$$C_{\min} = \min_{j=1}^k A_j / A_{j0} \quad (2)$$

where:  $A_j$  – mass fraction of j-th AIC in the product, g/100 g of protein;  $A_{j0}$  – mass fraction of j-th IAC of the reference, g/100 g of protein, k – quantity of IAC.

Coefficient of utility of aminoacid composition (U), numerically characterizing balanced composition of IAC as related to physiologically required norm (reference), units:

$$U = C_{\min} \sum_{j=1}^k A_{j0} / \sum_{j=1}^k A_j \quad (3)$$

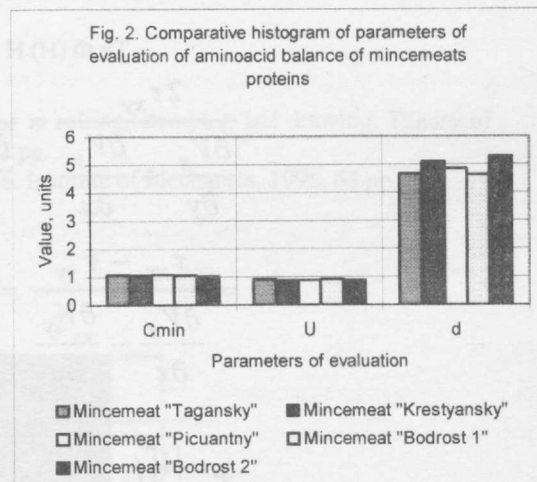
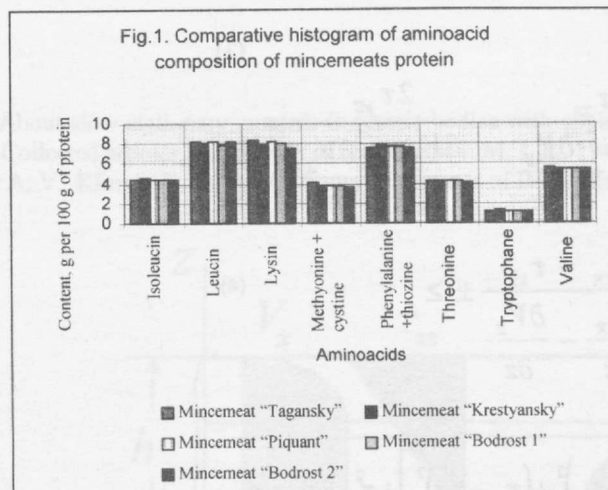
The index of comparable redundancy of the content of IAC (d), characterizing the total mass of IAC, not used for anabolic purposes, in such amount of protein of the evaluated product that is equivalent over their potentially utilized content to 100 g of the protein-reference:

$$d = \sum_{j=1}^k (A_j - C_{\min} A_{j0}) / C_{\min} \quad (4)$$

The essence of quality evaluation of proteins with the help of formalized indices (d, U) lies in the fact that the more are the values of the coefficient of utility ( $0 < U < 1$ ) and the less is the value of compared redundancy (ideally  $U=1$ ,  $d=0$ ), the better IAC are balanced and the more rationally they can be used by the organism.

Figs. 1 and 2 show comparative histograms of aminoacid composition and the parameters of evaluation of aminoacid balance of proteins of the presented products.

As can be seen from Fig. 1 the proteins of developed semi-prepared foods contain a complete range of IAC. The coefficient of utility and the index of comparable redundancy (Fig. 2) are equal to 0,8 and 4 – 5 units, respectively that demonstrates a balance of aminoacid composition and high biological value of products.



## Conclusions

Recipe of special meat semi-prepared products meeting the demands of prophylactic and curative foods were developed. The evaluation of aminoacid balance of the protein of polycomponent products on formalized indices (U, d) confirmed a balanced composition of aminoacids and high biological value of presented products.

## References

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