PROTEIN MIXTURES FOR MEAT PRODUCTS

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Non meat protein additives are widely used in meat industry because of their technological, nutritional properties and economy. Amino acid composition is mostly used as criteria to asses protein nutritional value according to 'ideal' pattern or requirement of human organism. However, any protein additive provides other essential nutrients, also. Earlier our research showed that changes in amino acids composition of meat that may carry the addition 5% of protein additives didn't excess 25%. But the possible changes in mineral composition are higher (from 20 till 380%) [1]. Using of meat substitutes with so high differences in mineral content may disbalance the common composition of food. So, mineral composition is necessary criteria to evaluate nutritional value of meat substitutes, also. Complementary nutritional effect, optimal technological properties and prices may be achieved by mathematical modeling of different protein or protein - meat systems [2 - 4]. In our research the SIMPLEX R method was used, that doesn't limit quantities of components and characteristics (criteria) of optimization.

Base on facts, that
- various amino acids compositional patterns are still developed for evaluation nutritional value of food,
- there is no agreement about necessity in balance of all nutrients in one product,
- meat has high biological value with good balance of amino acids and almost full complex of essential minerals for human vital activity, the lean pork, beef or poultry may be used as the reference pattern to optimize composition of protein mixture used as meat substitute. Because of the specific of analyzed materials the optimization of all amino acids and minerals is not possible or reasonable. In any formula of protein mixtures content of valine will be more and Na and Ca less than in pork meat. The content of P, Zn, Mg and leucine in any mixture will be the same or lower than in meat. The base on these reasons in our formulation of mathematical model nine essential amino acids and four minerals were used as criteria of optimization. The limits of these components were defined as average content in lean pork meat +, - coefficient variation. To eliminate influence of other factors (content of moisture and protein) the amino acids were defined in mg/100g protein and minerals - mg/100 g dry materials.

Amino acids, mg /100g protein			
Lysine	$\geq 7,2 \pm 10\%$	Histidine	$\geq 3,2 \pm 10\%$
Threonine	$\geq 4,0 \pm 10\%$	Aromatic amino acids	$\geq 6,4 \pm 10\%$
Isoleucine	$\geq 3,0 \pm 10\%$	Tryptophane	$\geq 1,1 \pm 15\%$
Sulphur - containing amino acids	$\geq 2,0 \pm 10\%$		

Minerals, mg/ 100 g dry material			
K	$\geq 1401 \pm 15\%$	Mn	$\geq 0,48 \pm 15\%$
Fe	$\geq 17,1 \pm 15\%$	Cu	$\geq 0,92 \pm 15\%$

The maximum content and optimal composition of amino acids and Fe, Cu, Mn, K was found in the following protein mixture: soy concentrate Danpro - H (Denmark) - 23,4%; sunflower protein (Ukraine) - 15,8%; sodium caseinate (Estonia) - 33,6%; whey protein concentrate (Lithuania) - 4,0%; butter milk powder (Lithuania) - 3,1%; whey powder (Lithuania) - 2,0%; dry protein mixture (Lithuania) - 18,1%.

The characteristics of this protein mixture are shown in Table. Mathematically found protein mixtures allow to increase utilization of protein, that in the single protein is low because of limits of some amino acids.

Table 1. Chemical composition of model protein mixture

MACRONUTRIENTS, %		AMINO ACIDS, g /100 g N				MINERALS, mg /100g dry material			
Moisture	6,87	Isoleucine	4,22	Histidine	2,81	Na	1690,6	Fe	14,5
Protein	71,35	Leucine	8,37	Phenylalanine	4,90	K	1187,8	Zn	1,6
Lipids	0,69	Lysine	6,51	Treonine	3,60	Ca	252,7	Cu	0,8
Ash	6,35	Methionine	1,38	Tryptophane	0,96	P	718,6	Mn	1,1
		Tyrosine	3,30	Valine	5,58	Mg	48,9		
		Total essential amino acid	41,63						
		Total amino acids	91,28						

CONCLUSION. Protein mixture is superior to the single protein additive because of better balance in amino acids and minerals. The minimum differences in the content of essential nutrients meat and the mathematically calculated protein mixture allow to propose this mixture as universal protein additive for majority meat products.

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