DEHYDRATED MIXED FOODS PREPARED BY USAGE OF SECONDARY MEAT RAW MATERIAL

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One of the significant sources of increasing the production of long-term storage foods is the secondary meat raw material with the primary importance of bones and blood of slaughter animals. The imperfection of existing technologies, high energy consumption, as well as the negative influence on the environment lead to the fact that the predominant quantity of this raw material is used for production of feed and technical products. At the same time bones and blood of slaughter animals have specific chemical composition, food value, and biological importance and may be good initial material for the production of foods, including specific medicinal and preventive products. Thus, the blood of slaughter animals contains high level of protein, vitamins, enzymes, hormones, minerals, and the hem iron having high assimilation being of great importance among them.

Bones are rich in phosphoric and calcium salts and contain a great quantity of protein and fat of good emulsifying ability because of the highest content of lecithin comparing to other animal fats. Protein and mineral components of bones are used insufficiently for food purposes, however the medicine needs in nutritious food products and medicinal preparations containing these salts for treatment and prevention of various diseases. All above said makes urgent the development of some technologies of food production on the basis of secondary meat raw material. To solve these problems, All-Russian Meat Research Institute carried out some studies. The basis of the new technology is the method of integral thermomechanical processing of mixed dehydrated components of animal and vegetable origin. Bone protein component, minerals, and dehydrated cattle blood are used as components of animal origin.

Thermomechanical processing of mixtures including vegetable and animal raw materials provoked some significant changes with the result of formation of new protein and carbohydrate complexes, disaggregation of starch, increase of porosity, and solubility of the end product. The time of processing is about 1.5 minutes. Basic factors influencing the end product quality are temperature, pressure, and quantity of added dehydrated blood or any other component of animal origin.

On the basis of the studies, it was concluded that the volumetric mass of the end product changed with adequate regularity and depended on parameters of the treatment:

$$M_v = A - BX_1 - \sim X_2 - DX_3 + EX_1^2 + FX_2^2 + GX_3^2,$$

where A, B, C, D, E, F, G are coefficients;
X_1 is mass share of dehydrated blood, %;
X_2 is temperature in zone of treatment, ^{0}C;
X_3 is pressure in zone of treatment, MPa.

This dependence was true in interval of $4 \le X_1 \le 8$; $1.5 \le X_2 \le 2.5$; $170.0 \le X_3 \le 190.0$. Such a dependence made it possible to choose optimal parameters of the treatment securing the obtaining of the end product with minimal volumetric mass and good organoleptic indices. On the basis of determined conditions, some specific technologies allowing to make high quality foods and medico-preventive preparations were developed.

Using of bone protein component enriched with aromatic substances, animal fat and maize groats and semolina made it possible to obtain, such new products as dehydrated ready-to-eat foods for lunches.

Chemical composition, main physical and chemical characteristics of these products are presented in Table 1.

Table 1. Main characteristics of dehydrated foods for lunches

Indices	Product with semolina	Product with maize groats
Composition, %:		
moisture	5.8	5.4
fat	0.9	0.8
protein	14.9	11.0
monosaccharides	0.4	0.8
disaccharides	0.8	1.1
dextrines	7.5	16.4
starch	51.2	38.2
cellulose	0.2	0.7
minerals	4.6	5.2
Poured mass, g/dm^3	85.0	85.0
Solubility, %	98.1	98.0

The high solubility of developed products and low dynamic viscosity of their solutions had every reason to consider that the chosen method of processing secured deep destruction of starch contained in groats. It was determined that developed products included complete complex of essential amino acids and were enriched with polyunsaturated fatty acids.

Using the blood of slaughter animals, two specific kinds of food products designed for prevention and treatment of iron deficient anaemic diseases, diabetes, hipertonia, disturbances of intestine and lipid metabolism were developed. Thus, the second of the mentioned products had a wide spectrum of usage and could be considered as multipurpose food product. The chemical composition of new products is presented in Table 2.

Table 2. Chemical composition of food products for medicinal and prophylactic purposes

Product	Content (in percent):						
	moisture	fat	ash	protein	starch	cellulose	other carbohydrates
Antianaemic	6.0-6.3	0.6-0.9	1.0-1.4	14.2-16.2	50.2-56.6	0.1-0.2	18.6-27.9
Multipurpose	4.7-6.0	0.5	1.3-1.4	16.0-17.0	70.0-71.5	1.8	2.0-4.9

Data summarized in Table 2 showed that new products containing dehydrated blood of slaughter animals were characterized by high protein level and low fat level. The content of iron fluctuated in dependence of the product type: antianaemic products contained about 140 mg/kg, while multipurpose products contained about 22.5-27.5 mg/kg of iron.

Medical and biological tests proved high antianaemic efficiency of new multipurpose products. Patients aged 35 to 65 were drawn in clinical tests which showed that taking these products by 100 g per day during four weeks, led to the fact that their arterial pressure became 8-11 percent lower than before tests, while patients with disturbances of lipid metabolism lost 5.0-8.0 % of body mass. 4-5 days later, functions of patients intestine were restored.

New food products for regulating phosphor-calcium metabolism of children and adults were developed on the basis of mineral components of bones. The content of these products was characterized by the following indices: moisture – 10 %; protein - 16-17 %; mineral salts - 6-7 %; fat – 0.15-0.20 %; starch - 69-70 %; calcium - 1500-2500 mg %; phosphorus - 1000-1500 mg %. Thus, presented data showed that these products contained sufficiently high share of protein, starch, calcium, and phosphorus.

Three groups of lab animals were used for biomedicinal tests of developed products. The first group received the new product as the source of calcium; the second group received an analogical feed ration contained lower level of calcium; the third group of animals was used as control one and received the same feed ration, containing the chalk as the source of calcium. Feed rations contained about 0.7 % phosphorus for all groups of animals. The test continued one month. Assimilation of calcium was estimated by the concentration of total calcium, inorganic phosphate, and ionized calcium (Table 3) in the blood serum. Indices presented in Table 3 showed that the usage of developed product containing bone mineral share as the only source of calcium in rations for lab animals did not lead to any metabolic disturbances in their organisms, while the ration with limited content of minerals for group II called forth the decrease of calcium concentration in the blood.

Positive results were received, when daily food rations for 7-10 aged schoolchildren contained 25 g of this product. During 12 days the blood of children was analyzed before and after the test. Average content of calcium in the blood of tested children was at the level of 9.0-9.8 mg % that corresponded to the normal concentration of 9-10 mg %.

It is to be mentioned that the content of microelements, heavy metals in particular, was significantly lower than permissible limits.

Table 3. Indices of calcium metabolism in the blood serum of lab animals

Group of animals	Content in blood serum		
	calcium, mmol/g	ionized calcium, $mmol/dm^3$	inorganic phosphate, $mmol/dm^3$
Test I	2.39 ± 0.07	1.17 ± 0.02	3.0 ± 0.09
Test II	1.15 ± 0.05	0.6 ± 0.01	3.07 ± 0.11
Control	2.38 ± 0.05	1.15 ± 0.01	3.03 ± 0.07

Microbiological analyses were carried out to prove the acceptability of chosen rates securing the manufacture of safe food products with reliable characteristics. Two-component product was analyzed. It included the semolina and enriched protein component from bones as groats raw material. Non-pathogenic stamm of E.Coli-1257 was added to the raw mix as the test culture. It was cultivated on the meat-infusion agar at 37 ^{0}C during 18 hrs. Then the suspension of cells on the physiological solution was prepared. It contained 1×10^9 cells in 1 cm^3. The suspension of test culture was injected into the initial mix of components with the rate of 500 cm^3/h.

It was determined that the ready product did not contain total number of mesophilic aerobic and facultatively anaerobic microorganisms, intestinal bacteria, moulds, and bacteria species of salmonella. Proposed rates were proved to secure the safety of end products.

To analyze quality characteristics of prepared samples during storage, they were packaged in polyethylene film and kept at 20 ^{0}C during 6 months. In the process of storage, samples were selected each month to estimate acid number, presence of dienes and trienes in their fat. Results of analyses showed that the increase of free fatty acids content was negligible in the fat, while dienes and trienes were not detected at all.

CONCLUSION

Studies carried out proved the potential for rational usage of blood and bones of slaughter animals in order to prepare dehydrated food products having a series of functional features. At the same time they contained low level of fat, had good assimilation, and were safe.

The usage of the mentioned secondary meat raw materials for preparing new products revealed potentials for their large-scale application with the purpose to extend the output of food products designed for medicinal and preventive aims. Besides, the offered technology guarantees high intensity of the process and prevent the contamination of the environment.