SAT–LCR-P-2-BFT(R)-10

THE MICROSTRUCTURE OF GERONTOLOGIC FOOD PASTES

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Abstract: *Technology of production the pastes which are balanced by micronutritional composition is researches for the purpose of developing and widening of assortment of gerontologic products.*

Designed paste has a more balanced micronutritional composition compared with control samples. Found that in the control sample of pastes content of Ca and P is dramatically unbalanced - 1: 9.8 at recommended 2: 1. While increasing content of protein-mineral gerontologic enricher, the content of Ca is increasing and content of P is decreasing. Thus when you add 10% protein-mineral gerontologic enricher to paste recipes , you get almost perfect ratio of Ca: P = 1: 0.5. Also found that the addition of 5% protein-mineral gerontologic enricher (recipe №1) is not sustainable because it is not optimal for gerontologic products - the content of Ca is just 174.1 mg per 100 g or 13.7% of the daily requirement.

The microstructure of the developed paste includes in its composition the muscle tissue in the form of muscle fibers fragments up to 0.7-0.8 mm. Muscle tissue has a microstructural changes which are typical for temperature impact - moderate destruction of muscle fibers, resulting in swelling, appearance of gaps and fragmentation. The cells found in the nucleus of muscle fibers in the form of shadows, in the connective tissue they survive better.

It is recommended to use the developed product in nutrition of elderly and centenarians.

Keywords: *meat, nutrition, herodiet, paste, protein, calcium.*

INTRODUCTION

Due to the shortage of meat raw materials, proteins of plant and animal origin are widely used. These additives are used in the manufacture of all kinds of meat products, including delicacies, boiled smoked and smoked products. This tendency persists, which contributes to the expansion of the range of proposed additives, to improve their functional properties and to increase the level of safety, one of the criteria of which is the use (application) of genetically modified raw materials (Huang et al., 2011; Bou et al., 2009).

Proteins occupy an important place in the living organism, both in content in the cell and in the sense of life. Their share accounts for about 18% of human weight. Protein is an indispensable part of food and basic life. Soy and animal proteins allow you to make an equivalent replacement of non-sufficient precious raw materials (Richardson, 2002).

Meat from important food is the only source of valuable protein, which is an average of 18.0%, which is a nutritional value of the first category. Depending on the species, the anatomical part of the animal, fattening, age, animal breeds, the protein content of the meat can vary from 11.0% to 22% (Peña et al., 2009; Hutchison et al., 2012). Among the proteins of the meat isolated connective tissue and muscle, which are divided into myofibrillary and sarcoplasmic. The nutritional and technological value of meat is higher, the more muscle tissue in it, the proteins of which belong to high-tech.

There is an international problem with providing population with diverse and high qualitied products.

The irony of the situation of shortage of food protein is in the fact that we have considerable source of protein (average 180 g / day per person), but we use 80 ... 90% of protein for fodder purposes, namely on the development of animal husbandry. The other part is scarce food protein - represented by 50 ... 56% by a plant protein, 7 ... 8% - meat one, 5% - eggs and egg products, 5 ... 6% - fish and 20 ... 30% - protein of oilseeds [Bou et al., 2009]. According to the biomedical requirements the human body needs not just food protein, but complete protein (in an amount not less than 20 kg / year), which can be found mainly in animal raw material: meat, milk, fish, eggs and, in part, oilseeds.

Results of regular mass screening [Alison J. et al., 2010] of the actual nutrition evidence about significant violations of the diet, such as excessive consumption of animal fats that leads to an increase in the number of people with overweight and different forms of obesity, lack of complete protein, polyunsaturated fatty acids, deficiency of vitamins (B, A and C) and minerals (calcium, iron, magnesium, iodine and selenium). Unbalanced diet is contributed by consuming a monotonous food due to the low purchasing power and low food culture - lack of knowledge of most of the population about the benefits of individual components of food and bad habits, such as excessive consumption of fatty foods, smoked and refined foods which are poor in vitamins and minerals. Therefore, the question of development of new innovative technologies in the food industry is very important.

Everything mentioned above leads to find additional alternative sources of calcium and development of technology of food products which will use these sources. The problem is especially actual in the meat industry because for meat products is an important component of the human diet, source of complete protein, minerals and biologically active substances. Due to excessive phosphorus and a small amount of calcium in raw meat products in the finished product is broken calcium - phosphorus balance.

The task of the research presented in this paper was to study the properties of developed gerontologic pastes with using protein-mineral gerontologic enricher obtained by enzymatic proteolysis and calcining the rumen of cattle.

In developing of recipes of gerontologic meat-based products we guided experience of our and foreign nutritionalist, gerontologists and nutritionists. It has been analyzed and codified norms of physiological needs in energy and food fibers for men and women who are over 60 years. Taking into account the metabolic and physiological characteristics of people with disorders of the musculoskeletal system, was formulated scientifically based recommendations for meat products for nutrition of people who have the aforesaid pathologies. In developing the recommendations adopted provided that developed product is the main source of nutriently-adequate protein and calcium.

Of the meat products consumed and the most promising among the various groups, including the elderly, taking into account the state of the masticatory apparatus is pate.

EXPOSITION

The studies examined the impact of protein-mineral gerontologic enricher (PMGE) on the chemical composition of meat minced systems depending on the percentage. Data on the chemical composition of of minced meat is presented on Table. 1.

Table 1. The chemical composition of minced meat models

Sample	Moisture, %	Protein, %	Fat, %	Ash, %
Control	62,2±1,1	17,2±0,3	19,6±0,3	1,02±0,02
Sample 1	64,2±1,3	17,0±0,3	16,4±0,3	2,41±0,02
Sample 2	65,0±1,4	16,7±0,3	15,6±0,3	2,72±0,02
Sample 3	66,1±1,4	16,5±0,3	14,5±0,3	2,93±0,02
Sample 4	67,2±1,3	16,3±0,3	13,3±0,3	3,21±0,02

From the data presented in Table. 1 we see that the total moisture content and ash elements in the experimental samples increases with the increasing of replacement of primary raw meat on protein-mineral gerontologic enricher. Along with the increase of moisture and ash observed - a slight decrease in the experimental samples of the mass fraction of protein and significant - fat. For product with calcium is important minimum fat content as if it is in excess, it prevents the absorption of calcium by the human body. These small differences in main nutrients content of control and experimental samples can be explained by difference in chemical composition of protein-mineral gerontologic enricher and principal raw meat - pork and poultry. The data indicate that prototypes have no significant differences in the chemical composition compared to the control sample and confirm the use of protein-mineral gerontologic enricher technology with minced meat with protein-mineral gerontologic enricher and cooked gerontologic sausages which are based on it.

Using a protein-mineral gerontologic enricher in composition of minced beef makes it possible to adjust the structural and mechanical properties, and predict the technological properties of cooked sausages. When modeling gerontologic pastes recipes it is important to investigate the content of phosphorus and calcium in their content and compliance with recommended standards - Ca: P = 2: 1.Therefore, a study was conducted in the finished pastes content of calcium and phosphorus. Research results are shown in Table 2.

Table 2. Results of the research of content of Ca and P in the finished pastes

Index	**Control**	**Recipe №1**	**Recipe №2**	**Recipe №3**	**Recipe №4**
The content of calcium in 100 mg of product	17,2±0,2	174,1±0,2	352,7±0,2	461,9±0,3	614,3±0,2
% of the daily requirement of calcium	1,4	13,7	26,0	38,5	51,2
The content of P mg per 100 g	208,4±0,1	195,1±0,1	184,2±0,1	180,1±0,1	175,2±0,1
Correlation of Ca:P	1:12,1	1:1,2	2:1	1:0,3	1:0,28

Designed paste has a more balanced micronutritional composition compared with control samples. Found that in the control sample of pastes content of Ca and P is dramatically unbalanced - 1: 9.8 at recommended 2: 1. While increasing content of protein-mineral gerontologic enricher , the content of Ca is increasing and content of P is decreasing . Thus when you add 10% protein-mineral gerontologic enricher to paste recipes , you get almost perfect ratio of Ca: P = 1: 0.5. Also found that the addition of 5% protein-mineral gerontologic enricher (recipe №1) is not sustainable because it is not optimal for gerontologic products - the content of Ca is just 174.1 mg per 100 g or 13.7% of the daily requirement.

The next stage of the research was the definition of functional and technological indicators of the finished product. In samples of gerontologic pates with protein-mineral gerontologic enricher there is a slight change in pH in the alkaline side, which, as predicted, contributed to the increase of the hydrophilicity of meat proteins and, consequently, the increase of water-binding ability of minced meat, resulting in the finished product obtained more juicy (Table 3).

Table 3. Physico-chemical properties of gerontologic pates

Sample	**Indicators**		
	pH	**Mass fraction of moisture,%**	**WBA%, to total moisture**
Control	7,05	73,97	95,46
Soy protein	7,01	73,60	90,68
Animal protein	7,01	76,41	82,30
Serum protein	6,90	74,70	88,12
SPC	6,92	74,80	88,76
PMHA	6,91	75,60	91,30
Soy protein + PMGE	6,95	74,20	90,57
Animal protein + PMGE	6,86	77,30	91,20
Whey protein + PMGE	6,85	75,10	92,17
SPC + PMGE	6,93	75,40	91,57
PMHA + PMGE	6,94	75,60	91,48

The conducting of studies water-binding ability (WBA) has shown that the introduction of PMGE in the amount of 10% in hydrated state positively affects the technological properties of minerals to retain moisture and fat during the heat treatment, which is important when using the technology of gerontologic pates. A slight increase in the output of prototype finished products was noted. There were no significant changes between the control and experimental samples of gerontologic pates in terms of physico-chemical composition

When developing a technology of gerontologic pates using PMGE, it is essential to identify its structure, structural changes of model gerontologic pates meat and finished gerontologic pates products. The usage of the precise chemical, physicochemical, histological and biochemical methods allows to obtain information about quality of meat foods. Microstructural researches make it possible to analyze not only the integral structure of product, but also changes which occur in separate components of the objects under investigation, it also helps to differentiate peculiarities of different tissue and cellular structures. That is why the aim of our investigation was to study the possibilities of using the PMGE in technology of gerontologic pates, investigating microstructure of model gerontologic pates meat and finished gerontologic pates products.

For histological investigations the gerontological paste with dimensions 10x5x4 mm. and model meat were fixed in 2.5% of gluteraldehyde on phosphate buffer (pH-7.4), samples were content for 24 hours in 4ºC. Then pieces were washed in phosphate buffer (pH - 7.3) for two hours. After this they were immersed into osmium fixator (G.M.Millonig) for additional fixation for two hours. Then the pieces of tissue are washed in 0,1M of phosphate buffer (pH - 7.3) for one hour. The next stage is to dehydrate the tissues in spirits of different strength (50%, 70%, 80%, 90% and the absolute spirit for 10 min. in each), then goes the mixture of spirit and acetone (3:1, 2:1, 1:1, 1:2, 1:3 – 15 min. each). After the samples are washed, they are processed under Laft method [6], the samples were poured with Epon - 812. The cuts were made on ultramicrotome by aimed microtoming. Before colouring, the object-plate with the cut was kept in thermostat in 45-50ºC for better fixation on the object-plate. For colouring was used the 0.1% mixture of toluidine blue. Morphometric analysis was done with the light optical microscope "MBI-15".

Microstructural features parts muscle, fat and connective tissue, preserved morphological features - characteristic animal products after heat treatment (Fig. 1 and 2).

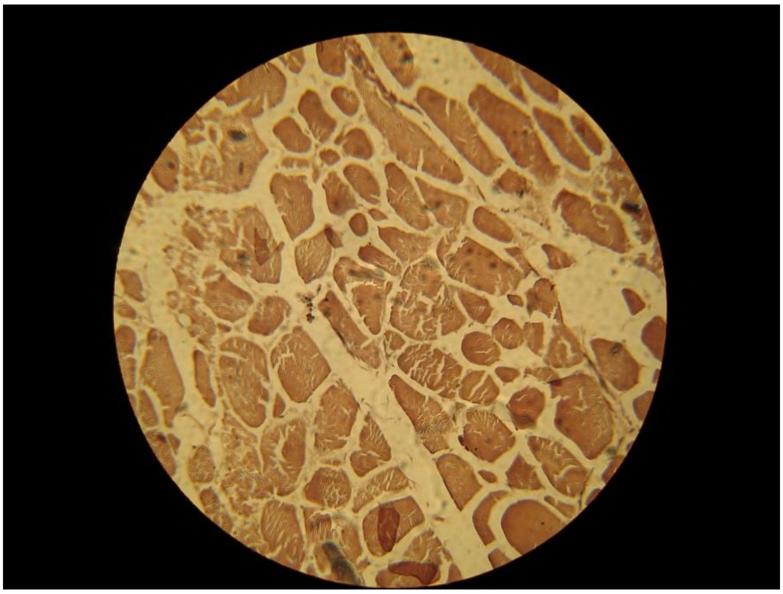

Fig. 1. The microstructure of the reference paste

From Figure 1 we see that the structure includes in a composition muscle tissue in the form of fragments of muscle fibers identified up to 0.7-0.8 mm. Muscle tissue has a characteristic temperature impact on microstructural changes - moderate destruction of muscle fibers, resulting in swelling, appearance of gaps and fragmentation. The cells found in the nucleus of muscle fibers in the form of shadows in the connective tissue of survival is higher.

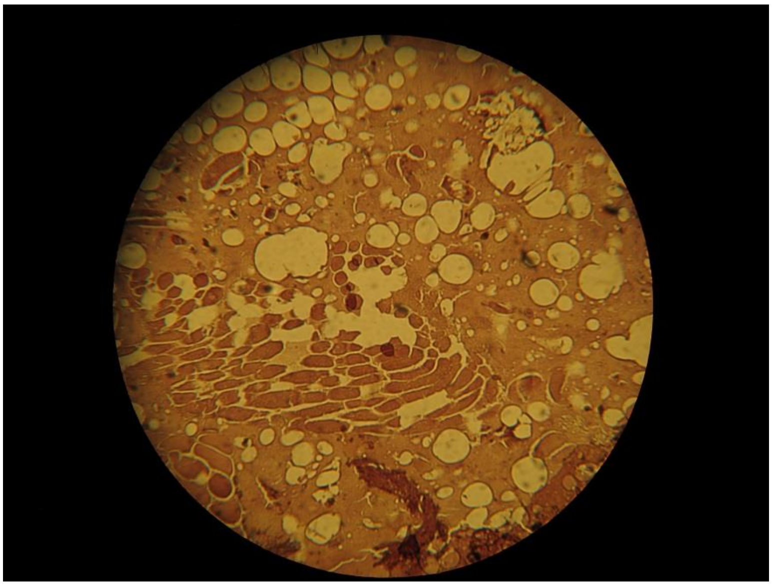

Fig. 2. Microstructure of gerontological paste

From Figure 2 we see that the replacement of raw meat protein and gerontologic mineral dresser porousness of structure remains moderate and response to this type of meat product. Adding of fermented by food collagenase rumen of cattle does not lead to significant changes in the microstructure of muscle and connective tissue structures.

Studies by a number of our and foreign scholars have shown that knowledge of the nature and direction of changes in the structure of raw meat and produced product gives the opportunity to objectively evaluate the quality characteristics of food products and their production processes in accordance with data obtained by such methods as analysis of physical, chemical, biochemical and physical-chemical studies. Therefore, histological studies were conducted in which established the following: the mass of mince is homogeneous, the main part of it is finely crushed and represented by finely granular mass, which forms the mesh bases framing and stuffing paste is about 78% by volume.

Gerontological paste which contained 10% has small-grained uniform structure with evenly placed particles of gerontological paste and vacuoles, which are less vivid than in previous sample. Finished gerontological paste have compressed coagulation layer, the fat is evenly distributed in vacuoles and in uniform protein mass. Organoleptic rates show that this gerontological paste is more juicy, has elastic consistence, is palatable, without aftertaste protein-mineral gerontologic enricher. Gerontological paste meat with 15 and 20% of protein-mineral gerontologic enricher has soft structure with big vacuoles filled with fat (sketch 7,9).

In both cases, shallow discovered fragments of cellular elements of natural spices. These cells have cellulose membrane and quite varied in shape and size.

CONCLUSION

1. The use of prototypes by the elderly people for 3 days does not lead to worsening of clinical symptoms. Researched product shows that calcium in it is accessible for elderly human body and can be absorbed from the gastrointestinal tract into the bloodstream.

2. An optimal amount of bringing of protein-mineral gerontologic enricher in recipes of pastes - 10%.

3. It was investigated a microstructure of developed gerontologic pates and proved that bringing fermented by food collagenase rumen of cattle does not lead to significant changes in the microstructure of muscle and connective tissue structure of the material.

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