

Development of technology of gerontologic food pastes

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Abstract

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Introduction. 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.

Materials and methods. The potential raw material for the development of special products for the elderly, nursing and long-lived people was analyzed. For development of recipes were used mathematical modeling methods which consider chemical composition, structure and mechanical properties of the product.

Results and discussion. 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.

The replacement of part of raw meat by protein and mineral gerontologic enricher results in remaining porosity moderated and responsible to this type of meat product. Adding fermented food collagenase of rumen of cattle don't lead to significant changes of the microstructure of muscle and connective tissue structures.

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

Introduction

There is an international problem with providing population with diverse and high quality 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 [2, 3]. 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 [1].

Results of regular mass screening [2] 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 [1]. 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 [2].

To solve this problem held:

- A comprehensive study functional and technological, structural and mechanical and organoleptic characteristics of minced meat, prepared using protein-mineral gerontologic enricher;
- Rational number protein-mineral gerontologic enricher the production of ground beef for Gerontologic pastes;
- Studied the chemical composition, biological value and microbiological safety of pates Gerontologic protein-mineral gerontologic enricher.

Statistics show that a need of complete protein can be solved by variability in diets in different countries. However, it can have a good result in high developed countries, while in Ukraine there is a chronic deficit in the amount of protein in general. Several ways of solution of this crisis situation are offered and their implementation can go in parallel ways:

- Increasing the number of livestock and poultry, Raising a productivity of animals. It needs long term programs, significant economic investments in the development of research in genetics, breeding, bioengineering, reconstruction of animal breeding, expansion fodder, fodder production, purchase feed grains, feed etc.;

- An increase in imports of animals or meat. This trend is linked to the high cost of raw meat and meat products on the world market, substantial costs for transportation, refrigeration software etc.

- Reducing losses in the field of processing animal raw materials and maximum use of secondary protein containing wastes of meat industry in food production. This solution on one hand not allows to achieve drastic increase of production, on the other hand – most types of recycled materials is low functional and contain defective protein that requires enrichment and modification of functional and technological properties;

- Involvement in the production of meat products protein intermediate products, supplements, concentrates, isolates and dresser from various sources that are secondary or incidental products in related with meat industry food industries, namely a combination of meat and protein ingredients that have high nutritional value and desired functional and technological properties. This way makes it possible to increase the depth of processing and protein level of use of resources in general turn of feed protein in food, quickly and significantly increase production volumes without radical restructuring of production, provide high quality meat products, ensure economic advantages [5, 6, 8].

Table 1
Standards of physiological needs for nutrients for people over 60

Guidelines(per day)	Men	Women
Protein, g	68	61
Including animal one, g	34	30,5
Fats, g	77	66
Ω-6, % from kcal	5-8	
Ω-3, % from kcal	1-2	
Phospholipids	5-7	
Vitamins		
Vitamin C, mg	90	
Vitamin B1, mg	1,5	
Vitamin B ₂ , mg	1,8	
Vitamin B ₆ , mg	2,0	
Vitamin B12, mg	3,0	
Beta-carotene, mg	5,0	
Vitamin E, mg	15	
VitaminD, mcg	10	
Minerals		
Calcium,mg	1200	
Phosphorus, mg	800	
Magnesium,mg	400	
Potassium, mg	2500	
Chlorides, mg	2300	
Iron, mg	10	
Iodine, mg	150	
Selenium, mg	70	

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 nutritly-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.

It is important not only to obtain certain number of amino acids, but also a compliance of their physiological ratios close to a ratio in a body tissues.

Scientifically based nutritional requirements to composition and quality of products on the meat based products for geronutritional human nutrition, who suffer from musculoskeletal deseases (Table. 1) were formulated by systematization and synthesis of physiological norms of

consumption of food substances of elderly people, taking into account the most frequently encountering deficits in states on connective tissue proteins, essential micronutrients (calcium, phosphorus, potassium, magnesium, iron, zinc, iodine), that have the biggest impact on the development of pathologies of musculoskeletal system.

Materials and methods

The potential raw material for the development of special products for the elderly, nursing and long-lived people was analyzed.

Subject of research – protein-mineral gerontologic enricher and technology of gerontologic food pastes.

To develop a range of recipes of pastes based on minced meat with protein-mineral gerontologic enricher, was a prerequisite for a comprehensive study of the properties, which shows the mince during the technological processing. In studies were used minced meat containing protein-mineral gerontologic enricher by 5, 10, 15 and 20%. As a control, was selected minced meat of beef and pork (cooked sausage recipe-grade analog of 1 sort). The level of substitution of raw meat due to the fact that the replacement of at least 5% is feasible from a technological point of view and does not give a noticeable change in quality characteristics, and the replacement of more than 20% is not recommended by legislative system of Ukraine.

Thus, using the techniques of computer modeling based on analogue – recipe of boiled sausage of 1 sort – Stolova. It was developed recipes of gerontologic meat-based products for further investigation.

In compounding analogue a beef of 1 grade been replaced to poultry meat to reduce the cost of the finished product and reduced quantitative salt accordantly with principles gerontologic food.

Result and discussion

The studies examined the impact of protein-mineral gerontologic enricher 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 2.

Table 2

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. 2 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 3.

Table 3

Results of the research of content of Ca and P in the finished pastes

Index	Control	Recipe 1	Recipe 2	Recipe 3	Recipe 4
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 requiremen of calcium	1,4	13,7	26,0	38,5	51,2
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	1:0,5 (1,9:1)	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.

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 [10]. 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. Microstructural features parts muscle, fat and connective tissue, preserved morphological features – characteristic animal products after heat treatment (Figure 1 and 2).

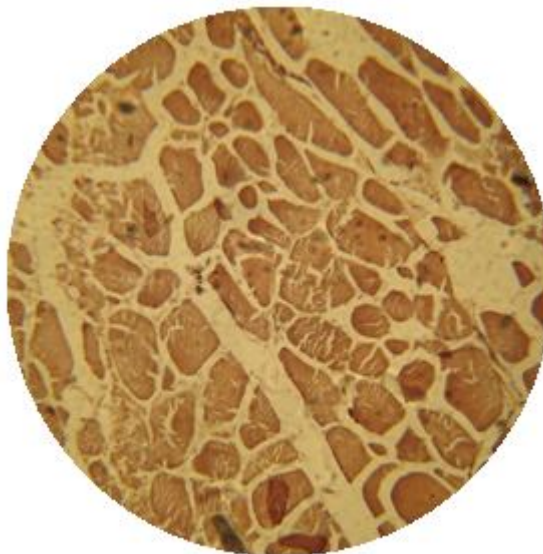


Figure 1. Microstructure of the reference paste



Figure 2. Microstructure of gerontological 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.

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.

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. An optimal amount of bringing of protein-mineral gerontologic enricher in recipes of pastes – 10%.
2. 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.
3. 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.

References

1. Jochen Weiss, Monika Gibis, Valerie Schuh, Hanna Salminen, (2010), Advances in ingredient and processing systems for meat and meat products, *Meat Science*, 86(1), pp. 196-213.
2. Hoffman L.C., Wiklund E. (2006), Game and venison – meat for the modern consumer, *Meat Science*, 74(1), pp. 197-208.
3. Alison J. McAfee, Emair M. McSorley, Geraldine J. Cuskelly, Bruce W. Moss, Julie M.W. Wallace, Maxine P. Bonham, Anna M. Fearon (2010), Red meat consumption: An overview of the risks and benefits, *Meat Science*, 84(1), pp. 1-13.
4. Huang S.C., Tsai Y.F., Chen C.M. (2011), Effects of wheat fiber, oat fiber on sensory and physico-chemical properties of Chinese-style sausages, *Asian–Australian Journal of Animal Science*, 24(6), pp. 875–880.
5. Bou R., Codony R., Tres A., Decker E.A., Guardiola F. (2009), Dietary strategies to improve nutritional value, oxidative stability, and sensory properties of poultry products, *Critical Review on Food Science and Nutrition*, 49(9), pp. 800–822.
6. Peshuk L., Galenko O. (2011), Gerodietic meat products technology enriched with calcium and phosphorus, *Food and Environment Safety*, 4(15), pp. 18-23.
7. Richardson D.P. (2002), Functional Food and Health Claims, *The world of Functional ingredients*, 9, pp. 12–20.
8. Peshuk L., Galenko O. (2014), Use of collagenase in technology gerodietetic products, *Journal of food and packing science, technique and technologies*, II(3), pp. 8-11.
9. Peshuk L., Galenko O. (2014), Rational use of the collagen, *Ukrainian Journal of Food Science*, 2(1), pp. 361-370.
10. Peña F., Bonvillani A., Freire B., Juárez M., Perea J., Gómez G. (2009), Effects of genotype and slaughter weight on the meat quality of Criollo Cordobes and Anglonubian kids produced under extensive feeding conditions, *Meat Science*, 83(3), pp. 417-422.
11. Hutchison C.L., Mulley R.C., Wiklund E., Flesch J.S. (2012), Effect of concentrate feeding on instrumental meat quality and sensory characteristics of fallow deer venison *Meat Science*, 90(3), pp. 801-806.