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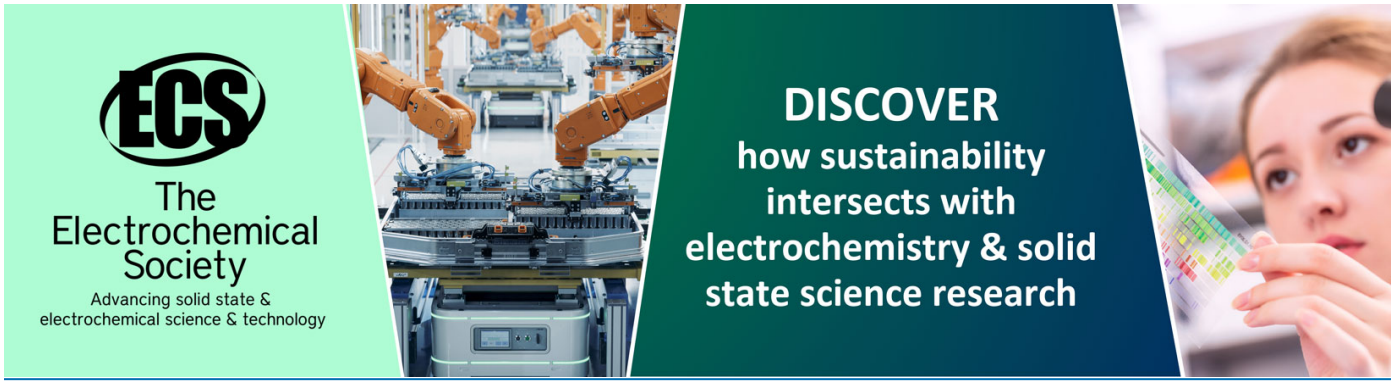

IOP Conf. Series: Earth and Environmental Science **422** (2020) 012061 doi:10.1088/1755-1315/422/1/012061

Composite mixtures in the creation of functional products based on rabbit meat

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Abstract. The actuality of obtaining high quality products enriched with functional ingredients is due to the expansion of the market of existing functional meat products and the involvement of plant resources in the production cycle, leveling the shortcomings of the main raw materials, as well as improving metabolic processes in the human body. The purpose of the article is to consider approaches to the use of composite mixtures based on dietary fibers of Jerusalem artichoke, Lupin flour, amaranth cake and animal protein in the production of chopped semi-finished products of increased nutritional and biological value. To assess the functional and technological properties of the composite mixture, methods based on the maximum absorption and retention of water and fat were used; model meat systems by methods based on the release and retention of moisture and fat, the chemical composition of the resulting product by standard physical and chemical research methods. The efficiency of using the composite mixture at a dosage of 25% to the weight of lean pork in obtaining stable meat systems is justified. The studies confirm the positive effect of composite mixtures on the base of complex use of raw materials of plant and animal origin to improve functional and technological properties of meat systems on the basis of the meat-based resource precocious meat – poultry and rabbits in optimally selected ratio and also the enrichment of the meat obtained system of dietary fiber and protein, which in turn allows solving the problem an integrated approach to the use of raw materials and stabilization of quality of meat products of functional orientation.

1. Introduction

One of the effective measures is the creation of functional foods using prebiotic herbal supplements that have a positive impact on the functioning of the gastrointestinal tract. The production of restructured meat products enriched with dietary fibers is relevant.

It is known that dietary fibers contribute to the regulation of the gastrointestinal tract, cholesterol excretion, lowering blood sugar levels.

Insufficient consumption of dietary fiber in the diet led to the spread of various metabolic disorders of the population, which in its turn led to an increase in the incidence of colon cancer, cholelithiasis and atherosclerosis [1, 2]. It is known that the supplier of dietary fibers in the body is products of plant origin, including root crops of Jerusalem artichoke. The physiological need for fiber, approved by the Ministry of health of Russia, is 30 g/day at the energy value of the diet 2500 kcal.

Fiber (food fiber) contributes to the accelerated excretion of harmful substances from the body, which is especially important in connection with the sharp deterioration of the environmental situation.

The excretion of heavy metal ions from the body is enhanced by sorption and ion-exchange properties of fiber. An important property of fiber is its moisture-binding capacity, which increases the volume of food in the stomach, which leads to a more rapid appearance of a sense of saturation. This reduces food intake and reduces body weight. Fiber reduces the rate of absorption of sugars in the intestine, protecting the body from a sharp increase in their content in the blood and increased synthesis of insulin, which stimulates the formation of fats. All this helps to reduce body weight and the risk of diabetes.

The use of vegetable raw materials in the production of meat products allows not only enriching them with functional ingredients, increasing digestibility, but also obtaining products that meet the physiological standards of nutrition [3 - 5].

One of the promising directions of meat production is the creation of minced semi-finished products in breading on the basis of precocious meat raw materials, in particular rabbit meat, ready for heat treatment. The chemical composition and biological value of rabbit meat meets the requirements of dietary nutrition, absorbed much better than beef, pork and lamb, because it contains little saturated fat [6] and is characterized by a balanced amino acid composition.

A promising source of additional protein production in the meat industry is collagen-containing raw materials (in particular, beef protein "Vitegra Beef Neutral"). The advantage of using animal protein is that collagen, which is part of its composition has a number of functional properties, such as high moisture-binding, moisture-retaining and texturing abilities, allowing its use in various food systems. The transformation of collagen during heat treatment plays a positive role, since after depolymerization it is digested better, and gluten, passing into an aqueous solution, forms a nutritious broth, gelling when cooled and binding a significant amount of water [7-9]. The use of collagen-containing raw materials allows obtaining stable stuffing systems with high functional and technological properties [10].

The aim of the work is the development of chopped semi-finished products based on rabbit meat, enriched with dietary fibers of Jerusalem artichoke and animal proteins.

2. Materials and methods

The experimental studies were carried out in the conditions of the research laboratory of the Department of private animal science of the Voronezh State Agrarian University. The objects of the study were dietary fibers of Jerusalem artichoke, animal protein "Vitegra Beef Neutral", as well as meat systems of combined composition based on raw materials of animal and vegetable origin. As an animal raw material, model minced meat was used, obtained on the basis of minced rabbit and poultry meat of manual boning in the ratio of 40: 60. Model minced meat was used on the basis of beef of the 2nd grade and low-fat pork as a control one.

For the enrichment of the model minced meat we used composite compound derived from the cellulose of Jerusalem artichoke on the other 9112-004-97357430-09 (LLC "Ryazan spaces"), containing in its composition of dietary fiber – 75% (insoluble dietary fiber – 67%, soluble dietary fiber – 8%), lupin flour, amaranth oil cake and animal protein "Beef Vitegra Neutral" (CAMPUS, Italy) with a protein content of 65% with a ratio of 1:1.5. "Vitegra Beef Neutral" is a complex based on beef protein, fiber and calcium alginate allows creating thermo-stable meat emulsions, which are characterized by meat flavor. Replacing up to 20.0% of raw meat with such emulsions leads to a significant reduction of frying, compaction of the structure and cost reduction. The composite mixture was introduced into model minced meat in the amount from 0 to 25% in a pre-hydrated form. The use of animal protein "Vitegra Beef Neutral" improves the functional and technological properties of meat systems, forms a viscoplastic structure, which contributes to the highly emulsified consistency of minced meat [11, 12]. Optimization of the composition of the composite mixture was made using the software module Statistica 6.0.

The functional and technological properties of dietary fibers, model meat systems and the chemical composition of the resulting product were evaluated by physical and chemical methods [13]. Determination of the total chemical composition was carried out by the method of one sample, which consists in the sequential determination in one sample product of moisture content, fat, ash, and protein using a device for determining the moisture and fat content of meat products by accelerated method [13]. Mass fraction of dietary fiber in the product was determined by the gravimetric method according to GOST R 54014-2010 [14].

The organoleptic evaluation of the product was carried out by the tasting commission on a five-point scale. During the organoleptic evaluation, the compliance of the main quality indicators (appearance, view on the section, smell (aroma), taste, consistency and juiciness) with the requirements was established. The STATISTICA 6.0 software module was used for statistical analysis of the calculated data.

As test object a rapid bioassay is used easily cultivated free-living single – celled organism Paramecium caudatum. Express Biotest includes three stages. Stage I-assessment of the biological activity of the studied objects. Stage II-assessment of the biological activity of the studied objects by the method of resolving influence. Stage III-assessment of biological activity of the studied objects by the intensity of reproduction of Paramecium caudatum. In the prepared samples, culture of infusoria is introduced in the exponential growth phase. The density of the inoculate is determined. Itis cultivated at 25 ° C for 3 days. After the time of cultivation the density of the inoculate is determined.

3. Results and discussion

Meat products are among the most consumed foods. The composite mixture used to enrich the model minced meat was characterized by the following functional and technological properties (FTP): WAC (water absorption capacity) was 105,5%, GA (geopolitically ability) was 112,6% and EP (emulsifying power) was 101,4%. The data confirm the high values of water-and fat-holding capacity, which will contribute to the stabilization of the meat emulsion.

To balance the chemical composition and enrichment of biologically active substances in accordance with the requirements for a healthy diet, minced meat was used, obtained on the basis of poultry and rabbit meat of manual boning, taken in a ratio of 40:60. When using minced meat on the basis of poultry and rabbit of hand boning instead of the 2nd grade beef together with lean pork, which was replaced by a composite hydrated mixture, the meat model system with high functional and technological properties was obtained. Functional and technological properties of the model stuffing system (WBC, WHC) with the introduction of the composite mixture increased from 62.5 to 68.7% and from 65.4 to 73.2%, respectively, while the maximum value of the indicators was obtained with the total dosage of the components of the composite mixture in hydrated form to the mass of the model stuffing in the amount of 25%. When the composite mixture is introduced into the stuffing base, the free hydrophilic groups increase, which in its turn bind and retain water molecules. It is also found a positive dynamics of increasing the FHC of the minced meat from 52.6 to 67.9% due to the introduction of the system of proteins involved in the formation of protein-fat matrix, promoting the binding and retention in the meat system of fat.

The selected dosages and ratios of ingredients were used in the formulation of minced meat products based on the matrix method of calculation of formulations and providing a preferred set and ratio of components based on the law of conservation of mass and the theoretical basis of linear programming.

The recipe of the developed chopped semi-finished products "Festive" is presented in table 1. Indicators of quality of cutlets "Festive" are presented in table 2. It was found that the introduction of the composite mixture revealed differences between the experimental and control samples (table 2), including amino acid balance (table 3). The results of the evaluation of the harmlessness of emulsified products on unicellular organism Paramecium caudatum are presented in tables 4 and 5.

Table 1. Recipe of minced meat semi-finished products

Component name	Cutlets “Home” (control)	Cutlets “Festive» (experience)
Unsalted raw materials, kg / per 100 kg of raw materials		
Beef of the 2nd grade	42.00	-
Lean pork	32.00	24.00
Poultry meat of manual boning	-	23.00
Rabbit meat of manual boning	-	19.00
Wheat bread	2.0	2.00
Onion	6.00	6.00
Egg melange	2.50	2.50
Functional composite mixture"T-Mix"	-	8.00
hydrated water (ice during cutting), l	10,00	10.00
Materials and spices, kg / 100 kg of raw materials		
Flour breading	4,00	4.00
Ground black pepper	0.50	0.50
Salt	1.00	1.00

Table 2. Quality indicators of chopped semi-finished products

Component name	Cutlets " Home» (control)	Cutlets "Festive» (experience)
Organoleptic indicator		
Appearance	A crushed homogeneous mass without bones, cartilage, tendons, coarse connective tissue, blood clots and films, evenly mixed, with single torn and broken edges, evenly coated with a breading ingredient. The shape is rounded, slightly flattened	Crushed homogeneous mass without bones, cartilage, tendons, coarse connective tissue, blood clots and films, evenly mixed, without torn and broken edges, evenly coated with a breading ingredient. The shape is rounded, slightly flattened
The colour on the cut	Minced meat well mixed; homogeneous mass with the inclusion of ingredients formulation	Minced meat well mixed; homogeneous mass with the inclusion of ingredients formulation and composite mixture
Smell, taste, consistency and juiciness	Peculiar to this name of semi-finished products, taking into account the used prescription components, without foreign taste and smell	Peculiar to this name of semi-finished products, taking into account the used prescription components, without foreign taste and smell. With a distinct aroma of the ingredients introduced composite mixture, delicate consistency, juicy
Physical and chemical parameters		
Mass fraction of protein,%, not less	12.5	13.8
Mass fraction of fat,%, not more	30.0	21.6
Mass fraction of carbohydrates,%, not more	2.5	12.9

The results of determination of harmlessness on the test culture showed that the prototype – cutlets "Holiday" have a higher reproduction intensity index of cells compared to control that was reflected in the sensitivity of life organisma single-celled Paramecium caudatum.

At a dilution of 1: 10000 the prototype has shown even a slight stimulating effect on a test object. Thus, the results of studies show that the emulsified product does not show toxic effects on the test object and as a consequence is harmless to humans.

Table 3. Amino acid composition and biological value of meat semi-finished products - cutlets

Indicator	FAO/WOS standard, g / 100 g of protein	Cutlets " Home» (control)	Cutlets "Festive» (experience)
Amino acid composition, g/ 100 g of protein			
Leucine	7,0	7,20	9,40
Isoleucine	4,0	3,40	4,90
Lysine	5,5	8,10	7,62
Methionine + cystine	3,5	3,75	4,12
Phenylalanine + tyrosine	6,0	6,80	8,71
Threonine	4,0	5,32	5,15
Tryptophan	1,0	1,30	1,72
Valine	5,0	5,10	5,44
CFAS,%	-	29,75	26,10
BV,%	-	71,25	73,90

Table 4. Changes in the intensity index of cell reproduction depending on breeding

The name of the sample	Index of cell reproduction intensity Breeding of the object		
	1:100	1:1000	1:10000
Cutlets "Festive» (experience)	0,776	0,730	0,820
Cutlets " Home» (control)	0,616	0,718	0,925

ICR – index of cell reproduction intensity
ICR – 1,0 – subject is not biologically active;
ICR – >1,0 – the object stimulates cell reproduction;
ICR – <1,0 – the object inhibits cell proliferation.

Table 5. Change of biological activity index depending on breeding

Sample name	Index of biological activity Depending on breeding		
	1:100	1:1000	1:10000
Cutlets "Festive» (experience)	1,54	1,58	1,80
Cutlets " Home» (control)	1,26	1,29	1,19

BAI- biological activity index
BAI – 1,0 – subject is not biologically active;
BAI – >1,0 – the object increases cell viability;
BAI – <1,0 – the object reduces cell viability.

The selected optimal dosage of the composite mixture for entering into the minced meat system improves its functional and technological properties and maximum retention of the introduced moisture. The use of a composite composite mixture based on raw materials of plant and animal origin

in the development of meat minced semi-finished products allows enriching the developed products with complexes of necessary food nutrients. The developed products allow expanding the range of meat chopped semi-finished products for functional purposes, and the resulting composite mixture opens up prospects for its use in the meat industry.

4. Conclusion

The studies confirm the positive effect of composite mixtures on the base of complex use of raw materials of plant and animal origin to improve functional and technological properties of meat systems on the basis of the meat-based resource precocious meat – poultry and rabbits in optimally selected ratio and also the enrichment of the meat obtained system of dietary fiber and protein, which in its turn allows solving the problem of an integrated approach to the use of raw materials and stabilization of quality of meat products of functional orientation.

Acknowledgments

The authors express their gratitude to Alexander Aristov, Dean of the faculty of veterinary medicine and animal husbandry technology of Voronezh State Agrarian University named after the Emperor Peter I, for his support and valuable comments.

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