

Research and Development of Functional Additives Based on Plant Materials for Dietary Meat Products

¹Aziza Nishanova, ²Oisha Alaviya, ³Dilfuza Madazizova,
⁴Pastumiya Sharipova, ⁵Sevara Safarova

Abstract--*The article presents an analysis of research and development of functional additives based on plant materials for use in the manufacture of dietary meat dishes. Data substantiating the principles of creating composite functional food environments that provide mineral, lipid, chemical, amino acid compositions of raw materials and developed products are presented. The scientific substantiation of the production technology of combined systems of multifunctional action was also carried out. The research data on the patterns of the influence of the ratio of raw material ingredients on the rheological properties of products are presented.*

Keywords--- *technology, meat products, food supplement, herbal supplements, microbiology and biotechnology, dietetic meat products*

I. INTRODUCTION

Expanding the range of dietary meat products of a multifunctional purpose is one of the trends that have been outlined in the development of the range of culinary products. The combination of food raw materials of plant origin, with various functional and technological properties allows to get products with a wide range of functional properties, directionally affecting various aspects of the functional activity of the body [2,8,10].

Improving the technology of functional food additives is an urgent task, from the point of view of creating functional products and dietary meat nutrition on their basis, both for the special contingent and for the population living in ecologically unfavorable regions of the country, in order to increase the body's immune status [7,11].

The most relevant solution for the production of dietary meat products is the use of plant materials, forming as a result of technological influences a homogeneous system with harmonious organoleptic characteristics and directionally formed composition [13].

Plant-based food additives such as Jerusalem artichoke, oat and corn grits, and potato flakes are characterized by certain indicators of nutritional and biological value, but the structural-mechanical and technological properties during storage do not allow the full use of these raw materials in the production of culinary products [2]. In this regard, research aimed at developing dietary technologies for foods of high nutritional and

¹Tashkent State Dental Institute Republic of Uzbekistan

²Tashkent State Dental Institute Republic of Uzbekistan madazizova72@mail.ru

³Tashkent State Dental Institute Republic of Uzbekistan

⁴Tashkent State Dental Institute Republic of Uzbekistan

⁵Tashkent State Dental Institute Republic of Uzbekistan

biological value, as well as improving technological parameters of products based on a combination of various animal and vegetable raw materials, is an urgent task [5,6].

The problem of enrichment of food products with polyunsaturated fatty acids which helps to reduce a number of diseases, is also relevant [11].

The aim of the work was to develop a functional herbal supplements for use in dietary meat production, taking into account the problem of its rational use.

II. MATERIAL AND METHODS

The object of the study is technology for the production of dietary meat products using vegetable raw materials

In the course of research, the following raw materials were used: Jerusalem artichoke, oat and corn grits, and potato flakes. The combined use of vegetable raw materials with chicken fillet. Research methods are based on the use of mathematical methods for planning the experiment, physical modeling of the studied processes, analysis of chemical and physicochemical indicators of the quality of raw materials and products.

During the research, biochemical and microbiological and biotechnological methods of analysis were also used.

Physical methods were used to determine the physical indicators (mass, size, color, temperature) of the ready product. Thermometers, halometers, colorimeters, scales were used during the determination.

Physicochemical (colorimetric, refractometric, polarimetric, spectral and potentiometric) analysis methods were used to assess the quality of minced meat based on plant materials. The content of water, nitrogen, lipids, amino acids, minerals, carbohydrates, vitamins, toxic chemical elements was determined. We also used methods based on the study of density, viscosity, surface tension.

Microbiological and biochemical studies were carried out in accordance with the requirements of SanPiN to establish biochemical, microbiological indicators, the degree of seeding by microorganisms of raw materials, semifinished, end products, etc.

III. RESULTS

During analyzing the composition and physicochemical properties of plant materials, the status of products based on them was correlated, and the rheological properties of food systems were considered (Table 1).

Table 1. The chemical composition of the raw materials (%)

No	Type of row	Moisture	Protein	Lipid	Ash
1	Jerusalem artichoke	74.2	5.95	0.54	6.01

2	Corn grits	14.0	10.3	4.85	1.2
3	Oatgrits	12.0	11.0	6.10	3.2
4	Potato flakes	76.0	2.0	0.4	1.1

The lowest moisture content in Oat grits leads to the creation of the best rheological system, and, therefore, it is recommended to use it as a raw material for the production of dietary meat products, in order to prepare functional cooking products. In terms of chemical composition, greater water cut, low lipid, protein and very low-calorie content Jerusalem artichoke is a low-value product.

The process of melanoidin formation in raw materials, the influence of the ratio of meat raw materials and food additives on the characteristics, nutritional value of products based on them were also studied. It was noted that during the period of research, the process of melanoidin formation took place in several stages.

The decomposition of carbohydrates as a result of hydrolysis and biological processes leads to the formation of reducing sugars. Reducing sugars undergoing redox interaction form furfuron, hydroxymethyl furfuron, acetaldehyde, isovalerianaldehyde and other compounds.

The breakdown of proteins as a result of hydrolysis and microbiological processes forms amino acids and peptides. The formed amino acids and peptides undergo a redox reaction, which leads to the formation of melanoidins.

As the data show, with increasing temperature, the accumulation of coloring substances increases, while they reach their maximum at temperatures above 140 ° C. We noted that in chemical reactions there can be no talk of any sharp boundary in the interaction between amino acids and sugars; the pH of the medium depends not only on the rate of formation of melanoidins, but also on the type of intermediate products formed.

It was established that the formation of melanoidins occurs not only in the pH range of 6–9, but also in a strongly acidic environment (pH 3.0–4.5) with the smallest amounts of amino acid.

Experimentally established that aqueous solutions of Jerusalem artichoke melanoidins are resistant to sunlight, particle sizes vary from 0.7 to 4.2 nm, they can be attributed to semicolloidal systems in which ions, molecules and various micelle complexes of different dispersion are simultaneously located.

It was noted that the main reason for the decrease in the intensity of the formation of coloring substances in a strongly alkaline medium should be considered a change in the direction of the reaction in the direction of the formation of colorless products and partial destruction of the chromophore systems of the molecules of coloring substances that occurs under the influence of a high concentration of hydroxyl ions.

The influence of the concentration of reacting components on the intensity of color formation, bringing food to the state of culinary readiness and the course of decomposition reactions is a constant change in the

concentration of carbohydrates, amino compounds and other substances, which affects the intensity of the formation of coloring substances.

It was revealed that for a comprehensive study of the use of raw meat in a single, homogeneous system with the introduction of additives of plant origin, it is necessary to develop methods for the technological processing of raw materials and products, taking into account their effect on combinations, formation and, accordingly, on the balance and functional properties of the product.

We have studied the effect of additives - plant proteins - on the quality of products p, with the introduction of vegetable food additives.

Table 2 presents the formulations of 3 variants of combined forcemeat with herbal additives were investigated. The quantitative composition of meat remains unchanged, and the amount of corn grits, oat and potato flakes varies.

Table 2. Combined minced meat with herbal additives

Component	Amount g / 100 g of product		
	Option 1	Option 2	Option 3
Meat	84	84	84
Oatmeal	11	-	-
Corn grits	-	8	-
Potato flakes	-	3	11
Jerusalem artichoke	5	5	5
Total, g	100	100	100

Table 3 presents the characteristics of the protein (amino acid rate) of combined systems based on meat and plant ingredients. Selected compositions of food raw materials of multifunctional action, stabilizing the system, were investigated in real conditions in the production process of industrial parties.

Table 3. Amino acid rate of combined minced meat

Amino acid	Amino acid rate,%		
	(option 1)	(option 2)	(option 3)
Isoleucine, mg / 100 g	126	127	128
Leucine	135.	139	137
Methionine + Cysteine	107	111	120
Lysine	195	196	202

Phenylalanine + Tyrosine	130	128	124
Threonine	121	120	124
Tryptophan	132	128	131
Valin	113	116	120

In order to make the final choice of the composition of a multifunctional food supplement, microbiological, biochemical and organoleptic studies of the products were carried out. The mineral composition of the studied systems are presented in table 6.

Table 6. The mineral composition of the studied systems

Minerals, mg	Daily Value	Opt. 1	Opt. 2	Opt. 3	Degree of satisfaction,%		
					Opt. 1	Opt. 2	Opt. 3
Calcium	850	43.5	35.4	41	5.1	4.2	4.8
Phosphates	1100	203.7	199.1	186.5	18.5	18.1	16.9
Sodium	4,500	76.7	75.6	68.7	1.7	1.68	1.5
Potassium	3000	439.4	453	587.1	14.6	15.1	19.57
Chlorides	5500	-	-	-	-	-	-
Magnesium	380	41	28.5	33.3	10.8	7.5	8.8
Iron	15	1.07	1.17	1.01	7.1	7.8	6.7

The data obtained confirm and make it possible to establish that the method of introducing ingredients of multifunctional action depends on the type of product and the method of technological processing.

A comprehensive study of chemical, physico-chemical, biochemical and microbiological properties showed the possibility and feasibility of introducing herbal supplements. This, in turn, significantly affects the structure formation of combined minced meat, changing its rheological and lyophilic properties, allowing to increase the shelf life of minced meat, and in some cases increasing the nutritional value of the product. Knowing the nature of the effect of the additives introduced into it, it is possible to obtain a product with predetermined properties, depending on its further purpose.

A comprehensive analysis of the chemical, physicochemical, biochemical and microbiological properties of the developed food systems showed that a further increase in the mass fraction of plant components leads to a loss in the ability of proteins to retain moisture, therefore, the quality indicators of the product are reduced. The optimal content of food additives in fish and meat rheological systems was established, which is 20% of the total mass.

IV. CONCLUSION

Thereby, one of the urgent tasks of the technology for the production of dietary meat products of public catering is the development of technologies for dishes of increased food and biological activity, the improvement of

technological parameters of products based on a combination of various animal and vegetable raw materials. A comprehensive and in-depth study of this problem will make it possible to develop recommendations both for public catering and food industry enterprises, and for traditional home cooking.

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