IRSTI 65.59.29 https://doi.org/10.48184/2304-568X-2024-4-150-156

# NON-TRADITIONAL PLANT RAW INGREDIENTS IN THE PRODUCTION OF MEAT AND VEGETABLE PATES

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***This article explores the use of non-traditional plant-based raw materials in the production of meat-and-vegetable pâté. Duck meat and offal serve as the primary meat components, while the vegetable ingredients include flaxseed and lentil flour, onions, garlic, sesame oil, carrots, table salt, cloves, ground black pepper, paprika, broth, and water. The broth is utilized after cooking the duck meat. To create high-quality, multi-component meat products with excellent organoleptic characteristics and to address deficiencies in specific nutrients, it is crucial to consider the biological value and qualitative composition of the protein component. The quality assessment, based on organoleptic and physicochemical indicators, was conducted using standard methods. The study also presents findings on the food safety and microbiological indicators of the meat-and-vegetable pâté. The research confirms that the pâté with non-traditional additives meets all regulatory requirements for microbiological safety and food quality. The development of meat products, including pâtés, with plant-based additives not only enhances the technological properties of raw materials but also enriches the products with essential nutrients and helps prevent potential functional disorders in the human body. This approach represents a key focus area in the modern meat industry.***

**Keywords: pates, duck meat, non-traditional vegetable raw materials, by-products, flax meal, biological value, organoleptic characteristics.**

# НЕТРАДИЦИОННЫЕ РАСТИТЕЛЬНЫЕ ИНГРИДИЕНТЫ В ПРОИЗВОДСТВЕ МЯСОРАСТИТЕЛЬНЫХ ПАШТЕТОВ

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***В статье изучено использование нетрадиционного растительного сырья для производства мясорастительного паштета. В качестве мясного компонента были использоны утиное мясо и субпродукты. В качестве растительной части применялись льняная и чечевичная мука, лук, чеснок, кунжутное масло, морковь, поваренная соль, гвоздика, молотый черный перец, паприка, томатный бульон и вода. Для создания качественных многокомпонентных мясных продуктов, которые могут компенсировать недостаток определенных пищевых веществ, важна биологическая ценность и качественный состав белкового компонента. Продукция также должна обладать хорошими органолептическими свойствами. Оценка качества проводилась по органолептическим и физико-химическим показателям с использованием общепринятых методик. Результаты исследования также включают анализ пищевой безопасности и микробиологических показателей мясорастительного паштета. Результаты исследований подверждают, что по микробиологическим показателям и безопасности пищевых продуктов палеты полностью соответствуют нормативным требованиям. Современная мясная промышленность занимается производством мясных продуктов, таких как паштеты, с использованием пищевых добавок и ингредиентов растительного происхождения. Эти добавки не только улучшают свойства сырья, но и обогащают продукцию различными веществами, предотвращая потенциальные нарушения здоровья в организме.***

**Ключевые слова: паштеты, мясо утки, нетрадиционное растительное сырье, субпродукты, льняная мука, биологическая ценность, органолептические показатели.**

# ЕТ-КӨКӨНІС ПАШТЕТТЕРІН ӨНДІРУДЕГІ ДӘСТҮРЛІ ЕМЕС ӨСІМДІК ИНГРЕДИЕНТТЕРІ

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***Мақалада дестүрлі емес өсімдік шикізатын пайдаланып, ет-көкөніс паштетінің өндірісі қарастырылған. Құрамында зығыр және жазымық ұны, пияз, сарымсақ, күнжіт майы, сәбіз, ас тұзы, қалампыр, ұнтақталған қара бұрыш, паприка, сорпа және су бар компоненттер қолданылған. Үйрек етінен дайындалған сорпа пайдаланылады. Құрамында көп компонентті ет өнімдерін жасау үшін биологиялық құндылық критерийлері мен ақуыз компонентінің сапалық құрамын ескеру қажет. Бұл өнімнің сапасын органолептикалық және физика-химиялық көрсеткіштер бойынша бағалау жалпы қабылданған әдістер арқылы жүзеге асырылды. Сонымен қатар, ет-көкөніс паштетінің тағамдық қауіпсіздігі мен микробиологиялық көрсеткіштері зерттелді. Зерттеулер нәтижелері бойынша, микробиологиялық көрсеткіштері мен дәстүрлі емес қоспалары бар ет-көкөніс паштетінің тағамдық қауіпсіздігі нормативтік құжаттарға толық сәйкес екені анықталды. Шикізаттың технологиялық қасиеттеріне әсер ететін және өнімдерді маңызды заттармен байытуға, сонымен қатар мүмкін болатын функционалдық бұзылулардың алдын алуға арналған өсімдік текстес тағамдық қоспалар мен компоненттерді пайдалану, қазіргі заманғы өнеркәсіптің басым бағыттарының бірі болып табылады.***

**Негізгі сөздер: паштеттер, үйрек еті, дәстүрлі емес өсімдік шикізаты, субөнімдер, зығыр ұны, биологиялық құндылық, органолептикалық көрсеткіштер.**

### *Introduction*

At the moment, meat pates produced in processing enterprises of the agro-industrial complex are high-calorie homogeneous preserves, the content of which is pure meat. The delicate texture of pates is achieved through special methods of processing raw materials and selecting ingredients according to the recipe. Meat pies are in great demand among the people.

Meat and meat-based products hold significant promise as raw materials for developing functional fods that not only deliver complete protein but also include biologically active components. Pates, in particular, exemplify meat products that benefit from a manufacturing process that facilitates the efficient use of raw materials and allows for the combination of various types of ingredients. Typically, pate is a finely ground, paste-like product primarily made from boiled offal and baked in a mold. The recipe can be supplemented with vegetable ingredients and other food components [1].

Many researchers agree that integrating meat with vegetable ingredients represents a highly promising approach to addressing the challenge of healthy nutrition. This combination yields high-quality products with diverse compositions, broadens the product range, and enables the creation of optimal, customized recipes that enhance the consistency and biological value of the final product [2].

Functional and therapeutic-prophylactic foods are designed to provide not only nourishment and energy but also essential vitamins, dietary fibers, and biologically important substances. Additionally, producing such products expands the variety of goods offered by processing enterprises, thereby boosting their economic activity by increasing net income and profitability. Currently, meat products produced in meat processing plants are predominantly high-calorie, homogenized canned foods, primarily composed of meat or its byproducts. Expanding the range of pâtés can be justified from the perspective of optimizing the use of available raw materials to maximize the production of high-quality edible meat products.

Pâtés are meat products where the production technology enables the efficient use of raw materials and allows for the combination of various types of ingredients. Besides meat, these products can include vegetable materials and other food components [3].

However, many pâtés available in the regional market are high in animal fat and low in protein, which does not align with contemporary scientific principles for designing healthy food products. Developing new types of pâtés involves maximizing the use of diverse raw materials, including non-traditional resources from the Republic of

Kazakhstan, such as secondary and byproducts from protein-rich animals and poultry [4].

L.V. Antipova, I.N. Tolpygina, and A.A. Mishchenko have proposed a method for preparing low-calorie pâté using white poultry meat, mushrooms, tomatoes, herbs, and lentils as the meat components, with olive oil and spices as vegetable components. This approach results in a product with high biological value and a balanced amino acid profile, which supports improved digestion and metabolism [5].

Currently, most meat pâtés are calorie-dense regardless of their chemical composition. However, by utilizing raw materials more efficiently and producing mixed meat products, it is possible to increase the availability of pâtés that are lower in calories, higher in protein, and possess greater biological value [6].

Current recipes for mixed meat pâtés often include processed grain and soy products as vegetarian elements. Among these, butter pie is highly regarded by experts for its exclusive blended meat-vegetable pâté recipes that ensure the inclusion of specific nutrients. Typical ingredients for making canned pâté include minced beef, pork or lamb liver, chopped brain, unsalted butter, fried onions, high-quality table salt, sand sugar, and various spices [6].

However, this method involves cooking the ingredients at high temperatures for extended periods, which significantly reduces the levels of several physiologically active components, particularly vitamins. This is a notable disadvantage of the process. Additionally, the inclusion of butter in the recipe is problematic due to its high saturated fat content, which results in elevated cholesterol levels in the final product. Consequently, pâtés prepared using this recipe are energy-dense [6].

Beef liver pâté typically contains beef liver, refined beef bone fat, full-fat soy flour, onion, red sweet pepper, bone broth, CO2 extracts of nutmeg and black pepper, vegetable lecithin, vitamin E, beta-carotene, and salt.

The widespread use of genetically modified soybeans has led to a negative perception of soy-containing products among many consumers. As a result, the inclusion of soy flour in the pâté recipe is viewed as a drawback of this technique [7].

The composition of beef fat is primarily made up of saturated fatty acids, which does not align with modern nutritional principles. Additionally, incorporating a gas-liquid processing phase for animal fats—designed to improve their quality and utilize fats with lower quality indicators—adds complexity to pâté manufacturing. This complexity reduces productivity and increases the cycle count. Furthermore, processing at temperatures ranging from 70 to 800 degrees Celsius for extended periods, along with intermittent high pressure, results in increased energy consumption [7].

A recipe provided by the authors for meat-vegetable pâté includes diced cow liver, cooked and pre-soaked chickpeas, vegetable oil, sautéed onions, table salt, spices, carrageenan, and cooking broth made from by-products [7].

One disadvantage of this method is the reliance on pre-cooked beans. The high temperatures used during processing cause protein denaturation, which reduces the nutritional value of the product [8].

To enhance the functionality of the pâté, Zhumagul M.S. suggested adding peas and carrots to a meat-vegetable pâté recipe that already includes lamb liver [9].

Incorporating different types of flour into meat pâté recipes can not only improve the consistency of the meat mixture but also significantly alter the flavor and aroma of the finished product. Various types of flour, such as those made from pea and bean sprouts, wheat and barley sprouts, as well as flax meal and lentil flour, offer nutritional and biological benefits comparable to wheat flour.

Flax meal, in particular, is a highly nutritious plant-based protein source. It is rich in amino acids such as arginine, valine, leucine, phenylalanine, and tyrosine. Due to its low calorie content, flax meal is suitable for producing products that meet both functional and nutritional objectives. Additionally, flax meal is known for its exceptional water (137.5%) and fat (123%) absorption capacities. It also exhibits a high emulsifying ability when mixed with oil, particularly in formulations containing 30% flax meal and 70% oil [12].

Sesame oil is used as a substitute for animal fats in semi-finished products, providing a rich source of fatty acids. Excessive consumption of animal fats has been linked to a rise in cardiovascular diseases among the population. Regular use of sesame oil, however, can positively impact cardiovascular health by improving vein tone, enhancing their strength and flexibility, reducing "bad" cholesterol, and normalizing blood pressure. Moderate consumption of fatty liquids like sesame oil has also been associated with an increase in platelet count [13].

Our goal is to broaden the range of meat products by developing a functional pâté with a

balanced chemical composition, exceptional sensory qualities, high nutritional value, and beneficial nutritional properties [13].

Poultry meat is a highly nutritious product, rich in easily digestible proteins, vitamins, and essential fatty acids. It provides healthy and satisfying proteins at a lower cost compared to other types of meat, making it economically advantageous. The production and sales of poultry meat and its processed products are crucial for food safety and hold significant societal value [14].

To address deficiencies in trace elements and vitamins, diversifying food ingredients is an effective strategy. Incorporating plant-based protein sources such as lentils and flax, and carbohydrate sources like pumpkin and carrots, can help balance the nutritional profile. Additionally, spices, medicinal herbs, and raw plant components can be used to enhance both the flavor and aroma of the pâté [14]. Plant-derived ingredients can supplement the physiological compounds that may be lacking in meat products, improving their overall nutritional quality.This study investigates meat-vegetable pâté incorporating plant-based components such as flax and lentil flour, along with onion, garlic, sesame oil, carrot, broth, and water. The broth is prepared from cooked duck meat. While traditional pâté recipes use wheat flour, this research substitutes flax and lentil flour for wheat flour when incorporating herbal components. The crushed flour is added to form a protein-fat emulsion, with sesame oil also utilized to create this emulsion [15], resulting in a product with enhanced organoleptic properties.

For the pâté production, minced duck meat, previously prepared from freshly frozen poultry, was used. The raw materials employed meet the standards set by technical documents and TR TS 034/2013 "On the Safety of Meat and Meat Products" [15].

Quality assessment of the meat-vegetable pâté was carried out using established methodologies. The physico-chemical characteristics of the pâté, including moisture content, ash content, and overall acidity, were evaluated using arbitration techniques [16].

***Results and discussion***

When selecting a product, consumers consider several organoleptic qualities, including appearance, cut style, flavor, aroma, and texture. These sensory factors are crucial for evaluating pâté. The table below presents the sensory attributes of the pâté samples assessed for functional purposes. Based on the data, the analyzed samples meet the established standards for organoleptic qualities.

Table 1. Organoleptic Parameters of Meat-Vegetable Pâté for Functional Purposes

| № | Indicator | Sample 1 | Sample 2 | Sample 3 | Sample 4 |
|---|---|---|---|---|---|
| 1 | Appearance | Light brown homogeneous mass | Homogeneous brown mass with inclusions | Light brown mass with inclusions | Thick, finely ground, paste-like mass, homogeneous, without extraneous impurities |
| 2 | Consistency | dense, not homogeneous | pasty with flexible inclusions | Homogenous, paste-like | Finely ground, spread, homogeneous, grainless |
| 3 | Colour | Too yellow | Uniform, light yellow | Pleasant yellow brown | Uniform, light brown |
| 4 | Smell | sweet, distinct aroma of spices | strong smell of spices | odor characteristic of this type of product | Normal, characteristic of meat, without foreign taste and smell |
| 5 | Taste | taste of oil and spices | taste of spices | pleasant aftertaste | Moderately pronounced meaty taste, without bitterness and foreign taste |

Based on our research, we selected the fourth sample of the finished product for further development. Using these findings, we can produce a functional additive and incorporate it into poultry meat to create a high-value product.

Table 2. presents the physico-chemical indicators and energy value of the functional meat-vegetable pâté.

| № | Indicator | Sample 1 | Sample 2 | Sample 3 | Sample 4 |
|---|---|---|---|---|---|
| 1 | Mass fraction of protein, %, | 14.5 | 15.3 | 15.7 | 16.7 |
| 2 | %, not less | 12.3 | 14.7 | 15.2 | 17.5 |
| 3 | Mass fraction of carbohydrates, %, not less | 1.35 | 1.47 | 1.55 | 1.65 |
| 4 | Mass fraction of sodium chloride (cooking salt), %, not more | 1.5 | 1.5 | 1.7 | 2.4 |
| 5 | Mass fraction of starch, %, not more | 2.0 | 3.7 | 5.0 | 5.0 |
| 6 | Calory content, kcal | 180.2 | 181.3 | 183.3 | 192.6 |

Based on the experimental results, it can be concluded that the samples containing flax and lentil flour offer greater protein content. The pâté made from duck meat and by-products adheres to food safety and microbiological regulations (Table 3). Levels of toxic elements such as lead and arsenic are 8-10 times below the maximum allowable concentration (MAC), and no traces of cadmium or mercury were detected in the samples.

Table 3. Food Safety Indicators of Meat-Vegetable Pâté for Functional Purposes

| № | Indicator, measuring unit | Amount | MAC |
|---|---|---|---|
| 1 | Toxic elements, mg/kg, not more | | |
| | Lead | 0.058 | 0.5 |
| | Arsenic | 0.0092 | 0.1 |
| | Cadmium | Not identified | 0.05 |
| | Mercury | Not identified | 0.03 |
| 2 | Antibiotics, not more than mg/kg | | |
| | Levomycetin | Not identified | Not allowed |
| | Tetracycline groups | Not identified | |
| 3 | Pesticides, mg/kg, not more | | |
| | Hexachlorocyclohexane (α, β, γ-isomers) | Not identified | 0.1 |
| | DDT (dichlorodiphenyltrichloromethylmethane) and its metabolites | Not identified | 0.1 |
| 4 | Radionuclides, Bq/kg, no excess | | |
| | Cesium-137 | 8.3 | 200 |
| | Mass fraction of sodium chloride (table salt), %, not more | 2.4 | - |

Microbiological indicators for the meat and vegetable pâté were assessed in accordance with the Technical Regulation by incorporating a protein-fat emulsion [16]. The microbiological indicators for the functionally oriented meat-vegetable pâté are presented in Table 4.

Table 4. Microbiological Indicators of Meat-Vegetable Pâté for Functional Purposes

| Indicator, measuring unit | Composition of pate prepared from duck meat and by-products | Accepted norms according to regulatory documents |
|---|---|---|
| Bacterial group of Escherichia coli (coliforms) | 1.2±0.2 | 1.0 |
| Pathogenic, including salmonella | 23.5 | 25.0 |
| Sulfite-reducing clostridia | 0.11 | 0.1 |
| S. aureus | 1.3 | 1.0 |
| L. monocytogenes | 27±0.2 | 25.0 |

***Conclusion***

The use of non-traditional raw materials in the production of meat-vegetable pâté enhances the potential to create balanced products that address deficiencies in essential nutrients (proteins, dietary fibers, vitamins, minerals, etc.). This approach contributes to achieving a high chemical composition, as well as improved nutritional and biological value. Additionally, incorporating non-traditional ingredients such as flax, lentils, and various meat by-products not only optimizes the utilization of meat raw materials but also enhances their nutritional properties, functional benefits, and organoleptic qualities.

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ҒТАМА 65.63.39 https://doi.org/10.48184/2304-568X-2024-4-156-163

# ҰЛТТЫҚ АҚУЫЗДЫ СҮТ ӨНІМІН ӨНДІРУДЕ ФУНКЦИОНАЛДЫҚ ҚОСПА РЕТІНДЕ ШЫРҒАНАҚ ЖЕМІСІН ПАЙДАЛАНУДЫҢ ТИІМДІЛІГІ

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***Мақалада шырғанақ өсімдігінің тағам өнеркәсібінде экологиялық таза, экономикалық тиімді ұлттық ақуызды сүтқышқылды функционалдық өнім жасауда қолдану жайлы жазылған. Функционалдық***