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**IMPROVEMENT OF RECIPE COMPOSITION AND TECHNOLOGICAL PROCESS OF PRODUCING VEGETABLE DISHES**

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**УДОСКОНАЛЕННЯ РЕЦЕПТУРНОГО СКЛАДУ ТА ТЕХНОЛОГІЧНОГО ПРОЦЕСУ ВИГОТОВЛЕННЯ ОВОЧЕВИХ СТРАВ**

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**ABSTRACT**

The article examines the peculiarities of the nutritional systems of different population groups, and gives a description of the chemical composition of fruits, vegetables, and mushrooms. The technological characteristics of vegetables, fruits and mushrooms are substantiated. Traditional methods of preparing vegetables and dishes made from them were examined, and a brief description of these methods was provided. To improve the cooking technology of vegetable dishes, the use of one of the innovative cooking methods, Sous-Vide, was proposed. The peculiarities of cooking food using the Sous-Vide method and its advantages compared to traditional cooking methods were indicated. The technology of preparing traditional vegetable stew, «Vegetable Stew» in an innovative way is presented, the calculation of technological parameters of improved dishes is given, and the organoleptic evaluation of the improved dish is analysed.

**The purpose of the article** is to study the improvement of the recipe composition and the technological process of the production of dishes from baked vegetables, fruits and mushrooms.

**Methodology.** Microbiological, physicochemical and organoleptic research methods.

**The scientific novelty** is that new technologies for the production of dishes from baked vegetables, fruits and mushrooms have been developed, the recipe composition and technological process for the production of dishes from baked vegetables, fruits and mushrooms have been researched.

**Conclusions:** dishes made from vegetables, fruits and mushrooms were developed, the technological process and recipes of well-known dishes were improved.

It has been established that substituting mushrooms for potatoes contribute to a decrease in the product's energy value, allowing it to be enriched with vitamins and minerals necessary for the proper growth and development of the human body. By enriching dishes with vegetable proteins, it is possible to improve the diet of people and prevent the development of diseases associated with the lack of certain essential substances in the human body.

**Key words:** mushrooms, nutritional and biological value, innovative cooking methods, Sous-Vide

**АНОТАЦІЯ**

У статті розглянуто особливості систем харчування різних верств населення, наведено характеристику хімічного складу плодів, овочів та грибів. Обґрунтовано технологічну характеристику овочів, плодів та грибів. Розглянуто традиційні способи приготування овочів та страв із них, наведено їх коротку характеристику. Для вдосконалення технології приготування страв із овочів було запропоновано використання одного із видів інноваційних способів приготування – Sous-Vide. Було вказано особливості приготування харчових продуктів способом Sous-Vide та його переваги у порівнянні з традиційними способами приготування. Наведено технології приготування традиційного овочевого рагу, «Овочевого рагу» інноваційним способом та розрахунок технологічних параметрів удосконалених страв, здійснено їх органолептичну оцінку.

**Мета статті** полягає в удосконаленні рецептурного складу та технологічного процесу виробництва страв із запечених овочів, плодів та грибів.

**Методологія.** Мікробіологічні, фізико-хімічні та органолептичні методи досліджень.

**Наукова новизна** полягає в тому, що розроблено нові технології виробництва страв із запечених овочів, плодів та грибів, досліджено рецептурний склад та технологічний процес виробництва страв із запечених овочів, плодів та грибів.

**Висновки:** було розроблено страви з овочів, плодів та грибів, удосконалено технологічний процес та рецептурний склад відомих страв.

Встановлено, що введення грибів замість картоплі сприяє зменшенню енергетичної цінності продукту, дозволяє збагатити його необхідними для повноцінного росту та розвитку організму людини вітамінами і мінеральними речовинами. За допомогою збагачення страв рослинними білками можна досягти покращення раціону харчування людей та запобігти розвитку захворювань, пов'язаних з нестачею певних незамінних речовин у організмі людини.

**Ключові слова:** гриби, харчова та біологічна цінність, інноваційні методи приготування, Sous-Vide

## Formulation of the problem

*The relevance of the work.* In connection with the deterioration of the ecological state, it is advisable to include various biologically active substances (BASs) or additives (BADs) of animal and plant origin in the composition of innovative developments in the food industry and restaurant industry, which bind and remove from the body radionuclides, toxins, residues of antimicrobial substances, products of protein, fat and carbohydrate metabolism.

Improper nutrition, especially in youth, can lead to weakened health, decreased immune system function, and reduced ability to cope with external factors. This can ultimately lead to the development of chronic illnesses in the digestive, respiratory, urinary, and other systems. Gastritis, colitis, cholecystitis, and peptic ulcer disease are not uncommon in young people as a result of this. In recent years, obesity has become an increasingly common problem among young people, which is associated with reduced physical activity and consumption of large amounts of food (Pavlotska et al., 2007). Obesity can lead to the development of functional cardiovascular and vascular diseases, liver pathologies, pathological changes in joints and spine, diabetes, and many other illnesses.

*Analysis of recent research and publications.* This problem was studied by such scientists as Kovrov «Rational Nutrition of Schoolchildren», Kaprelyants «Functional Products: Trends and Prospects», Novozhenov «Dietary Foods», Bogucheva «Food Preparation Technology», Dotsenko «Dietary Nutrition», Shidlovskaya «Organoleptic Properties of Vegetables, Fruits, and Mushrooms».

*The aim of the work* is to study the improvement of the recipe composition and technological process of producing dishes with baked vegetables, fruits, and mushrooms.

*Methodology.* The following products were used: Potato (DSTU 4506:2005), Carrot (DSTU 7035:2009), Onion (DSTU 3234-95), Fresh white cabbage (DSTU 7037:2009), Culinary fat (DSTU 4463:2005), Garlic (DSTU 8033:2015), Peppercorns (DSTU 959-1:2008), Bay leaf (DSTU 17594-81), Cream butter (DSTU 4399:2005), Mushrooms (DSTU 7786:2015).

*The scientific novelty* is that new technologies for the production of dishes from baked vegetables,

fruits and mushrooms have been developed, the recipe composition and technological process for the production of dishes from baked vegetables, fruits and mushrooms have been researched.

## Research results

The technological properties of vegetables manifest during the process of preparing them into semi-finished products, culinary products, and dishes, and are determined by their type, nutritional value, and tissue structure characteristics.

Cooking vegetables for different lengths of time affects their chemical composition. However, most vitamins and minerals transfer to the broth. Using a small amount of water to cook vegetables has also been found to be effective, but the vitamins also break down with this method. Frying vegetables preserves their juices thanks to the crispy coating, but this method can make the vegetables too high in calories.

Nowadays, in addition to traditional methods of preparing vegetables and dishes from them, such as frying, baking, stewing, and boiling, new methods of cooking have emerged, such as steaming, grilling, open-fire cooking, cooking in a microwave oven, and in a steam convection oven.

Certainly, these methods differ significantly from each other and have certain advantages compared to traditional ones - speed of dish preparation, more preserved nutrients.

Cooking vegetable dishes using a steam convection oven is becoming increasingly popular because they are not only cooked quickly, but also maintain their shape and have high sensory characteristics, while not losing vitamins, minerals, and other important nutrients. The steam mode ensures even cooking of vegetables, preserves their color and texture.

Not only whole potatoes and root vegetables can be cooked using steam ovens, but also sliced vegetables for salads, vinaigrettes, and side dishes. This excludes the possibility of

repeated microbiological contamination. For boiling, perforated GN1/1 containers with a height of 65 mm are used, and the optimal mode is steam cooking. The temperature mode is chosen depending on the type of vegetables. For vegetables with a delicate structure, a lower temperature is better (for example, 80 °C for asparagus), while for root vegetables, a higher temperature is preferable (110...130 °C).

To improve the technology of cooking vegetable dishes, one of the types of innovative cooking methods – Sous-Vide – was chosen, which is not inferior to the traditional method of cooking food with steam. This method is characterized by vacuum sealing the product and subjecting it to traditional thermal processing at a temperature below 100°C (Lobo, Patil et al., 2010). Vacuum sealing the product in a polyethylene bag prevents valuable nutrients from entering the broth through osmosis, unlike the conventional cooking method (Grzegorz Kosewski et al., 2018).

Sous vide cooking differs from traditional cooking methods in two main ways: raw products are vacuum-sealed in heat-resistant food-grade plastic bags, and the food is cooked using precisely controlled heating (Kathuria, 2022).

Vacuum sealing has several advantages: it allows for effective transfer of heat from water (or steam) to food (Onyeaka et al., 2022); increases the shelf life of food products, reducing the risk of recontamination during storage; it suppresses off-flavors from oxidation and prevents evaporation of volatile flavor and moisture during cooking (Church & Parsons, 2000); and reduces the growth of aerobic bacteria – leading to especially flavorful and nutritious food.

Precise temperature control has more advantages for chefs than vacuum sealing: it provides almost perfect reproducibility and allows for better control of food readiness than traditional cooking methods (Baldwin, 2012).

Despite the high cost of equipment, the Sous-Vide method has become widely used among restaurant industry professionals. Taking into account the above, it can be concluded that the Sous-Vide method is an optimal option for cooking vegetable dishes.

Potatoes are a fairly valuable product that contains a large amount of protein, starch, fats, and other nutrients. During long-term storage (up to a year), potatoes lose all their beneficial

properties and only starch remains. During 10 months of storage, solanine accumulates in potatoes – this is a toxin that can cause poisoning, and it is contained in the stem, leaves, and skin. A large amount of toxin is found in damaged potatoes, as well as in green areas.

Mushrooms, due to their unique chemical composition, are a popular and original food product. Their high protein content, the presence of free amino acids and extractive substances contribute to the use of mushrooms in the preparation of soups, as well as various sauces and side dishes. Consuming mushroom products is able to compensate for the deficiency of animal products in the diet, which is particularly relevant when following a vegetarian diet (Simahina, 2008). When comparing potatoes with mushrooms, one advantage is the content of about 20 types of amino acids, including essential ones. The substances contained in mushrooms can be considered as the building material of protein.

The lipid content in different strains of mushrooms ranges from 1.4 to 4.8 %. Scientific studies have shown that raw mushroom fat contains all classes of lipid components: free fatty acids, mono-, di-, and triglycerides, sterols, esters, and phospholipids. Palmitic, stearic, oleic, and linoleic acids constitute a larger portion of the fatty acids (Gnitsevych & Chekhova, 2017).

The content of carbohydrates in the fruiting bodies of mushrooms is significantly lower compared to nitrogenous compounds, which fundamentally distinguishes mushrooms from plants, where the opposite ratio is observed. Sugars such as glucose, fructose, trehalose, and lactose dominate among carbohydrates, while sugar alcohol such as mannitol and polysaccharides such as glycogen, cellulose, and chitin are also present.

Mushrooms contain B-group vitamins, which promote skin preservation and strengthen the nervous system. Mushrooms also contain iron, which promotes the absorption of B-group vitamins.

To justify the use of mushrooms in vegetable dishes technology, it is necessary to study the chemical composition, organoleptic, and structural-mechanical indicators of selected vegetables instead of potatoes.

A comparative description of the chemical composition of potatoes and mushrooms is given in Table 1.

Table 1

**Comparative characterization of the chemical composition  
of potatoes and mushrooms**

Name	Potato	Mushrooms (button mushrooms)
Proteins, g	2	4.5
Fats, g	0.4	0.1
Carbohydrates, g	16.3	3.5
Mineral substances, mg		
K	568	447
Ca	10	18
Mg	23	9
P	58	120
Fe	0.9	0.4
Vitamins, mg.		
Beta-carotene	0.02	0.01
B <sub>1</sub>	0.1	0.09
B <sub>2</sub>	0.07	0.49
PP	1.3	3.8
C	20	7

From the data in Table 1, it can be seen that mushrooms contain a higher amount of proteins and a lower amount of fats and carbohydrates compared to potatoes. Therefore, replacing potatoes with mushrooms in

vegetable dishes technology is reasonable. The organoleptic and structural-mechanical indicators of potatoes and mushrooms are presented in Table 2.

Table 2

**Organoleptic and structural-mechanical indicators  
of potatoes and mushrooms after heat treatment**

Indicator name	Potatoes	Mushrooms (button mushrooms)
Appearance	Round shape, with skin, clean and undamaged	White stem and cap, undamaged
Crispiness	Depends on the variety	Not present
Structural-mechanical properties	May become deformed when boiled	Elastic, maintain their shape well
Color	May change when cooked with other vegetables	White

It should be noted that button mushrooms are grown artificially and therefore do not contain harmful substances, including poisonous substances that can lead to fatal consequences.

Therefore, by comparing the chemical composition, organoleptic and structural-mechanical indicators of potatoes and mushrooms, it is possible to determine their increased nutritional and biological value, as well as improved indicators after heat treatment of mushroom raw materials. Mushrooms contain sufficient amounts of protein, making them a recommended food for people who follow a vegetarian diet.

The recipe «Vegetable stew with potatoes» was chosen as a prototype, which includes: potatoes, carrots, onions, white cabbage, cream butter, cooking fat, and spices (Dotsiak, 1998). The modification of the dish involves replacing potatoes with mushroom raw materials (button mushrooms) and using an innovative cooking method - Sous vide, as opposed to the one indicated in the prototype (simmering and stewing).

The comparative characteristics of the technological maps of the prototype dish «Vegetable stew with potatoes» and the developed dish «Vegetable stew with mushrooms» are presented in Table 3.

Table 3

The comparative characteristics of the technological maps of the prototype dish «Vegetable stew with potatoes»

No.	Types of ingredients	Control		Types of ingredients	Sample	
		Per 1 serving, g			Per 1 serving, g	
		Gross	Net		Gross	Net
1	Mushrooms (button mushrooms)	-	-	Mushrooms (button mushrooms)	125	50
2	Potatoes	67	50	Potatoes	-	-
3	Carrots	40	27	Carrots	40	27
4	Onion (bulb onion)	30	15	Onion (bulb onion)	30	15
5	Fresh white cabbage	30	27	Fresh white cabbage	30	27
6	Cooking fat	10	10	Cooking fat	10	10
7	Garlic	1	0,8	Garlic	1	0,8
8	Peppercorns	0.05	0.05	Peppercorns	0.05	0.05
9	Bay leaf	0.02	0.02	Bay leaf	0.02	0.02
10	Butter	5	5	Butter	5	5
11	Sauce No. 863	-	75	Sauce No. 863	-	75
12	Weight of ragout	-	100	Weight of ragout	-	100
Yield		-	180	Yield	-	180

The cooking technology for the developed dish «Vegetable stew with mushrooms» involves the following technological operations: mechanical culinary processing; cutting; vacuuming (mushrooms, roots, cabbage); cooking using the Sous vide method at a temperature of 85 °C for 45 minutes; sautéing the onion; mixing all vegetable components; baking in a convection oven (to form a crust) at a temperature of 165...170 °C for 3...5 minutes; preparation for sale and serving of the finished dish.

The technological scheme for preparing the developed dish «Vegetable stew with mushrooms» is shown in Figure 1.

To justify the feasibility of replacing the vegetable raw materials and cooking method, an organoleptic evaluation of the prototype dish and the developed dish was conducted. The results of the sensory evaluation are presented in the form of a diagram (Figure 2).

From the presented sensory profile, it can be seen that the developed dish has higher sensory characteristics than the prototype dish.

Based on the developed technological cards, the nutritional and biological value of the dishes was calculated (Table 4).

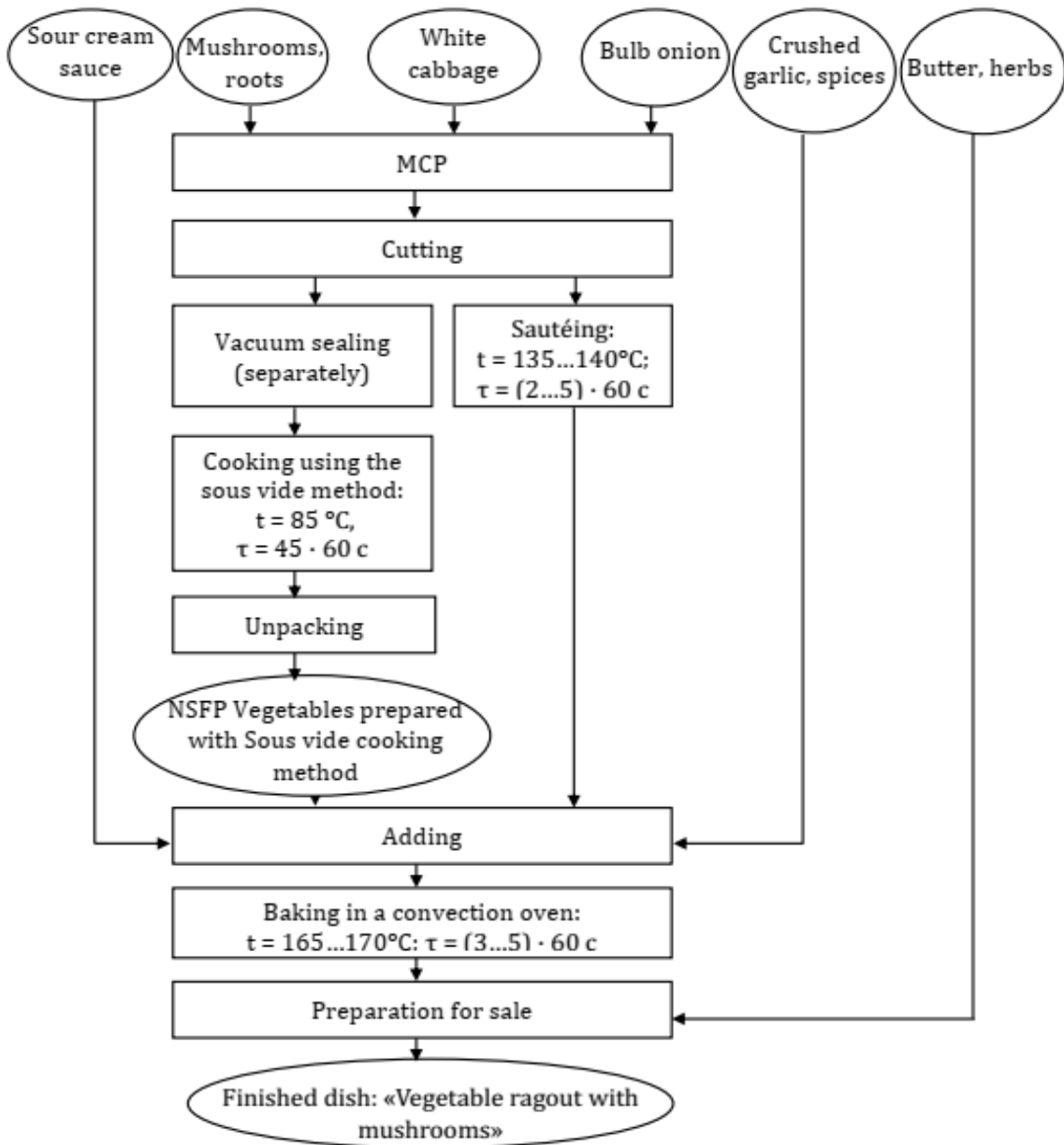


Fig. 1. Technological scheme for preparing the developed dish «Vegetable ragout with mushrooms»

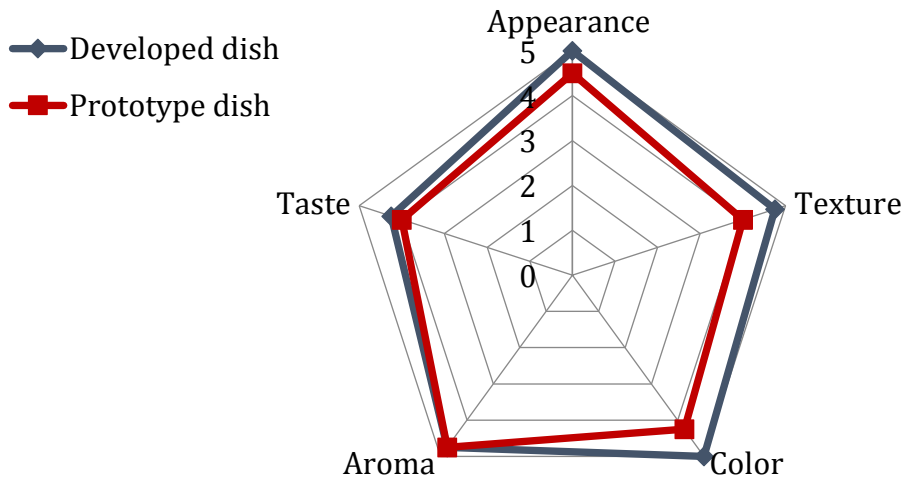


Fig. 2. Organoleptic profile of the prototype dish and the developed dish

Table 4

**Nutritional and biological value  
of the prototype dish and the developed dish per 100 g**

Indicator	Daily requirement	Comparing two dishes			
		Vegetable ragout with stewed potatoes		Vegetable ragout with Sous vide mushrooms	
		Content per 100 g of product	Integral score, %	Content per 100 g of product	Integral score, %
Proteins, g	55	1.9	11.6	4.3	16.1
Fats, g	56	4.5	10.5	3.5	6.2
Carbohydrates, g	320	10.6	5.1	8	2.5
including non-starch polysaccharides, g	20	6.5	32.5	7	35
Caloric value, kcal	2450	292.1	11.9	265.1	10.8
Vitamins, mg					
E	15	1.2	8	1.5	10
B <sub>1</sub>	1.4	0.05	3.5	0.08	5.7
B <sub>2</sub>	1.6	0.05	3.1	0.08	5
C	80	8	10	8.5	10.6
Mineral substances, mg					
Iron	15	0.8	5.3	1	6.6
Potassium	2000	306	15.3	450	22.5
Calcium	1000	38	3.8	91	9.1
Silicon	25	6.2	24.8	7.1	28.4
Magnesium	400	27	6.75	30	7.5
Manganese	3	0.282	9.4	0.421	14
Copper	1	0.154	15.4	0.212	21.2
Phosphorus	800	65	8.1	83	10.3
Zinc	12	0.64	5.3	0.75	6.25

The developed dish is characterized by a high content of vitamin E (1.5 mg/100g in the experimental samples).

All samples of the developed dish have a significant content of minerals, namely potassium (450 mg/100 g in the samples), silicon (7.1 mg/100 g), and copper (0.212 mg/100 g). Consuming this dish provides an average of

22.5% of the daily requirement for potassium, 28.4 % for silicon, and 21.2 % for copper.

The quality and safety of the dish were checked according to the standard DSP 4.4.5.078-2001, and moreover, artificially grown mushrooms, which are safe for consumption, were used in the preparation.

From the information presented above, it can be stated that the developed dish «Vegetable ragout with mushrooms» prepared by the Sous vide method retains its structural and mechanical properties (preserved slice shape), as well as has lower calorie content and increased content of micro- and macronutrients. As a result, we have a more balanced vegetable dish that is made in accordance with quality requirements and approved standards.

### Conclusions

In this work, dishes made from vegetables, fruits, and mushrooms were developed, and the technological process and recipe of known dishes were improved.

Introducing mushrooms instead of potatoes contributes to a reduction in the

energy value of the product, allowing it to be enriched with vitamins and minerals essential for the proper growth and development of the human body. By enriching dishes with plant proteins, it is possible to improve people's diets and prevent the development of diseases associated with a lack of certain essential nutrients in the human body.

Based on the results of sensory evaluation, it can be concluded that the addition of mushrooms improved the taste, aroma, texture, and color of the dishes.

As a result of this work, it was determined that enriching dishes with vegetables, fruits, and mushrooms is a promising approach as they can retain beneficial nutrients. This can help normalize the population's diet and expand the variety of dishes.

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