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**ANALYSIS OF THE EFFICIENCY OF  
USING THE CULINARY PROCESSING  
OF MUSHROOMS IN ORDER TO  
REDUCE THE CONCENTRATION OF  
HEAVY METALS IN THEM**

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*The samples of mushrooms were collected in the forestry of the village Tyvriv and the town of Kalynivka, Vinnytsia and Kalynivka districts, in the conditions of Right-Bank Forest-Steppe of Ukraine. The studies of heavy metals concentration were performed in the scientific agrochemical laboratory of the Department of Ecology and Environmental Protection, the Faculty of Agronomy and Forestry at Vinnytsia National Agrarian University. The concentrations of Cu, Zn, Pb and Cd of the studied mushrooms were determined by the method of atomic absorption spectrometry after the dry mineralization. The research of the effect of culinary processing on the concentration of heavy metals in mushrooms were conducted according to the following scheme: 1. The control: mushrooms, cleaned and washed with tap water; 2. Option 1: mushrooms soaked in tap water for 3 hours and boiled in it; 3. Option 2: mushrooms soaked in the water without mineral residue for 3 hours and boiled in it; 4. Option 3: mushrooms soaked in distilled water for 3 hours and boiled in it.*

*Summarizing the obtained results, it should be noted that the most effective way to reduce the concentration of lead and cadmium in mushrooms was the option of soaking and boiling mushrooms in the water without mineral residue. The most effective way to reduce the concentration of zinc and copper was Option 3, where distilled water was used. The influence of soaking and boiling mushrooms in different types of water is investigated. When soaking and boiling mushrooms in tap water for 3 hours, the concentration of zinc in them was found to decrease from 1.01 to 1.04 times, the concentration of copper – from 1.0 to 1.2 times, the concentration of lead – from 1.09 to 1.16 times and the concentration of cadmium – from 1.08 to 1.2 times. When soaking and boiling mushrooms in the water without mineral residue, the concentration of zinc decreased from 1.01 to 1.04 times, the concentration of copper – from 1.16 to 1.25 times, the concentration of lead – from 1.8 to 2.0 times and the concentration of cadmium – from 1.75 to 2.0 times. When soaking mushrooms and boiling them in distilled water, the concentration of zinc decreased from 1.13 to 1.18 times, the concentration of copper – from 1.2 to 1.29 times, the concentration of lead – from 1.22 to 1.28 times and the concentration of cadmium – from 1.08 to 1.2 times.*

**Key words:** mushrooms, concentration, zinc, copper, lead, cadmium, distilled water, water without mineral residue, tap water, boiling of mushrooms.

**Tabl. 4. Fig. 4. Lit. 9.**

**Setting the problem.** Mushrooms have always been considered a valuable food product, and mushroom dishes are a favorite food of many peoples. This is not accidental, since they contain many organic and mineral compounds, similar in chemical composition to vegetables and products of animal origin [1, 2]. It is known that fresh mushrooms contain: 84-94% of water, 2-6% of nitrogenous substances (80% of which are proteins), 1-3% of carbohydrates, 0.2-6.0% of fats, 0.6-1.0% of minerals, as well as vitamins A, B1, B2, C, D, PP [3-4].

The high content of chitin forms complexes with proteins, pigments and calcium salts. It differs significantly from vegetable fiber – cellulose and prevents the complete absorption of mushroom dishes during digestion. In the dry matter of mushrooms there are many proteins [5], the content of which often exceeds 40%, that is, it is higher than in the seeds of peas and beans. The digestibility of fungal proteins is 54-85%, that is, approximately the same as that of vegetable ones. The carbohydrate content in the dry matter of mushrooms can reach 70% and they are absorbed by 93-99%. Such carbohydrates as Glycogen (animal starch), Trehalose, Glucose, Mycosis and Mannitol are dominated in mushrooms. These substances cause a pleasant sweet taste of mushrooms. Many species are characterized by the high content of carbohydrates in the dry matter. They are still little used, but they are widespread and suitable for saulting, in particular *Russula Pers. (Lat.)* and *Lactarius resimus (Lat.)*. [7] Fatty substances of mushrooms (phosphatides, cholesterol and ergosterol) are absorbed by 92-97%, and their content in the fruiting bodies is greater than in potatoes or other vegetables. In the fruiting bodies there are also extractive substances, carotene, pantothenic acid, enzymes and antibiotic substances, in addition to various mineral substances, in the content of which mushrooms are close to fruit [8-9].

The forestry products of vegetable origin, namely their harvesting is of great importance for the enterprises of the forest industry, providing people with food of high value. In particular, mushrooms and berries sometimes supplement people's diets, but there are also occasions when they serve staple foods, even on a par with bread, meat and vegetables.

Wild berries and edible mushrooms are mostly used for consumption without special processing. That is why the sanitary and hygienic quality of non-timber raw materials is a significant factor affecting its safety [5]. However, the content of heavy metals in the phytomass of representatives of Ukraine's wild flora, suitable for using as non-timber raw materials, has not been sufficiently studied. The bulk of the research is devoted to the characteristics of migration and accumulation of heavy metals in crops, while wild species remain outside the focus of scientists. Because of the intensification of technogenic and anthropogenic pressure on ecosystems, the number of areas suitable for the collection of environmentally friendly non-timber raw materials is sharply reduced.

The consumption of non-timber forest resources containing heavy metals can lead to adverse effects occurring in the human body. Therefore, the topic of finding ways to reduce the content of these substances in forestry products is very relevant.

**Analysis of recent researches and publications.** The studies on the bioaccumulation of heavy metals in various types of phytocenoses are of considerable interest, since plants and mushrooms, as an autotrophic block of ecosystems, play an important role in the redistribution of chemical elements between individual components of the biosphere. The forest landscapes, as dominant geochemical regulators of cyclic mass flows of heavy metals at the global level, are of particular importance in this process [10-11].

The excessive concentrations of heavy metals in the environment, far exceeding the natural ones, can greatly affect the functioning of plants and mushrooms, reduce the biotic productivity of forests, impair their recreational potential and alter the quality of wood, which may affect its environmental safety. In the complex of researches on the biotic productivity, the study of the role of timber and non-timber forest resources in the biogeocenoses in relation to the migration and deposition of elements of the heavy metals group, especially in the area of technogenic loading, is an urgent and timely task. Its solution will allow finding the mechanisms of selective ability of forest species to absorb and accumulate heavy metals in tissues, and to remove them from circulation for a long time. The excessive concentrations of heavy metals can influence the course of physiological processes to some extent that is reflected in the change of the integral indicator of forest plants – phytomass. According to the literature, timber and non-timber forest resources respond to the environmental pollution by reducing their biotic productivity [12]. Therefore, the need to monitor the pollution of non-timber forest resources by heavy metals and to study the ways to improve their quality remains relevant.

**Research methodology and conditions.** The samples of mushrooms were collected in the forestry of the village Tyvriv and the town of Kalynivka, Vinnytsia and Kalynivka districts, in the conditions of Right-Bank Forest-Steppe of Ukraine. The studies of heavy metals concentration were performed in the scientific agrochemical laboratory of the Department of Ecology and Environmental Protection, the Faculty of Agronomy and Forestry at Vinnytsia National Agrarian University. The concentrations of Cu, Zn, Pb and Cd of the studied mushrooms were determined by the method of atomic absorption spectrometry after the dry mineralization [13, 14]. The research of the effect of culinary processing on the concentration of heavy metals in mushrooms were conducted according to the following scheme: 1. The control: mushrooms, cleaned and washed with tap water; 2. Option 1: mushrooms soaked in tap water for 3 hours and boiled in it; 3. Option 2: mushrooms soaked in the water without mineral residue for 3 hours and boiled in it; 4. Option 3: mushrooms soaked in distilled water for 3 hours and boiled in it.

**The purpose of the article** is to study the efficiency of using the methods of culinary processing of mushrooms in order to reduce the content of heavy metals in them.

**Presenting the main material.** The obtained results of the research showed a certain influence of soaking and boiling mushrooms in different types of water on the concentration of heavy metals in them (Table 1-4).

Table 1

**Zinc concentration in mushrooms, mg/kg**

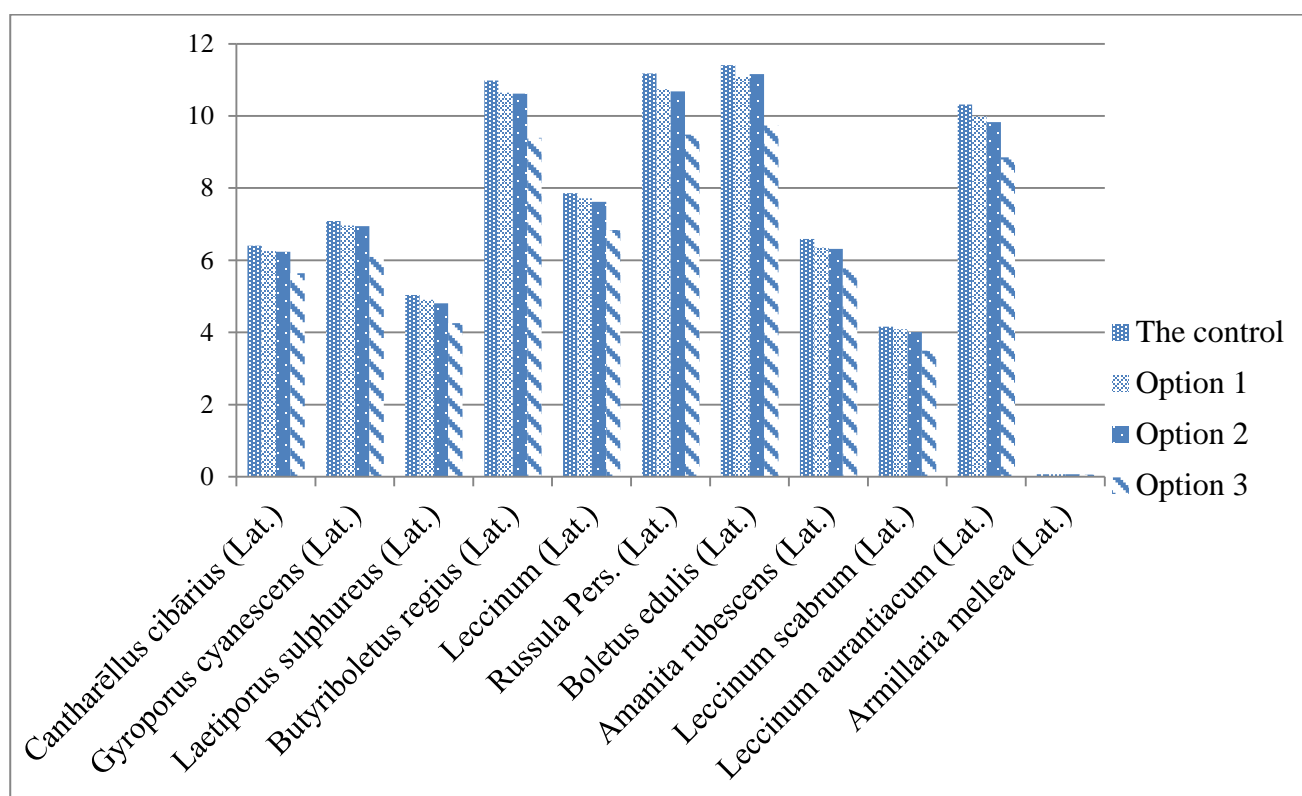
Kind of mushrooms	MPC	The control	Option 1	Option 2	Option 3
<i>Cantharëllus cibãrius (Lat.)</i>	20	6.41	6.26	6.24	5.64
<i>Gyroporus cyanescens (Lat.)</i>	20	7.09	6.97	6.95	6.1
<i>Laetiporus sulphureus (Lat.)</i>	20	5.04	4.91	4.81	4.26
<i>Butyriboletus regius (Lat.)</i>	20	10.99	10.65	10.62	9.4
<i>Leccinum (Lat.)</i>	20	7.86	7.72	7.62	6.84
<i>Russula Pers. (Lat.)</i>	20	11.18	10.75	10.68	9.49
<i>Boletus edulis (Lat.)</i>	20	11.41	11.08	11.16	9.74
<i>Amanita rubescens (Lat.)</i>	20	6.59	6.35	6.32	5.78
<i>Leccinum scabrum (Lat.)</i>	20	4.16	4.09	4.01	3.5
<i>Leccinum aurantiacum (Lat.)</i>	20	10.32	9.99	9.83	8.86
<i>Armillaria mellea (Lat.)</i>	20	0.074	0.073	0.073	0.064

The source is based on our own research findings

In Option 1 (Table 1) the concentration of zinc in mushrooms decreased from 1.01 to 1.04 times, in particular, in *Cantharëllus cibãrius (Lat.)* – by 1.02 times, in *Gyroporus cyanescens (Lat.)* – by 1.01 times, in *Laetiporus sulphureus (Lat.)* – by 1.02 times, in *Butyriboletus regius (Lat.)* – by 1.03 times, in *Leccinum (Lat.)* – by 1.01 times, in *Russula Pers. (Lat.)* – by 1.04 times, in *Boletus edulis (Lat.)* – by 1.02 times, in *Amanita rubescens (Lat.)* – by 1.03 times, in *Leccinum scabrum (Lat.)* – by 1.01 times, in *Leccinum aurantiacum (Lat.)* – by 1.03 times and in *Armillaria mellea (Lat.)* – by 1.01 times.

In Option 2 the concentration of zinc in the mushrooms decreased from 1.01 to 1.04 times, in particular, in *Cantharëllus cibãrius (Lat.)* and *Gyroporus cyanescens (Lat.)* – by 1.02 times, in *Laetiporus sulphureus (Lat.)* – by 1.04 times, in *Butyriboletus regius (Lat.)* and *Leccinum (Lat.)* – by 1.03 times, in *Russula Pers. (Lat.)* – by 1.04 times, in *Boletus edulis (Lat.)* – by 1.02 times, in *Amanita rubescens (Lat.)* – by 1.04 times, in *Leccinum scabrum (Lat.)* – by 1.03 times, in *Leccinum aurantiacum (Lat.)* – by 1.04 times and in *Armillaria mellea (Lat.)* – by 1.01 times.

In Option 3 the concentration of zinc in mushrooms decreased from 1.13 to 1.18 times, in particular, in *Cantharëllus cibãrius (Lat.)* – by 1.13 times, in *Gyroporus cyanescens (Lat.)* – by 1.16 times, in *Laetiporus sulphureus (Lat.)* – by 1.18 times, in *Butyriboletus regius (Lat.)* – by 1.16 times, in *Leccinum (Lat.)* – by 1.14 times, in *Russula Pers. (Lat.)* and *Boletus edulis (Lat.)* – by 1.17 times, in *Amanita rubescens (Lat.)* – by 1.14 times, in *Leccinum scabrum (Lat.)* – by 1.18 times, in *Leccinum aurantiacum (Lat.)* – by 1.16 times and in *Armillaria mellea (Lat.)* – by 1.15 times (Fig. 1).



**Fig. 1 Concentration of zinc in mushrooms**

The source is based on our own research findings

In Option 1 (Table 2) the concentration of copper in mushrooms decreased from 1.0 to 1.2 times, in particular, in *Cantharēllus cibārius* (Lat.) – by 1.03 times,

Table 2

**Copper concentration in mushrooms, mg/kg**

Kind of mushrooms	MPC	The control	Option 1	Option 2	Option 3
<i>Cantharēllus cibārius</i> (Lat.)	10	0.32	0.31	0.26	0.25
<i>Gyroporus cyanescens</i> (Lat.)	10	0.63	0.62	0.51	0.49
<i>Laetiporus sulphureus</i> (Lat.)	10	0.06	0.05	0.05	0.05
<i>Butyriboletus regius</i> (Lat.)	10	0.18	0.17	0.15	0.14
<i>Leccinum</i> (Lat.)	10	0.25	0.24	0.2	0.2
<i>Russula Pers.</i> (Lat.)	10	0.64	0.62	0.51	0.51
<i>Boletus edulis</i> (Lat.)	10	0.26	0.25	0.21	0.21
<i>Amanita rubescens</i> (Lat.)	10	0.16	0.15	0.13	0.13
<i>Leccinum scabrum</i> (Lat.)	10	0.70	0.68	0.57	0.55
<i>Leccinum aurantiacum</i> (Lat.)	10	0.14	0.13	0.12	0.11
<i>Armillaria mellea</i> (Lat.)	10	2.80	2.72	2.25	2.17

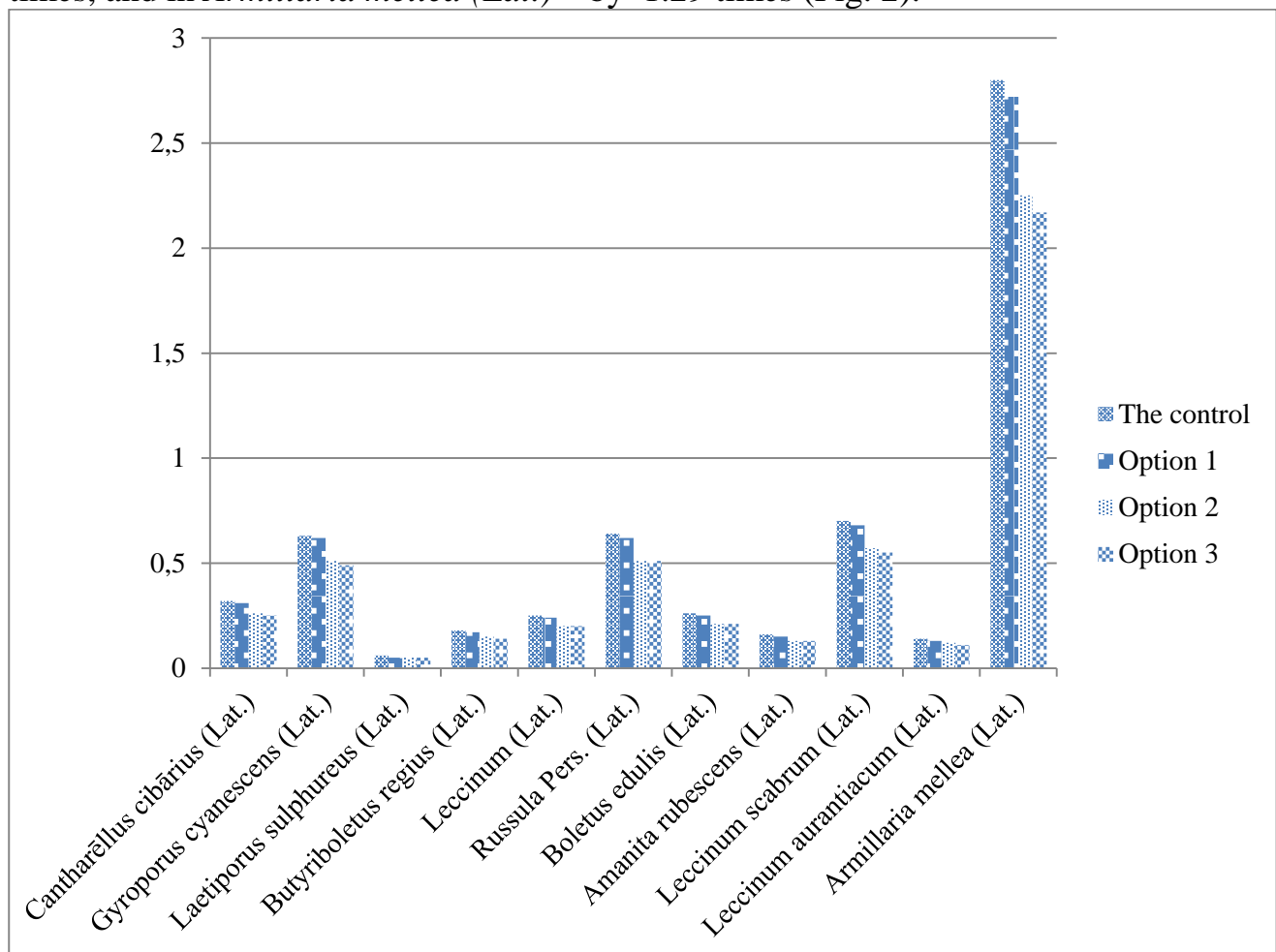
The source is based on our own research findings

in *Gyroporus cyanescens* (Lat.) – by 1.01 times, in *Laetiporus sulphureus* (Lat.) – by 1.2 times, in *Butyriboletus regius* (Lat.) – by 1.05 times, in *Leccinum* (Lat.) – by 1.04 times, in *Russula Pers.* (Lat.) – by 1.0 times, in *Boletus edulis* (Lat.) – by 1.04 times, in *Amanita rubescens* (Lat.) – by 1.06 times, in *Leccinum scabrum* (Lat.) – by 1.02

times, in *Leccinum aurantiacum* (Lat.) – by 1.07 times and in *Armillaria mellea* (Lat.) – by 1.02 times.

In Option 2 the concentration of copper in mushrooms decreased from 1.16 to 1.25 times, in particular, in *Cantharēllus cibārius* (Lat.) and *Gyroporus cyanescens* (Lat.) – by 1.23 times, in *Laetiporus sulphureus* (Lat.) and *Butyriboletus regius* (Lat.) – by 1.2 times, in *Leccinum* (Lat.) and *Russula Pers.* (Lat.) – by 1.25 times, in *Boletus edulis* (Lat.) and *Amanita rubescens* (Lat.) – by 1.23 times, in *Leccinum scabrum* (Lat.) – by 1.22 times, in *Leccinum aurantiacum* (Lat.) – by 1.16 times and in *Armillaria mellea* (Lat.) – by 1.24 times.

In Option 3 the concentration of copper in mushrooms decreased from 1.2 to 1.29 times, in particular, in *Cantharēllus cibārius* (Lat.) and *Gyroporus cyanescens* (Lat.) – by 1.28 times, in *Laetiporus sulphureus* (Lat.) – by 1.2 times, in *Butyriboletus regius* (Lat.) – by 1.28 times, in *Leccinum* (Lat.) and *Russula Pers.* (Lat.) – by 1.25 times, in *Boletus edulis* (Lat.) and *Amanita rubescens* (Lat.) – by 1.23 times, in *Leccinum scabrum* (Lat.) and *Leccinum aurantiacum* (Lat.) – by 1.27 times, and in *Armillaria mellea* (Lat.) – by 1.29 times (Fig. 2).



**Fig. 2. Concentration of copper in mushrooms**

The source is based on our own research findings

Table 3

**Lead concentration in mushrooms, mg/kg**

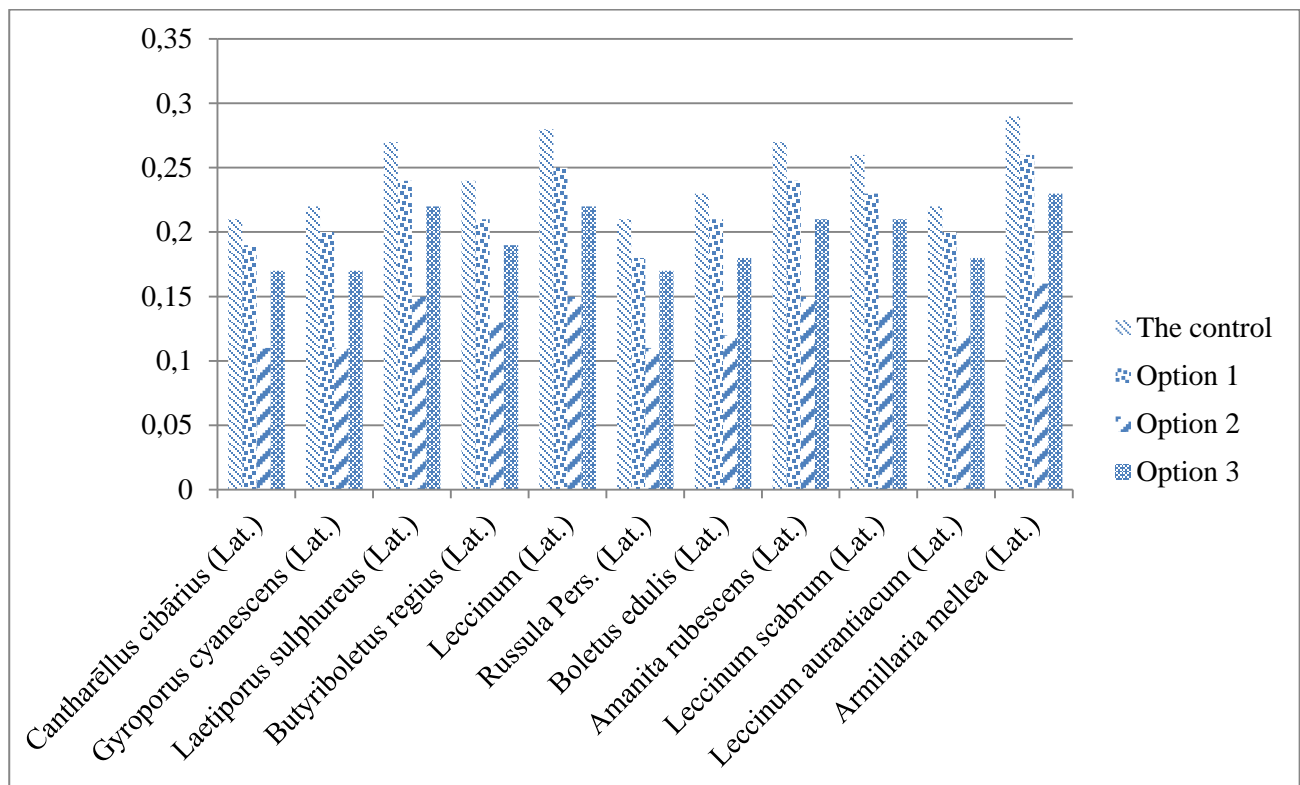
Kind of mushrooms	MPC	The control	Option 1	Option 2	Option 3
<i>Cantharëllus cibãrius (Lat.)</i>	0.5	0.21	0.19	0.11	0.17
<i>Gyroporus cyanescens (Lat.)</i>	0.5	0.22	0.20	0.11	0.17
<i>Laetiporus sulphureus (Lat.)</i>	0.5	0.27	0.24	0.15	0.22
<i>Butyriboletus regius (Lat.)</i>	0.5	0.24	0.21	0.13.	0.19
<i>Leccinum (Lat.)</i>	0.5	0.28	0.25	0.15	0.22
<i>Russula Pers. (Lat.)</i>	0.5	0.21	0.18	0.11	0.17
<i>Boletus edulis (Lat.)</i>	0.5	0.23	0.21	0.12	0.18
<i>Amanita rubescens (Lat.)</i>	0.5	0.27	0.24	0.15	0.21
<i>Leccinum scabrum (Lat.)</i>	0.5	0.26	0.23	0.14	0.21
<i>Leccinum aurantiacum (Lat.)</i>	0.5	0.22	0.20	0.12	0.18
<i>Armillaria mellea (Lat.)</i>	0.5	0.29	0.26	0.16	0.23

The source is based on our own research findings

In Option 1 (Table 3) the concentration of lead in mushrooms decreased from 1.09 to 1.16 times, in particular, in *Cantharëllus cibãrius (Lat.)* – by 1.1 times, in *Gyroporus cyanescens (Lat.)* – by 1.1 times, in *Laetiporus sulphureus (Lat.)* – by 1.12 times, in *Butyriboletus regius (Lat.)* – by 1.14 times, in *Leccinum (Lat.)* – by 1.12 times, in *Russula Pers. (Lat.)* – by 1.16 times, in *Boletus edulis (Lat.)* – by 1.09 times, in *Amanita rubescens (Lat.)* – by 1.12 times, in *Leccinum scabrum (Lat.)* – by 1.13 times, in *Leccinum aurantiacum (Lat.)* – by 1.1 times and in *Armillaria mellea (Lat.)* – by 1.11 times.

In Option 2 the concentration of lead in mushrooms decreased from 1.8 to 2.0 times, in particular, in *Cantharëllus cibãrius (Lat.)* – by 1.9 times, in *Gyroporus cyanescens (Lat.)* – by 2.0 times, in *Laetiporus sulphureus (Lat.)* – by 1.8 times, in *Butyriboletus regius (Lat.)* – by 1.84 times, in *Leccinum (Lat.)* – by 1.86 times, in *Russula Pers. (Lat.)* – by 1.9 times, in *Boletus edulis (Lat.)* – by 1.91 times, in *Amanita rubescens (Lat.)* – by 1.8 times, in *Leccinum scabrum (Lat.)* – by 1.85 times, in *Leccinum aurantiacum (Lat.)* – by 1.83 times and in *Armillaria mellea (Lat.)* – by 1.81 times.

In Option 3 the concentration of lead in mushrooms decreased from 1.22 to 1.28 times, in particular, in *Cantharëllus cibãrius (Lat.)* – by 1.23 times, in *Gyroporus cyanescens (Lat.)* – by 1.29 times, in *Laetiporus sulphureus (Lat.)* – by 1.22 times, in *Butyriboletus regius (Lat.)* – by 1.26 times, in *Leccinum (Lat.)* – by 1.27 times, in *Russula Pers. (Lat.)* – by 1.23 times, in *Boletus edulis (Lat.)* – by 1.27 times, in *Amanita rubescens (Lat.)* – by 1.28 times, in *Leccinum scabrum (Lat.)* – by 1.23 times, in *Leccinum aurantiacum (Lat.)* – by 1.22 times and in *Armillaria mellea (Lat.)* – by 1.26 times (Fig. 3).



**Fig. 3. Concentration of lead in mushrooms**

The source is based on our own research findings

In Option 1 (Table 4) the concentration of cadmium in mushrooms decreased from 1.08 to 1.2 times, in particular, in *Cantharēllus cibārius* (Lat.) – by 1.2 times, in *Gyroporus cyanescens* (Lat.) – by 1.14 times, in *Laetiporus sulphureus* (Lat.) – 1.15 times, in *Butyriboletus regius* (Lat.) – by 1.16 times, in *Leccinum* (Lat.) – by 1.13

Table 4

**Cadmium concentration in mushrooms, mg/kg**

Kind of mushrooms	MPC	The control	Option 1	Option 2	Option 3
<i>Cantharēllus cibārius</i> (Lat.)	0.1	0.06	0.05	0.03	0.04
<i>Gyroporus cyanescens</i> (Lat.)	0.1	0.16	0.14	0.09	0.12
<i>Laetiporus sulphureus</i> (Lat.)	0.1	0.15	0.13	0.08	0.12
<i>Butyriboletus regius</i> (Lat.)	0.1	0.14	0.12	0.07	0.11
<i>Leccinum</i> (Lat.)	0.1	0.17	0.15	0.09	0.13
<i>Russula Pers.</i> (Lat.)	0.1	0.65	0.59	0.37	0.53
<i>Boletus edulis</i> (Lat.)	0.1	0.17	0.15	0.09	0.14
<i>Amanita rubescens</i> (Lat.)	0.1	0.15	0.13	0.08	0.12
<i>Leccinum scabrum</i> (Lat.)	0.1	0.17	0.15	0.09	0.14
<i>Leccinum aurantiacum</i> (Lat.)	0.1	0.13	0.12	0.07	0.10
<i>Armillaria mellea</i> (Lat.)	0.1	0.17	0.15	0.09	0.13

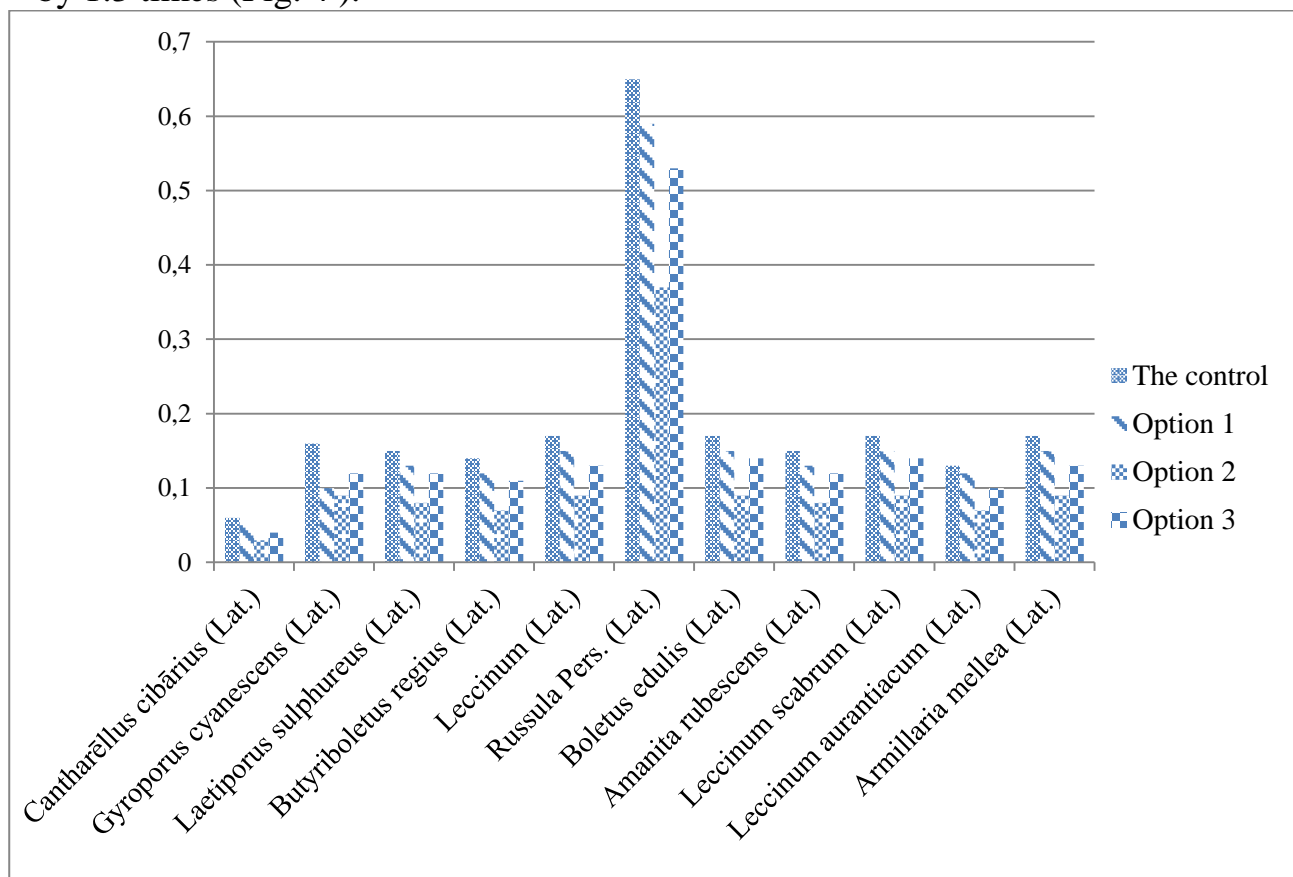
The source is based on our own research findings



times, in *Russula Pers. (Lat.)* – by 1.1 times, in *Boletus edulis (Lat.)* – by 1.13 times, in *Amanita rubescens (Lat.)* – by 1.15 times, in *Leccinum scabrum (Lat.)* – by 1.13 times, in *Leccinum aurantiacum (Lat.)* – by 1.08 times and in *Armillaria mellea (Lat.)* – by 1.13 times.

In Option 2 the concentration of cadmium in mushrooms decreased from 1.75 to 2.0 times, in particular, in *Cantharēllus cibārius (Lat.)* – by 2.0 times, in *Gyroporus cyanescens (Lat.)* – by 1.77 times, in *Laetiporus sulphureus (Lat.)* – by 1.87 times, in *Butyriboletus regius (Lat.)* – by 2.0 times, in *Leccinum (Lat.)* – by 1.88 times, in *Russula Pers. (Lat.)* – by 1.75 times, in *Boletus edulis (Lat.)* – by 1.88 times, in *Amanita rubescens (Lat.)* – by 1.87 times, in *Leccinum scabrum (Lat.)* – by 1.88 times, in *Leccinum aurantiacum (Lat.)* – by 1.85 times and in *Armillaria mellea (Lat.)* – by 1.88 times.

In Option 3 the concentration of cadmium in mushrooms decreased from 1.21 to 1.5 times, in particular, in *Cantharēllus cibārius (Lat.)* – by 1.5 times, in *Gyroporus cyanescens (Lat.)* – by 1.33 times, in *Laetiporus sulphureus (Lat.)* – by 1.25 times, in *Butyriboletus regius (Lat.)* – by 1.27 times, in *Leccinum (Lat.)* – by 1.3 times, in *Russula Pers. (Lat.)* – by 1.22 times, in *Boletus edulis (Lat.)* – by 1.21 times, in *Amanita rubescens (Lat.)* – by 1.25 times, in *Leccinum scabrum (Lat.)* – by 1.21 times, in *Leccinum aurantiacum (Lat.)* – by 1.3 times and in *Armillaria mellea (Lat.)* – by 1.3 times (Fig. 4).



**Fig. 4. Concentration of cadmium in mushrooms**  
The source is based on our own research findings

**Conclusions and prospects for further research.** Summarizing the obtained results, it should be noted that the most effective way to reduce the concentration of lead and cadmium in mushrooms was the option of soaking and boiling mushrooms in the water without mineral residue. The most effective way to reduce the concentration of zinc and copper was Option 3, where distilled water was used. Thus, the concentration of zinc in mushrooms decreased from 1.01 to 1.04 times, the concentration of copper – from 1.0 to 1.2 times, the concentration of lead – from 1.09 to 1.16 times and the concentration of cadmium – from 1.08 to 1.2 times, when soaking and boiling them in tap water for 3 hours. When soaking and boiling mushrooms in the water without mineral residue, the concentration of zinc decreased from 1.01 to 1.04 times, the concentration of copper – from 1.16 to 1.25 times, the concentration of lead – from 1.8 to 2.0 times and the concentration of cadmium – from 1.75 to 2.0 times. When soaking mushrooms and boiling them in distilled water, the concentration of zinc decreased from 1.13 to 1.18 times, the concentration of copper – from 1.2 to 1.29 times, the concentration of lead – from 1.22 to 1.28 times and the concentration of cadmium – from 1.08 to 1.2 times.

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#### **АНОТАЦІЯ**

#### **АНАЛІЗ ЕФЕКТИВНОСТІ ЗАСТОСУВАННЯ КУЛІНАРНОЇ ОБРОБКИ ГРИБІВ ДЛЯ ЗМЕНШЕННЯ В НИХ КОНЦЕНТРАЦІЇ ВАЖКИХ МЕТАЛІВ**

Досліджено вплив вимочування та переварювання грибів у різних видах води. Встановлено, що у грибах концентрація цинку, міді, свинцю та кадмію знизилась від 1,01 до 1,04 рази; від 1,0 до 1,2 рази; від 1,09 до 1,16 рази; від 1,08 до 1,2 рази відповідно при вимочуванні та переварюванні їх у водопровідній воді впродовж 3-х годин. При вимочуванні та переварюванні грибів у воді без мінерального залишку концентрація цинку, міді, свинцю та кадмію знизилась від 1,01 до 1,04 рази; від 1,16 до 1,25 рази; від 1,8 до 2,0 рази; від 1,75 до 2,0 рази відповідно. При вимочуванні грибів та переварюванні їх у дистильованій воді концентрація цинку, міді, свинцю та кадмію знизилась від 1,13 до 1,18 рази; від 1,2 до 1,29 рази; від 1,22 до 1,28 рази; від 1,08 до 1,2 рази.

**Ключові слова:** гриби, концентрація, цинк, мідь, свинець, кадмій, дистильована вода, вода без мінерального залишку, водопровідна вода, переварювання грибів.

**Табл. 4. Рис. 4. Літ. 14.**

#### **АННОТАЦИЯ**

#### **АНАЛИЗ ЭФФЕКТИВНОСТИ ПРИМЕНЕНИЯ КУЛИНАРНОЙ ОБРАБОТКИ ГРИБОВ ДЛЯ СНИЖЕНИЯ В НИХ КОНЦЕНТРАЦИИ ТЯЖЕЛЫХ МЕТАЛЛОВ**

Исследовано влияние вымачивания и переваривания грибов в разных видах воды. Установлено, что в грибах концентрация цинка, меди, свинца и кадмия снизилась от 1,01 до 1,04 раза; от 1,0 до 1,2 раза; от 1,09 до 1,16 раза; от 1,08 до 1,2 раза соответственно при вымачивании и переваривании их в водопроводной воде в течение 3-х часов. При вымачивании и переваривании грибов в воде без минерального остатка концентрация цинка, меди, свинца и кадмия снизилась от 1,01 до 1,04 раза; от 1,16 до 1,25 раза; от 1,8 до 2,0 раза; от 1,75 до 2,0 раза соответственно. При вымачивании грибов и переваривании их в дистиллированной воде концентрация цинка, меди, свинца и кадмия снизилась от 1,13 до 1,18 раза; от 1,2 до 1,29 раза; от 1,22 до 1,28 раза; от 1,08 до 1,2 раза.

**Ключевые слова:** грибы, концентрация, цинк, медь, свинец, кадмий, дистиллированная вода, вода без минерального остатка, водопроводная вода, переваривания грибов.

**Табл. 4. Рис. 4. Лит. 14.**

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