



Науковий вісник Львівського національного університету
ветеринарної медицини та біотехнологій імені С.З. Гжицького.
Серія: Харчові технології

Scientific Messenger of Lviv National University
of Veterinary Medicine and Biotechnologies.
Series: Food Technologies

ISSN 2519–268X print
ISSN 2707-5885 online

doi: 10.32718/nvlvet-f9920
<https://nvlvet.com.ua/index.php/food>

UDC 637.146:666.144:615.451.2

Changes in the quality of sour milk curds with candied fruit and dry licorice root during storage

V. O. Nagovska, O. Ya. Bilyk[✉], N. B. Slyvka, O. R. Mykhaylytska

Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies Lviv, Ukraine

Article info

Received 14.03.2023
Received in revised form
17.04.2023
Accepted 18.04.2023

Stepan Gzhytskyi National
University of Veterinary Medicine
and Biotechnologies Lviv,
Pekarska Str., 50, Lviv,
79010, Ukraine.
Tel: +38-097-662-97-01
E-mail: bilyk_oksi@ukr.net

Nagovska, V. O., Bilyk, O. Ya., Slyvka, N. B., & Mykhaylytska, O. R. (2023). Changes in the quality of sour milk curds with candied fruit and dry licorice root during storage. Scientific Messenger of Lviv National University of Veterinary Medicine and Biotechnologies. Series: Food Technologies, 25(99), 116–120. doi: 10.32718/nvlvet-f9920

In recent years, there has been a scientific interest in healthy nutrition, namely the development and consumption of products, which have a beneficial effect on the human body and can reduce the risk of various diseases. The work aimed to investigate the change in the quality of sour milk curds with candied fruit and dry licorice root during storage. The research was carried out at the Ivano-Frankivsk DP, as well as in the laboratory of the Department of Technology of Milk and Dairy Products of the Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies Lviv. When determining the titrated acidity in curds with candied fruit without licorice root during the storage period at a temperature of 4 ± 2 °C, it increases from 200 °T to 230 °T. In sour milk curds with candied fruit and dry licorice root, the titrated acidity on the first day of storage was 220 °C T, and on the fifth day – 230 °T. Since, according to the standard, fermented milk curds with candied fruit can be stored for no more than 3 days, based on the conducted research, we conclude that the newly made curds are entirely safe for consumption during the above period. Analyzing the microbiological indicators of newly created sour milk curds with candied fruit and dry licorice root, we can conclude that this product is harmless to health, as its sanitary condition meets the standard's requirements. Thus, using dry licorice root in producing sour milk curds with candied fruit as a non-dairy additive does not impair the microbiological indicators of this type of curd.

Key words: fermented milk products, candied fruit, licorice root, titrated acidity, microbiological indicators.

Introduction

Sour milk cheese is a sour product made by fermenting milk, buttermilk, or its mixture with milk and leavening preparations using acid, acid-rennet, or thermo-acid protein coagulation methods. According to the accepted classification, sour milk cheese is divided into the following types depending on the fat content: fatty, semi-fat, and low-fat. The method of protein coagulation, hardware and technological design of the process, etc., can also be the basis of the distribution. Cheese products include cheese products and semi-finished cheese products. Cheese products occupy the largest segment in the production of the products mentioned above (Nazarenko, 2014; Mostova & Klusovych, 2015; Popescu, 2015; Telezhenko et al., 2018; Aini et al., 2019; Gao et al., 2021).

Sour milk cheese is a product of a highly digestible universal purpose. In addition to direct consumption, it is

used to prepare various dishes and as a basis for a wide range of cheese products. The main feature that characterizes sour milk cheese and determines its high nutritional and biological value is the increased protein content (10–16 %) compared to whole milk (3.2–3.3 %). Most of the proteins in sour milk cheese are casein. The protein composition of sour milk cheese includes all essential amino acids (Ryzhkova, 2013; Kitchenko, 2014; Lialyk, 2015; Horiuk, 2016; Samilyk, 2017; Lappa et al., 2022).

Curd products are made from sour milk cheese obtained from pasteurized milk or buttermilk or its mixture with milk, with the addition of cream, butter, flavoring and aromatic fillers and food additives with or without further heat treatment (for thermized curd products), and are intended for direct consumption. Semi-finished products from sour milk cheese are produced in special workshops at dairy enterprises following the regulatory documentation for these products. For direct use, cottage

cheese semi-finished products require additional processing: mechanical or thermal (Nagovska et al., 2016; Sukhorska et al., 2017; Hachak et al., 2018).

The development and production of dairy products using raw materials of plant origin is one of the priority areas of the dairy industry. For the organization of the production of such products, preference is given to an integrated approach, which is connected with the intensification of traditional technologies of dairy products, on the one hand, and the use of non-traditional sources, mainly of plant origin, on the other (Slyvka et al., 2019, 2022; Nagovska et al., 2023).

The production of sour milk curds with candied fruit and dry licorice root will expand the range of products, give them therapeutic and preventive properties, and reduce the cost of milk per unit of production.

For the first time, licorice was used in China, along with ginseng root (Hnitsevych & Volnova, 2010; Kwon et al., 2020; Ding et al., 2022). Licorice is often used for children, expectant mothers, and the elderly, as it is safe and has general strengthening effects. Its value for official and folk medicine is due to its anti-inflammatory, expectorant, and antispasmodic effects. Licorice stimulates the body, helps increase immunity, and combats systemic inflammation and excessive fat deposition. Has weak antidepressant effects. The healing properties of licorice root are determined by its unique composition of biologically active components. The plant contains asparagine, glycyrrhizin, and several acids – glycyrrhizic, ascorbic, glycyrrhizic, and some others, which form the main effect on the body. In addition, the plant contains coumarins, terpene compounds (saponins), sterols, and bioflavonoids. Licorice root is also rich in mineral components - iron, copper, aluminum, selenium, zinc, manganese, potassium, etc (Hnitsevych & Kravchenko, 2011; Poperechnyi et al., 2012).

The aim of the research

To investigate the change in the quality of sour milk curds with candied fruit and dry licorice root during storage.

Material and methods

The experimental part of the work was carried out at the Ivano-Frankivsk City Dairy Product and in the laboratory of the Department of Technology of Milk and Dairy Products of the Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies Lviv.

Determination of mass fraction of moisture. An accelerated method was used to determine the mass fraction of moisture based on drying the sample at a temperature of 150 °C for an hour. A 3–5 g sample weight is mixed with 6–7 g of sand and placed in a drying cabinet. The mass fraction of moisture is calculated according to the formula:

$$B = (X_2 - X_3) / (X_2 - X_1)$$

where X_1 , X_2 , X_3 – mass of sand and gravel weighed and, after drying, g

Determination of the acidity of sour milk cheese. Devices and reagents: burettes, porcelain mortars, 50 ml pipettes, technochemical scales, 0.1 n. NaOH solution, distilled water (temperature 35–40 °C), and a dropper with an alcoholic phenolphthalein solution.

Technique of work:

1. Place a portion of cheese (5 g) in a porcelain mortar and grind well in 50 ml of distilled water heated to 35–40 °C.

2. Add 2–3 drops of phenolphthalein and titrate to 0.1 n. alkali solution until a faint pink color appears, which does not disappear within 1 minute.

3. The number of milliliters of alkali used for titration is multiplied by 20, and the product's acidity is obtained in degrees Turner.

Determination of the number of lactic acid bacteria. This standard applies to food and fermented milk products, leavens, bacterial concentrates, and bacterial preparations of lactic acid bacteria and establishes a method for determining viable lactic acid microorganisms and their maximum possible number (MPN). The method is based on sowing a certain amount of the product and (or) its dilutions in liquid or agarized selective nutrient media, cultivating the crops under optimal conditions, and, if necessary, determining the morphological and biochemical properties of the detected microorganisms and their counting. The method is designed to establish compliance with microbiological indicators of the quality of food and fermented milk products, leavens, bacterial concentrates, and bacterial preparations of lactic acid bacteria with regulatory and technical documentation requirements to clarify the causes of food product defects.

Identification of *Escherichia coli* bacteria (*E. coli*). The method is based on the ability of bacteria of the group of *Escherichia coli* (sporeless, gram-negative, facultatively anaerobic bacteria) to ferment lactose in a nutrient medium at a temperature of (37 ± 1) °C for 24 hours with the formation of acid and gas (BGCP).

Determination of the number of yeasts and molds is carried out. The method is based on sowing a certain amount of the product or its dilutions in a selective agar medium, cultivating the crops at (24 ± 1) °C for 5 days, counting all visible colonies of yeast and mold fungi, typical for macro- and (or) microscopic morphology.

Results and discussion

To establish how the quality of sour milk curds with candied fruit and dry licorice root changes during the storage period, their samples stored at a temperature of 4 ± 2 °C and air humidity not higher than 85 % were studied. According to SSTC 4503:2005, “Curd products. General technical conditions”, the storage period of non-thermalized sour-milk curds is 72 hours. To see whether curds' quality changes after their storage period ends, we will also analyze it after the period specified in the standard.

Table 1

Changes in the indicators of sour-milk curds with candied fruit and dry licorice root during storage

Storage period, days	Titrated acidity, °T		Mass fraction of moisture, %	
	sour milk cheeses with candied fruit	sour milk curds with candied fruit and dry licorice root	sour milk cheeses with candied fruit	sour milk curds with candied fruit and dry licorice root
1	200	220	66	66
2	210	220	66	66
3	220	220	66	68
5	230	230	70	70

As we can see from the values given in Table 1, titrated acidity in curds with candied fruit without licorice root increases from 200 °T to 230 °T during the storage period at a temperature of 4 ± 2 °C, i.e., by 30 °T. In sour-milk, curds with candied fruit and dry licorice root, titrated acidity on the first day of storage was 220 °T, and on the fifth day – 230 °T, i.e., the increase in acidity level will be only 10 °T.

According to SSTC 4503:2005, the storage period of sour milk curds is no more than 72 hours, that is, three days, but we also conducted research for 5 days of storage. That is why it is necessary to establish the microbiological indicators of curds with candied fruit and dry licorice root for one to five days, including storage, i.e., 120 hours.

The primary safety criteria for any products, including sour milk curds, are the following indicators: the titer of bacteria of the Escherichia coli group and MAFAM in 1 g of the product. These indicators should not be higher than specified in regulatory documents (TCC 25027034-004-99) when establishing the storage period of new types of products.

Table 2

Microbiological indicators of sour milk curds with candied fruit and dry licorice root during storage at temperature (4 ± 2) °C

Indicators	Sour milk curds with candied fruit				Sour milk curds with candied fruit and dry licorice root				Norm
	Duration of storage, days				Duration of storage, days				
	1	2	3	5	1	2	3	5	
Bacteria of the coliform group (coli-forms), absent in the mass of the product, g	0.1	0.1	0.01	0.01	0.1	0.1	0.01	0.01	0,001
Pathogenic microorganisms, including salmonella	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	not allowed
Microscopic fungi, CFU/g	3	3	3	4	2	2	3	4	-
Yeast, CFU/g	2	2	3	3	2	2	2	3	-

For example, Kesler's medium was used to establish the titer of Escherichia coli, and three dilutions of the product were made (0.1, 0.01, and 0.001 g). During five days of storage at $4-6$ °C, the indicator remained at 0.01 g. Also, the titer of Escherichia coli in curds with dry licorice root did not differ from curds without the addition of licorice.

In addition, in newly made curds with dry licorice root and curds without licorice, the number of microscopic fungi and yeast and the process of their growth during storage at temperature (4 ± 2 °C) were determined. Based

on the data in Table 2, it can be seen that the values of both types of cards are slightly different from each other. Therefore, it can be concluded that using dry licorice root in producing sour milk curds with candied fruit as a non-dairy additive does not worsen the microbiological indicators of this type of curds.

In addition, to determine the shelf life of new products, it is essential to determine the number of microscopic fungi and yeast necessary for the long-term storage of products. Since dairy products are stored at a low temperature (4 ± 2 °C), the development of fungi and yeast is possible. At the same time, the protein and fat products change, and their marketability deteriorates. Also, the appearance and development of mold fungi in dairy products, particularly in sour milk cheeses and curds, leads to the advancement of toxins by 2–4 mm inside the product.

For microbiological studies, fermented milk curds with candied fruit and dry licorice root were selected for the 1st, 2nd, 3rd, and 5th days of storage at temperature ($4-6$ °C). Fermented milk curds with candied fruit without dry licorice root with the same term and storage temperature were selected for comparison.

Analyzing the microbiological indicators of newly created sour milk curds with candied fruit and dry licorice root, we can conclude that this product is harmless to health, as its sanitary condition meets the requirements of the standard.

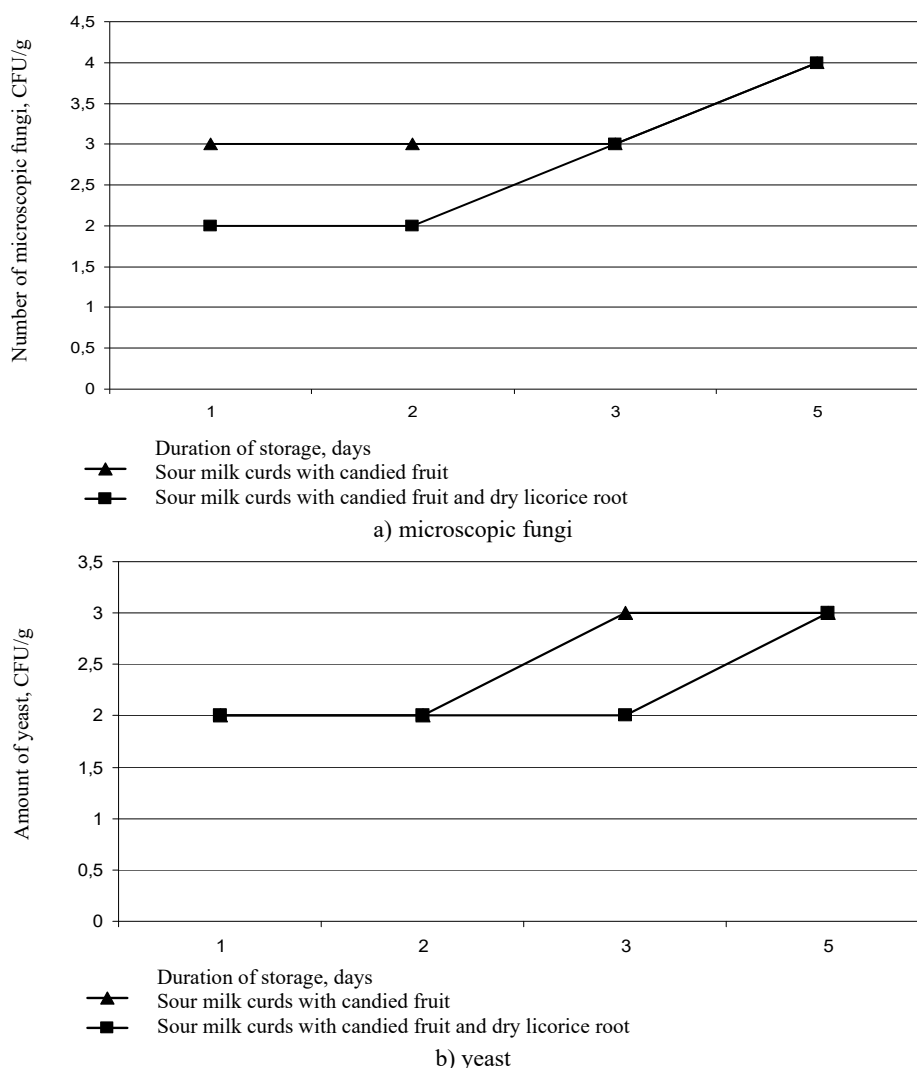


Fig. 1. Growth curves of: a) microscopic fungi; b) yeast

The presented figures show that the growth of fungi and yeast is small during the entire storage period, namely 5 days. Since, according to the standard, fermented milk curds with candied fruit can be stored for no more than 3 days; the newly created curds are entirely safe for consumption during the above period.

Conclusions

Curds with candied fruit and dried licorice root are functional products, as licorice contains natural anti-inflammatory steroids.

In producing curds with candied fruit and dry licorice root, it is not necessary to use new expensive equipment. For this, you can use the existing equipment of whole milk products at any factory.

In the production of sour milk curds with candied fruit and dry licorice root, the amount of sugar is reduced due to the introduction of licorice.

Dry licorice root does not reduce the microbiological indicators of these curds, and they correspond to curds without licorice root.

Conflict of interest

The authors declare no conflict of interest.

References

- Aini, N., Prihananto, V., Sustrawan, B., Romadhon, D., & Ramadhan, R. N. (2019). The Formulation of Cheese Analogue from Sweet Corn Extract. *Int J Food Sci.*, 2019, 8624835. doi: 10.1155/2019/8624835.
- Ding, Y., Brand, E., Wang, W., & Zhao, Z. (2022). Licorice: Resources, applications in ancient and modern times. *J Ethnopharmacol*, 298, 115594. DOI: 10.1016/j.jep.2022.115594.
- Gao, J., Li, X., Zhang, G., Sadiq, F.A., Simal-Gandara, J., Xiao, J., & Sang, Y. (2021). Probiotics in the dairy industry-Advances and opportunities. *Compr Rev Food Sci Food Saf*, 20(4), 3937–3982. DOI: 10.1111/1541-4337.12755.
- Hachak, Y., Gutyj, B., Bilyk, O., Nagovska, V., & Mykhaylytska, O. (2018). Effect of the cryopowder “Amaranth” on the technology of meolten cheese. *Eastern-European Journal of Enterprise Technologies*, 1(11(91)), 10–15. DOI: 10.15587/1729-4061.2018.120879.
- Hachak, Y., Gutyj, B., Bilyk, O., Nagovska, V., & Mykhaylytska, O. (2018). Investigation of the influence of “Amaranth” cryoadditive on organoleptic and microbiological parameters of processed cheeses.

- EUREKA: Life Sciences, 1, 18–24. DOI: 10.21303/2504-5695.2018.00555.
- Hnitsevych, V. A., & Kravchenko, N. V. (2011). Obgruntuvannya terminiv zberihannya napivfabrykatu na osnovi znezhyrenoho moloka z vykorystanniam ekstraktu korenja solodky. *Naukovyi visnyk Poltavskoho universytetu ekonomiky i torhivli. Serii: Tekhnichni nauky*, 1, 141–144. URL: http://nbuv.gov.ua/UJRN/nvpuetn_2011_1_30 (in Ukrainian).
- Hnitsevych, V. A., & Volnova, N. V. (2010). Doslidzhennia khimichnoho skladu ta biolohichnoi tsinnosti molochnoho napivfabrykatu z vykorystanniam ekstraktu korenja solodky Prohresyvnii tekhnika ta tekhnolohii kharchovykh vyrobnytstv restorannoho hospodarstva i torhivli, 2, 447–452. URL: http://nbuv.gov.ua/UJRN/Pt_2010_2_75 (in Ukrainian).
- Horiuk, Yu. V. (2016). Mikrobiolohichna otsinka bezpechnosti syru kyslomolochnoho "domashnoho" vyrobnytstva *Naukovyi visnyk Lvivskoho natsionalnoho universytetu veterynarnoi medytsyny ta biotekhnolohii imeni S. Z. Gzhytskoho. Serii: Veterynarni nauky*, 18(1(2)), 177–182. URL: [http://nbuv.gov.ua/UJRN/nvlnu_2016_18_1\(2\)_35](http://nbuv.gov.ua/UJRN/nvlnu_2016_18_1(2)_35) (in Ukrainian).
- Kitchenko, L. M. (2014). Vplyv baktofuhuvannia na pokaznyky yakosti moloka-syrovyny dlia syru kyslomolochnoho. *Visnyk Sumskoho natsionalnoho ahrarnoho universytetu. Serii: Tvarynnytstvo*, 2(2), 177–180. URL: [http://nbuv.gov.ua/UJRN/Vsna_tvar_2014_2\(2\)_41](http://nbuv.gov.ua/UJRN/Vsna_tvar_2014_2(2)_41) (in Ukrainian).
- Kwon, Y. J., Son, D. H., Chung, T. H., & Lee, Y. J. (2020). A Review of the Pharmacological Efficacy and Safety of Licorice Root from Corroborative Clinical Trial Findings. *J Med Food*, 23(1), 12–20. DOI: 10.1089/jmf.2019.4459.
- Lappa, I. K., Kachrimanidou, V., Alexandri, M., Papadaki, A., Kopsahelis, N. (2022). Novel Probiotic/Bacterial Cellulose Biocatalyst for the Development of Functional Dairy Beverage. *Foods*, 11(17), 2586. DOI: 10.3390/foods11172586.
- Lialyk, A. (2015). Development and research dairy products – cheese pasta with flaxseed oil during storage. *Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies. Series: Food Technologies*, 17(1), 55–60. URL: <https://nvlvet.com.ua/index.php/food/article/view/3285>.
- Mostova, L. M., & Klusovych, T. V. (2015). Upravlinnia yakistiu ta bezpechnistiu pry vyrobnytstvi kyslomolochnoho syru ozdorovchoho pryznachennia. *Vostochno-Evropeyskyi zhurnalпередовыkh tekhnolohiyi*, 2(10), 50–57. URL: [http://nbuv.gov.ua/UJRN/Vejpte_2015_2\(10\)_11](http://nbuv.gov.ua/UJRN/Vejpte_2015_2(10)_11) (in Ukrainian).
- Nagovska, V., Hachak, Y., Mykhaylytska, O., Slyvka, N., & Bilyk, O. (2016). Change of technological indicators for soft cheese with bran depending on the rye bran dose. *Technology Audit and Production Reserves*, 3 (3(29)), 29–33. DOI: 10.15587/2312-8372.2016.71225.
- Nagovska, V., Mykhaylytska, O., Slyvka, N., Bilyk, O., & Hachak, Y. (2023). Influence of the biologically active supplement "immunocort" on the production and quality of the "Mozzarella Ukrainian" cheese. *Eastern-European Journal of Enterprise Technologies*, 1 (11(121)), 31–40. DOI: 10.15587/1729-4061.2023.272399.
- Nazarenko, Yu. V. (2014). Udoskonalena tekhnolohiia syru kyslomolochnoho dlia dytiachoho kharchuvannia z podovzhenym terminom zberihannia. *Naukovi pratsi [Odeskoi natsionalnoi akademii kharchovykh tekhnolohii]*, 46(2), 218–223. URL: [http://nbuv.gov.ua/UJRN/Np_2014_46\(2\)_57](http://nbuv.gov.ua/UJRN/Np_2014_46(2)_57) (in Ukrainian).
- Poperechnyi, A. M., Hnitsevych, V. A., Kornichuk, V. H., Kravchenko, N. V., & Kalarash, V. (2012). Vyznachennia vplyvu tekhnolohichnykh parametriv na kinetyku konvektyvnoho sushinnia napivfabrykatu na osnovi znezhyrenoho moloka z vykorystanniam ekstraktu korenja solodky *Naukovi pratsi [Odeskoi natsionalnoi akademii kharchovykh tekhnolohii]*, 41(1), 108–111. URL: [http://nbuv.gov.ua/UJRN/Np_2012_41\(1\)_29](http://nbuv.gov.ua/UJRN/Np_2012_41(1)_29) (in Ukrainian).
- Popescu, A. (2015). Research on the trends in milk production and consumption in Romania. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, 15(1), 387–392. URL: https://managementjournal.usamv.ro/pdf/vol.XV_1/Art58.pdf.
- Ryzhkova, T. M. (2013). Vplyv kombinatsiinykh soluchen zakvashuvalnoi mikroflory na yakist ta vykhid kozynoho kyslomolochnoho syru. *Visnyk Kharkivskoho natsionalnoho tekhnichnoho universytetu silskoho hospodarstva imeni Petra Vasylenka*, 140. URL: http://nbuv.gov.ua/UJRN/Vkhdusg_2013_140_11 (in Ukrainian).
- Samilyk, M. (2017). Improving the technology of soft sour milk cheese by increasing biological value. *Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies. Series: Food Technologies*, 19(80), 33–37. DOI: 10.15421/nvlvet8007.
- Slyvka, N., Bilyk, O., & Nagovska, V. (2022). Development of the technology of fermented milk drink with goji berries. *Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies. Series: Food Technologies*, 24(97), 65–71. DOI: 10.32718/nvlvet-f9711.
- Slyvka, N., Bilyk, O., Mikhailytska, O., & Nagovska, V. (2019). Improvement of technology of curd products with succade from pumpkin. *Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies. Series: Food Technologies*, 21(92), 47–52. DOI: 10.32718/nvlvet-f9209.
- Sukhorska, O., Slyvka, N., & Bilyk, O. (2017). Analysis of main sources of bioflavonoids the creation of products of medical and prophylactic appointment. *Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies. Series: Food Technologies*, 19(80), 107–110. DOI: 10.15421/nvlvet8022.
- Telezhenko, L., Bilenka, I., Zolovska, O., & Lazarenko, N. (2018). The development of technology of dairy-vegetative dessert with functional additives. *Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies. Series: Food Technologies*, 20(90), 46–52. DOI: 10.32718/nvlvet9010.