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**COMMODITY EXPERTISE OF BUTTER  
MANUFACTURERS OF THE SIBERIAN REGION**  
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**Abstract.** Due to the growing interest of consumers in healthy food products, it is important not only to develop new types of useful goods, but also to pay attention to the properties of existing products, one of which is butter. The possible sale of low-quality and potentially dangerous products determines the relevance of the research on the chosen topic. The purpose of the study was the commodity expertise of butter, including microbiological safety, produced in the Siberian region. Five samples of butter were selected as research objects. During the commodity examination and the samples studied, the following was revealed. According to the organoleptic and physico-chemical quality indicators, all the studied samples comply with the requirements of the state standard for butter.

The results of the definitions and comparisons of the actual values of microbiological safety indicators with the requirements of regulatory documents showed that all the products considered were free of pathogenic microorganisms - *L. monocytogenes* and bacteria of the genus *Salmonella*. However, in part of the butter samples, the content of sanitary-indicative microorganisms was exceeded. The presence of *E. coli* bacteria in the production of three out of five samples was revealed, but does not exceed the norm of the technical regulations. Yeast and mold were found in all butter samples, but in two of the five samples, the amounts of these micro-organisms were found in quantities significantly exceeding the norm. A microbiological study of product safety made it possible to make an assumption about a possible violation of the sanitary regime of the production of these samples and about the influence of the packaging method on the growth and development of microorganisms. The obtained results indicate the need to control the microbiological parameters of butter, both at the production stage and at the product sale stage.

**Keywords:** butter, food quality, microbiological safety indicators.

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**ТОВАРОВЕДНАЯ ЭКСПЕРТИЗА СЛИВОЧНОГО МАСЛА  
ПРОИЗВОДИТЕЛЕЙ СИБИРСКОГО РЕГИОНА**

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**Аннотация.** В связи с ростом интереса потребителей к продуктам здорового питания важно не только разрабатывать новые виды полезных товаров, но и обращать внимание на свойства существующих продуктов, одним из которых является сливочное

масло. Возможная реализация некачественной и потенциально опасной продукции обуславливает актуальность исследования по выбранной теме, целью которого стала товароведная экспертиза сливочного масла (в том числе его микробиологической безопасности), произведенного в сибирском регионе. В качестве объектов были выбраны пять образцов. В ходе проведения их товароведной экспертизы было выявлено следующее. По органолептическим и физико-химическим показателям качества все исследуемые образцы соответствуют требованиям государственного стандарта на сливочное масло. При сравнении фактических значений микробиологической безопасности с требованиями нормативных документов выявлено, что во всех рассмотренных продуктах отсутствуют патогенные микроорганизмы – *L. monocytogenes* и бактерии рода *Salmonella*. Однако в части образцов превышено содержание санитарно-показательных микроорганизмов. Выявлено присутствие (но не превышающее норму технического регламента) бактерий группы кишечных палочек у трех из пяти образцов.. Дрожжи и плесень были обнаружены во всех образцах сливочного масла, но в двух из пяти суммы данных микроорганизмов обнаружены в количествах, значительно превышающих норму. Микробиологическое исследование безопасности продукции позволило сделать предположение о возможном нарушении санитарного режима производства данных образцов и о влиянии способа упаковывания на рост и развитие микроорганизмов. Полученные результаты свидетельствует о необходимости контроля микробиологических показателей сливочного масла как на стадии производства, так и при реализации.

**Ключевые слова:** сливочное масло, качество продуктов питания, микробиологические показатели безопасности.

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**Introduction.** Dairy products occupy an important place in the diet of a modern person. Milk and products derived from it contribute to the diversity of nutrition and are of great dietary and medicinal value, as they contain substances indispensable for the human body: proteins, fats and fat-like compounds, carbohydrates, mineral salts, vitamins and enzymes. Due to the growing interest of consumers in healthy food products, it is important not only to develop new types of useful goods, but also to pay attention to the properties of existing products, one of which is butter.

Butter is butter made from cow's milk, in which the mass fraction of fat is at least 50% [1], which allows us to consider this high-calorie product as a source of animal fat, phospholipids and fat-soluble vitamins. The lack of animal fats in the diet is dangerous, as they are necessary for the synthesis of hormones. Vitamin A helps with violations of the digestive system, during colds, with diseases of the lungs and bronchi. It is important to observe the measure when using this high-calorie product.

Butter is very popular among consumers, being part of everyday, dietary, baby food. On the modern market, manufacturers offer butter with different fat content, with or without the addition of salt and flavoring components.

However, referring to the regular ratings published on the official website of the FBI "State Regional Center for Standardization, Metrology and Testing in the Krasnoyarsk Territory, the Republic of Khakassia and the Republic of Tyva", not all butter sold in the retail network of Krasnoyarsk, complies with the requirements of regulatory documentation in

terms of not only quality, but also safety. The presence of such goods on the market leads to a decrease in consumer demand for these products and a loss of confidence in its manufacturers.

The presence of low-quality and potentially dangerous products on the shelves of commercial enterprises determines the relevance of the chosen research.

**Materials and methods.** Based on a study of the prevalence of butter brands and an analysis of the range [9-12], five samples of butter from manufacturers in the Siberian region were taken as objects of study. To ensure impartiality during the analysis, the samples of the studied products were depersonalized and encrypted in accordance with GOST R 58185-2018 [2].

Studies of quality indicators and microbiological safety indicators were carried out with three repetitions using standard techniques and modern equipment.

Determination of the number of mesophilic aerobic and facultative anaerobic microorganisms (QMAFAnM) was carried out by counting the colonies of mesophilic aerobic and facultative anaerobic microorganisms growing on a solid nutrient medium QMAFAnM at a temperature of  $(30 \pm 1) ^\circ\text{C}$  for 72 hours in accordance with GOST 32901-2014 [3].

The presence of bacteria of the *Escherichia coli* group (CGB) was determined by signs of growth on the Kessler liquid medium according to GOST 32901-2014 [3].

The determination of bacteria of the genus *Salmonella* was carried out by identifying colonies of bacteria of the genus *Salmonella* growing on a selective medium according to GOST 31659-2012 (ISO 6579:2002) [4].

Staphylococci (*S. aureus*) were determined by biochemical signs of belonging to coagulase-positive staphylococci and *S. aureus* according to GOST 30347-2016 [5].

The detection of *L. Monocytogenes* bacteria was carried out by identifying colonies of *L. monocytogenes* bacteria growing on selective media in accordance with GOST 32031-2012 [6].

The presence of yeasts and molds was determined by counting characteristic colonies when sowing dilutions of the product on a dense nutrient medium in accordance with GOST 33566-2015 [7].

**Results and discussion.** As a result of the analysis of the structure of the assortment of butter in terms of the ratio of the number of goods from producers and manufacturers of regional and federal significance and types of butter by the mass fraction of fat, the presence of salt and the net weight presented in [9], the following was revealed (Figure 1).

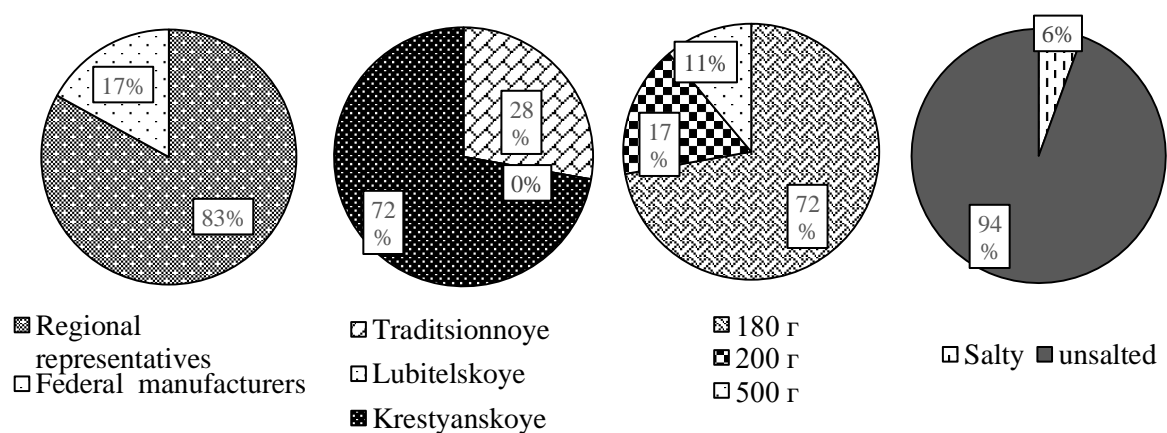


Figure 1. The structure of the assortment of butter

In the structure of the range of trade enterprises in Krasnoyarsk, Krestyanskoye unsalted sweet butter from Siberian producers in a package weighing 180 g predominates.

The stability coefficient, calculated in relation to the goods of sustainable demand to their total number, has an average value (66.65%). The most demanded are the butter brands "Tayzhny Istok", "Semenishna", "Balakhtinskoe razdolye", "Tree korovy", "Selo rodnoye", which became the object of the study.

During the commodity examination, the following results were obtained. The packaging and labeling of the studied butter samples meets the requirements set out in the technical regulations. The analysis of the labeling showed that all manufacturers have available, sufficient, and reliable information on the packaging in the form of text, images and symbols, which makes it possible to uniquely identify the product and not mislead about its properties. In addition, data on the material of the packaging is taken out separately.

In terms of organoleptic quality indicators, all the samples under study correspond to the requirements of the state standard [1] for butter of the highest "Balakhtinskoe razdolye" and "Semenishna", which received 20 points each. Such kinds as "Tree korovy" and "Selorodnoye" have 19 points each, in both samples, one point was removed for an insufficiently pronounced aftertaste of pasteurization. The lowest score (18 points) was received by "Tayzhny Istok" butter. The product has an insufficiently intense aftertaste of pasteurization and an insufficiently plastic consistency.

In accordance with the physicochemical analysis of the quality, the mass fractions of fat and moisture, as well as the titratable acidity of the milk plasma of all the studied samples, meet the requirements of the state standard [1]. According to these indicators, the butter samples "Semenishna" and "Balakhtinskoye razdolye" expand trademarks, which have the most intense flavoring properties, were recognized as the best. The combination of insufficiently intense organoleptic characteristics and high values of physical and chemical indicators of the quality of "Tayzhny Istok" can be explained by non-compliance with the rules for transporting or storing the product at a trade enterprise.

The results of the determination of QMAFAnM in the studied samples of sweet cream butter are shown in Figure 2.

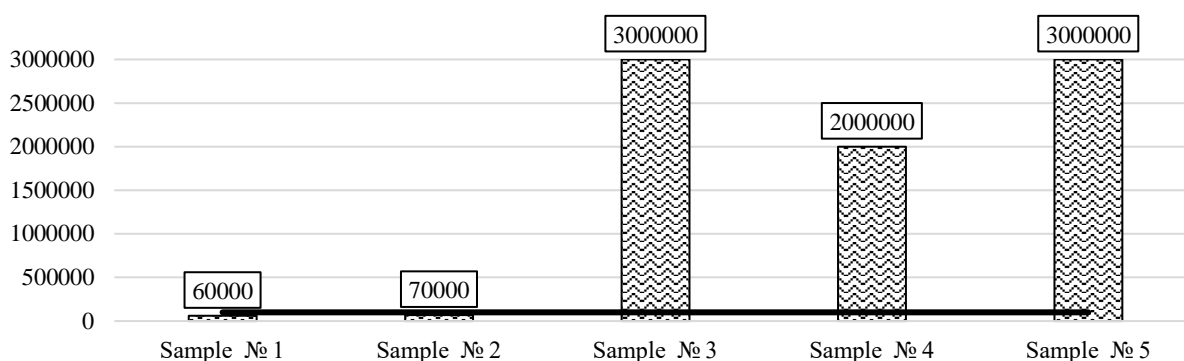


Figure 2. Determination of QMAFAnM in samples of sweet butter

As it can be seen from the figure, the bacterial contamination only in samples No. 1 ( $6.0 \times 10^4$ ) CFU and No. 2 ( $7.0 \times 10^4$ ) CFU corresponds to the TR TS 033/2013 standard (no more than  $1.0 \times 10^5$  CFU) [12]. In the rest of the studied samples, the content of mesophilic aerobic and facultative anaerobic microorganisms is significantly exceeded.

The result of a violation of technology may be the exceeding this indicator (insufficient pasteurization of cream) or a sanitary regime of production, rules of

transportation and storage [13-16]. In addition, increased contamination can be caused by insufficient tightness of the package.

QMAFAnM reflects the presence of microorganisms of various taxonomic groups in butter, but does not give an idea of their qualitative composition. When analyzing the obtained values of this indicator, it can be assumed that pathogenic microorganisms can be detected in samples of butter with the highest contamination. For a more accurate assessment of the composition of the microflora of products, it is necessary to determine the presence or absence of specific groups and types of microorganisms, also by TR CT 033/2013 [8].

When determining CGB in sweet cream butter, three successive dilutions (0.1; 0.01 and 0.001 cm<sup>3</sup>) were sown, the average of which (0.01 cm<sup>3</sup>) corresponds to the standard according to TR CU 033/2013 [8]. The results of the determination of CGB in the studied samples are presented in Table 1.

As can be seen from the table, bacteria of the *Escherichia coli* group were not found in all dilutions of samples No. 1 and No. 2, and crops of dilutions of the three remaining samples made it possible to detect the presence of CGB in 0.001 cm<sup>3</sup>. The obtained results of the determination meet the requirements of the technical regulation [8].

Table 1. Determination of CGB in the studied samples of butter

Sample butter	The result of the definition	The norm according to TR CU
Sample № 1	not found in 0.01 cm <sup>3</sup>	not allowed in 0.01 cm <sup>3</sup>
Sample № 2		
Sample № 3	no tfound in 0.001 cm <sup>3</sup>	
Sample № 4		
Sample № 5		

The bacteria of the *Escherichia coli* group belong to sanitary indicative microorganisms and are an indicator of fecal contamination of the product. The reason for their presence and development in butter may be non-compliance with sanitary rules during production or transportation. Possible sources of entry of these microorganisms into the product are raw materials, water, equipment, hands of working personnel, etc.

When using butter containing CGB, the development of toxic infection is possible. Once in a weakened body, some strains of *Escherichia coli* can cause diseases outside the gastrointestinal tract [13-16].

The excess of QMAFAnM and the presence of CGB even in a small volume of the product (0.001 cm<sup>3</sup>) allows us to make an assumption about the likely presence of pathogenic microorganisms in it and justify the need for further microbiological studies.

After incubation of the inoculations of the studied butter samples on XLD-agar and on bismuth-sulfite agar, typical or not quite typical colonies for bacteria of the genus *Salmonella* were found (Table 2).

Table 2. Determination of bacteria of the genus *Salmonella* in butter

Sample butter	The result of the definition	The norm according to TR CU
Sample № 1	not found in 25 cm <sup>3</sup>	not allowed in 25 cm <sup>3</sup>
Sample № 2		
Sample № 3		
Sample № 4		
Sample № 5		

Thus, all samples of butter meet the requirements of the technical regulations [9] for this indicator.

The absence of *Salmonella* bacteria in all the studied butter samples indicates that the cream for the production of the product was obtained from healthy animals and underwent high-quality heat treatment, and workers who were not infected with salmonellosis were allowed to participate in the technological process [13, 14].

After incubation of the crops of the studied butter samples on yolk-salt agar, typical or not quite typical coagulase-positive staphylococcal colonies were not detected (Table 3).

The absence of these bacteria in 0.1 cm<sup>3</sup> of the product meets the norm of the technical regulation [8] for this indicator.

*Staphylococcus aureus* are sanitary indicative microorganisms: their presence in the product is indicative of oral contamination. The danger of the presence of staphylococci in food products is that they form enterotoxins resistant to external influences that cause staphylococcal food poisoning.

Table 3. Determination of staphylococci (*S. aureus*) in sweet butter

Sample butter	The result of the definition	The norm according to TR CU
Sample № 1	not found in 25 cm <sup>3</sup>	not allowed in 25 cm <sup>3</sup>
Sample № 2		
Sample № 3		
Sample № 4		
Sample № 5		

Bacteria of the genus *Staphylococcus aureus* are found in the milk of cows with mastitis and not sufficiently heat treated. The absence of these microorganisms in all studied samples of sweet butter is an indicator of the use of safe and properly pasteurized raw materials and sufficient control over the health of production workers [13, 19, 20].

After incubation of inoculations (25 cm<sup>3</sup>) of the studied butter samples on dense selective media, the growth of characteristic colonies of bacteria of the genus *Listeria* and *Listeria Monocytogenes* was not observed. Thus, all samples meet the requirements of the technical regulations [8] for this indicator.

Like bacteria of the genus *Salmonella*, *Listeria Monocytogenes* bacteria are pathogenic microorganisms, the content of which in food products is subject to the most stringent requirements. The absence of *Listeria Monocytogenes* bacteria in all studied samples of sweet butter indicates the production of products from safe and thermally processed raw materials and sufficient control over the health of production workers.

However, these microorganisms are highly resistant to external influences and can remain in the production environment for a long time in small quantities. Therefore, the determination of the content of *Listeria Monocytogenes* bacteria in butter production enterprises should be carried out systematically [13, 20].

The results of the determination of yeast and mold fungi in the studied samples of sweet butter are shown in Figure 3.

According to the culture results, yeasts and molds are present in all butter samples. In oils of trademarks "Balakhtinskoe razdolye", "Semenishna", "Tree korovy" their total content does not exceed the norms of TR CU 033/2013 (no more than 100 CFU) [12].

The sum of yeasts and molds in samples trademarks "Tayzhny Istok" (1.3 x 10<sup>2</sup> CFU) and "Selorodnoye" (4.4 x 10<sup>2</sup> CFU) significantly exceeds the value established by it, and the largest amount of these microorganisms was found in sample No. 5.

Metabolites of certain types of mold can cause allergic reactions and respiratory diseases, so products in which an excess of the total amount of molds and yeasts is found are unsafe.

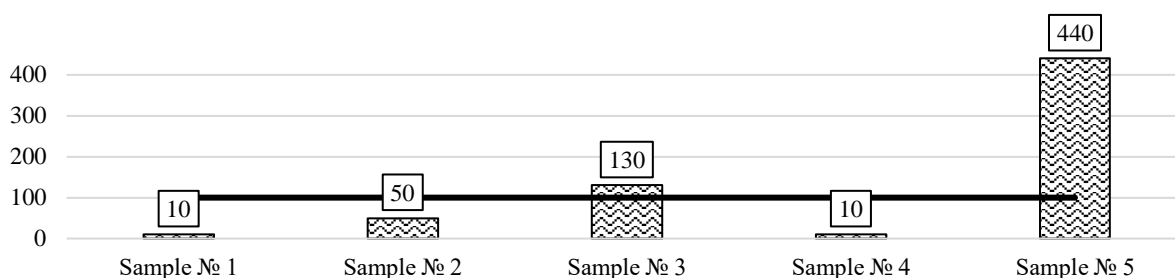


Figure 3. Determination of yeasts and molds in sweet butter

Exceeding the permissible content of mold and yeasts was found in samples with increased bacterial contamination, which, moreover, contain bacteria of the *Escherichia coli* group. The discrepancy between these microbiological indicators and the norm of the technical regulation [8] is a possible consequence of a violation of the sanitary regime of production, transportation and storage rules.

**Conclusions.** In this work, a commodity examination of Krestyanskoye sweet butter produced by Siberian region was carried out on the example of five samples sold in the retail network of the city of Krasnoyarsk.

The analysis of packaging and labeling, analysis of organoleptic and physico-chemical quality indicators and microbiological safety indicators were carried out. Based on the research results, the following conclusions were drawn.

The packaging and labeling of the studied goods meets the requirements set forth in the technical regulations. The studied samples do not have any contamination or packaging deformations. An analysis of the labeling showed that all manufacturers have available, sufficient, and reliable labeling on the packaging in the form of text, images and information signs, which allows you to uniquely identify the product and not mislead about its properties. In addition, data on the material of the packaging is taken out separately.

According to organoleptic quality indicators, all the studied samples correspond to the requirements of the state standard for premium butter. Sweet and creamy unsalted butters "Balakhtinskoye razdolye" and "Semenishna" were recognized as the best, having received 20 points each. Samples "Tree korovy" and "Selo rodnoye" have 19 points each, in both samples, one point was removed for insufficiently intense aftertaste of pasteurization. The lowest score (18 points) was received by "Tayzhny Istok". The product has an insufficiently intense aftertaste of pasteurization and an insufficiently plastic consistency.

In accordance with the physicochemical analysis of the quality, the mass fractions of fat and moisture, as well as the titratable acidity of the milk plasma of all the studied samples, meet the requirements of the state standard [1]. According to these indicators, the samples of butter of the "Semenishna" and "Balakhtinskoye razdolye" trademarks, which have the most intense flavoring properties, were recognized as the best. The combination of insufficiently intense organoleptic characteristics and high values of physical and chemical indicators of the quality of "Tayzhny Istok" butter can be explained by non-compliance with the rules for transporting or storing the product at a trade enterprise.

The results of determining the microbiological safety indicators showed that in all the studied samples of butter from local producers there are no pathogenic microorganisms, however, in some samples, the content of sanitary-indicative microorganisms is exceeded. In butter samples trademarks "Tayzhny Istok", "Tree korovy" and "Selo rodnoye", bacterial contamination (QMAFAnM) was exceeded, bacteria of the *Escherichia coli* group were found in small quantities, and mold and yeast growth was also observed in samples trademarks "Tayzhny Istok" and "Selo rodnoye". A microbiological study of product safety made it

possible to make an assumption about a possible violation of the sanitary regime for the production of these samples and about the impact of the packaging method on the growth and development of microorganisms.

Thus, a systematic study and control of the safety of butter, both at the stage of production and at the stage of sale, continues to be relevant for regional manufacturers whose products are presented on the market of Krasnoyarsk and the Siberian region. Compliance of local food products with the requirements of technical regulations is a prerequisite for their sale and attractiveness to the consumer.

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