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**MICROBIOLOGICAL ANALYSIS AND SANITARY AND HYGIENIC
CONTROL OF RAW MILK**
**МІКРОБІОЛОГІЧНИЙ АНАЛІЗ ТА САНИТАРНО-ГІГІЄНІЧНИЙ КОНТРОЛЬ
МОЛОЧНОЇ СИРОВИНИ**

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Abstract. За результатами дослідження сирого незбираного молока коров'ячого, викладеними у статті, встановлена його контамінація не лише мікрококами, психрофільними мікроорганізмами родів *Achromobacter*, *Pseudomonas*, *Aeromonas*, *Enterobacter*, але й патогенними та умовно-патогенними мікроорганізмами (стафілококами, стрептококами, кишковою паличкою, коринебактеріями), які спричинюють виникнення запалення молочної залози і є збудниками харчових отруєнь людей. Відповідно до вимог ЄС, значне підвищення нормативів безпеки та якості молока-сировини за вимогами національного стандарту (ДСТУ 3662–2018 «Молоко-сировина коров'яче. Технічні умови») вимагає перегляду нормативної бази стосовно санітарно-гігієнічних та технологічних умов одержання, його первинної обробки на потужностях з виробництва незбираного коров'ячого молока-сировини. Для визначення ефективності санітарної обробки і нормативної чистоти доїльного обладнання й молочного устаткування досить надійним та інформативним показником є встановлення титру ентерококів, оскільки нині широко використовуваний з цією метою титр бактерій групи кишкової палички має децю нижчу результативність, а тому не зовсім виправданий.

Keywords. молоко-сировина коров'яче, доїльне обладнання, норматив чистоти, КМАФАнМ, патогенні мікроорганізми, титр БГКП, титр ентерококів, субклінічний мастит.

Introduction. One of the main points of the state policy on ensuring the safety and quality of milk and dairy products for the life and health of the population is to control the safety and quality of milk, raw milk and dairy products. There are special requirements for the safety and quality of raw cow's milk, because, with the slightest violation of the sanitary and hygienic conditions of its production and primary processing at milk production facilities, it can serve as a favorable environment for the development of opportunistic and pathogenic microorganisms [1,2].



Under modern conditions, indirect methods of identification of pathogenic microorganisms are widely used in the study of whole cow's milk, which only with a certain degree of probability make it possible to detect them, due to the fact that the arsenal of direct microbiological methods of pathogenic bacteria is still insufficient. An indicator of fecal contamination of raw milk, in particular, and the environment in general, is the presence of bacteria of the *Escherichia coli* group (BGKP), namely - *Escherichia coli* [3,4]. At present, ecological science is becoming a specific general scientific approach to the study of various objects of the environment and society, and on the basis of the principles of greening, somewhat new approaches to obtaining safer raw milk are being formed. [5]. With this approach, it is very important to identify sanitary-indicative microorganisms in raw milk.

The main source of microbial contamination of whole cow's milk is milking equipment and dairy equipment, as more than 90% of the microflora is microorganisms that are on their internal surfaces, therefore, compliance with sanitation requires considerable attention and priority and ensures the safety of raw milk. [5].

Experimental studies have shown that during the period of receipt of fresh milk in the total tank capacity and its cooling to a temperature of 4 ± 2 ° C, the number of microorganisms in it increases by 3–3.5 times due to their washing from the surface of milking equipment and their subsequent development [5, 6,7]. For delivery to raw milk processing capacity with the number of mesophilic aerobic and optionally anaerobic microorganisms (KMAFanM) up to 100 thousand CFU, it is required that 1 cm³ of fresh milk yield had no more than 20 thousand colony-forming units. Such milk can be obtained only if the amount of MAFANM in washes from milking equipment parts does not exceed 500 CFU / cm³, which in turn requires not only the availability of appropriate technologies in raw milk production facilities, effective detergents and disinfectants, qualified staff, but also systematic monitoring of the effectiveness of sanitation of milking equipment, which is the main source of contamination of fresh milk with microflora [8, 9].

Therefore, it is important to find an alternative, faster and easier to implement method for determining the effectiveness of sanitation of milking equipment and dairy equipment, with results adequate to the direct cup method.

Material and methods. The research was conducted in accordance with current regulations: DSTU 3662–2018, DSTU 7089: 2009, DSTU IDF 122C: 2003 (IDF 122C: 1996, IDT), DSTU ISO 5944: 2005 (IDF 60: 2001). DSTU 7357: 2013, DSTU IDF 73A: 2003 [2-8]. To determine the effectiveness of the titers of BGKP and enterococci, the effectiveness of sanitation of milking equipment and dairy equipment, parts of the milking machine, cooling tank, for their different sanitary condition were washed, in accordance with the requirements of "Sanitary rules for care of milking equipment and dairy equipment and their sanitary condition " [1 - 6], «Рекомендацій щодо санітарно-мікробіологічного дослідження змивів з поверхонь тест-об'єктів та об'єктів ветеринарного нагляду і контролю» [7].

Results of the research. For sanitary treatment in this farm use the drug "Desmol", produced by the industry for simultaneous washing and disinfection of milking equipment and dairy equipment and is a mixture of inorganic salts,



detergents and chlorine component (5-6% active chlorine), as well as anti-corrosion substances and water softeners. In the case of manual processing of portable cans in which milk is produced from cows on the farm, disinfection is carried out with a solution of "Desmol" with a mass fraction of 0.5%.

Micrococci (31.8%), psychrophilic bacteria of the families *Achromobacter*, *Pseudomonas*, *Aeromonas*, *Enterobacter* (21%), staphylococci (14.2%), streptococci (13%) and corynebacteria were found to be the largest percentage of bacteria in fresh milk. (thirteen%).

The first experimental group presents the results of the study of washes, the microbial count (KMAFANM) which was within the normative limits of effective sanitation, and the titers of both groups of sanitary-indicative microorganisms (BGKP and enterococci) was > 1.0 .

In the second experimental group, the results of the study of washes with titers of BGKP > 1.0 , and enterococci - 1.0 and < 1.0 (range of MAFANM - from 1000 to 1000 000 CFU).

In the third experimental group - data on the results of the study of all washes with a microbial number from 1000 to 1000 000 CFU and more than 1000 000 CFU, the titer of BGKP and enterococci - 1.0 and < 1.0 , respectively.

The results of the study of washes in the second experimental group give grounds to claim that the titer of BGKP more than 1.0 can not serve as an indirect indicator of the regulatory purity of milking equipment. The titer of enterococci (first experimental group) more than 1.0 in 91.0% of cases had almost the same indicators with the normative amount of MAFANM in washes (≤ 500 CFU). The slight deviation of the microbial number from 500 to 1000 CFU is only 9%, and therefore we will consider it not fundamental.

With an enterococcal titer of more than 1.0, the standard amount of mesophilic aerobic and optionally anaerobic microorganisms in fresh milk was up to 19 thousand CFU / cm³.

Thus, the results of the study confirmed the statements of a number of Ukrainian and foreign scientists [5-9] on the high informativeness and effectiveness of determining the titer of enterococci as a bioindicator group of bacteria to control good hygienic and industrial practices of obtaining and primary processing of whole cow's milk. .

Bacteriological studies of raw milk were performed to determine the number of mesophilic aerobic and facultative anaerobic microorganisms (KMAFanM), the presence of *Escherichia coli* bacteria (BGKP), pathogenic staphylococci and streptococci, which are the causative agents of mastitis. It was found that the number of mesophilic aerobic and facultative anaerobic microorganisms in the secretion of cows with subclinical mastitis is from 1 to 3 million CFU / cm³, and clinically healthy - from 10 to 100 thousand CFU / cm³. Morphologically, it was the microflora, which was gram-positive cocci (mostly) and rods.

In subclinical mastitis, hemolytic and plasma-coagulating staphylococci were more frequently isolated, agalactic streptococci and *Escherichia coli* bacteria were less common. Of the 12 cultures of staphylococci studied, of the affected udder of cows suffering from mastitis, 74.6% of their strains were identified as



Staphylococcus aureus, as they had such basic biochemical properties as blood plasma coagulation, hemolysis of erythrocytes, mannitol fermentation.

Examination of secretions from the affected udder of cows with mastitis identified mainly *Streptococcus agalactiae* group B streptococci, which accounted for 54.7% of the total number of these microorganisms. Regarding *Escherichia coli* bacteria isolated from the affected parts of the mammary gland of cows, 7 strains out of 12 were classified as *Escherichia coli*.

The main pathogens of mastitis were not detected in milk samples obtained from clinically healthy cows, adjacent unaffected parts of the udder of cows suffering from mastitis. Milk from clinically healthy cows and from unaffected parts of the udder of patients did not contain pathogenic microorganisms that could cause pathological processes and food poisoning in humans.

Conclusion. 1. Fresh milk from cows, obtained at the milk production facility of STOV "Burivske" Gorodnyansky district of Chernihiv region, contaminated not only with micrococci, psychrophilic microorganisms (*Achromobacter*, *Pseudomonas*, *Aeromonas*, *Enterobacter*), but also pathogenic streptococcus, including staphylococci, including corynebacteria, which cause not only inflammation of the breast, but also are the causative agents of food poisoning in humans.

2. In the milk of clinically healthy cows, the number of mesophilic aerobic and facultative anaerobic microorganisms ranged from 10 to 100 thousand CFU / cm³, and the main causative agents of mastitis were not detected.

3. In the milk of cows suffering from subclinical mastitis, the number of mesophilic aerobic and facultative anaerobic microorganisms ranged from 1 to 3 million CFU / cm³, more often *Staphylococcus aureus* was isolated, less often *Streptococcus agalactiae* and *Escherichia coli*.

References

1. 1. Kozenko OV, Svergun Zh. G. Prerequisites for creating a system of good hygienic practice in farms producing raw cow's milk. Scientific Bulletin of Lviv National University of Veterinary Medicine and Biotechnology named after S.Z. Gzhytsky. 2011. T. 13 № 2 (48). Ch. 2, S. 234–240.
2. 2. Svergun JG Titer of enterococci as an indicator of the efficiency of sanitation of milking parlors. Scientific Bulletin of the National University of Life and Environmental Sciences of Ukraine. Kyiv, 2010. Part 2. № 3. P. 353–356.
3. 3. Svergun JG Enterococci as a bioindicator group of bacteria in milk hygiene. Scientific Bulletin of Lviv National University of Veterinary Medicine and Biotechnology named after SZ Gzhytsky. 2009. T. 11. Ch. 3. № 3 (42). Pp. 126–130.
4. Lück H. Reduction tests for determination of the bacteriological quality of raw milk. *Kieler Milchwirtschaftliche Forschungsberichte*. 2012. № 1. P. 108–116.
10. DSTU 3662–2018 Raw cow's milk. Specifications". [Valid from 2019-01-01]. Kind. officer Kyiv, 2019. 22 p. (Information and documentation).
6. Biochemical and microbiological quality control of food products. Tutorial. / T.M. Prilipko, TV Koval, N.V. Bukalova. - Kamyanskyi-Podilsky, 2020. - 653 p.
7. Nadia M. Bogatko, Natalia V. Bukalova, Vasil P. Lyasota, Lyudmyla P. Artemenko1, Leonid M. Bogatko, Tetiana . Bakhu., Tatiana M. Prilipko, Inna V.



Zabarna, Lubov B. Savchuk, Svetlana A. Tkachuk Some indices' determination of raw and pasteurized cow milk by ukrainian manufacturers using unique express methods Journal of Microbiology, Biotechnology and Food Sciences (JMBFS) August – September 2019, vol. 9, no. 1 MAIN WEB SITEISSUE

8. Tetiana Prylipko, Volodymyr Kostash, Viktor Fedoriv, Svitlana Lishchuk, Volodymyr Tkachuk. Control and Identification of Food Products Under EC Regulations and Standards. International Journal of Agricultural Extension.- Special Issue (02) 2021. p.83-91.

9. Prylipko, T.M., Prylipko, I.V. Task and priorities of public policy of Ukraine in food safety industries and international normative legal bases of food safety // Proceedings of the International Academic Congress «European Research Area: Status, Problems and Prospects» (Latvian Republic, Rīga, 01–02 September 2016).

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