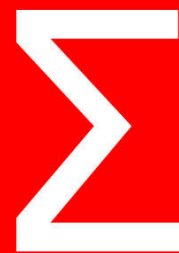


# ЛОГО



МИСТЕЦТВО НАУКОВОЇ ДУМКИ

ЗБІРНИК НАУКОВИХ ПРАЦЬ

ЗА МАТЕРІАЛАМИ МІЖНАРОДНОЇ НАУКОВО-ПРАКТИЧНОЇ КОНФЕРЕНЦІЇ

## ІННОВАЦІЙНИЙ РОЗВИТОК: ОСВІТА ТА НАУКА ХХІ СТОЛІТТЯ

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## СЕКЦІЯ 4. БІОЛОГІЧНІ НАУКИ

### ANTAGONISTIC EFFECT OF A MIXTURE OF BIOACTIVE COW'S COLOSTRUM FRAGMENTS ON PATHOGENIC MICROORGANISMS

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Colostrum is a complex biological fluid with high nutritional and energy value, containing biologically active and protective factors, that provides a reliable adaptation of a newborn child to the environment and protection against a range of pathogenic infections. Colostrum is produced by the mammary glands of mammals in late pregnancy and during the first 3 – 4 days after the delivery. For a new born, colostrum not only provides nutrition, but also provides protection against infection while immune system is still developing [1].

This «early» milk nutrient profile and immunological composition is found to be substantially different from 'mature' milk. Colostrum usually contains higher nutrients than normal mature milk, including total solids, protein and ash contents. The most remarkable difference between colostrum and normal milk is protein content, especially immunoglobulin content. The immunoglobulins contain antibody that can be absorbed by the newborn during its first day of life. After the first day, due to changes in the absorptive ability of the intestine, the digestive enzymes break down the globulins so that they lose their ability to protect the animal [2].

Colostrum contains 10 times as much vitamin A as mature milk. Colostrum also higher content of calcium, magnesium, phosphorus, and chlorine, and lower level of potassium than normal milk.

Bovine milk and colostrum are suggested to be the important sources of natural bioactive components. Since past two decades, major advances have been taken place with regard to the technology, science and commercial applications of bioactive components present naturally in bovine milk and colostrum.

Therefore, the bovine colostrum is recommended to be taken for the preservation and maintenance of a healthy lifestyle, so its medicinal properties could help heal the body and support the immune system.

**The purpose of this work** was confirmation of the value of colostrum as a nutrient and antibacterial product by determining the physical and

chemical parameters (protein content, density, titratable acidity) colostrum bovine animals, implementation of a compare the obtained of the results with the physical and chemical parameters of milk, which is manufactured according to DSTU 2661: 2010 and studying antibacterial properties of biologically active fragments colostrum in bacterial cells with the minimum inhibitory concentration (MIC) using the method of gradual twofold serial dilutions in liquid medium BCH, for the growth of bacterial cultures and the wort for yeast growth.

**Materials and methods.** Material of study were purified mixture of biologically active fragments from cows' colostrum. The samples were taken every morning starting from the first day of calving and for three days. Preparation of samples was made according to the following scheme which shown in Figure 1.

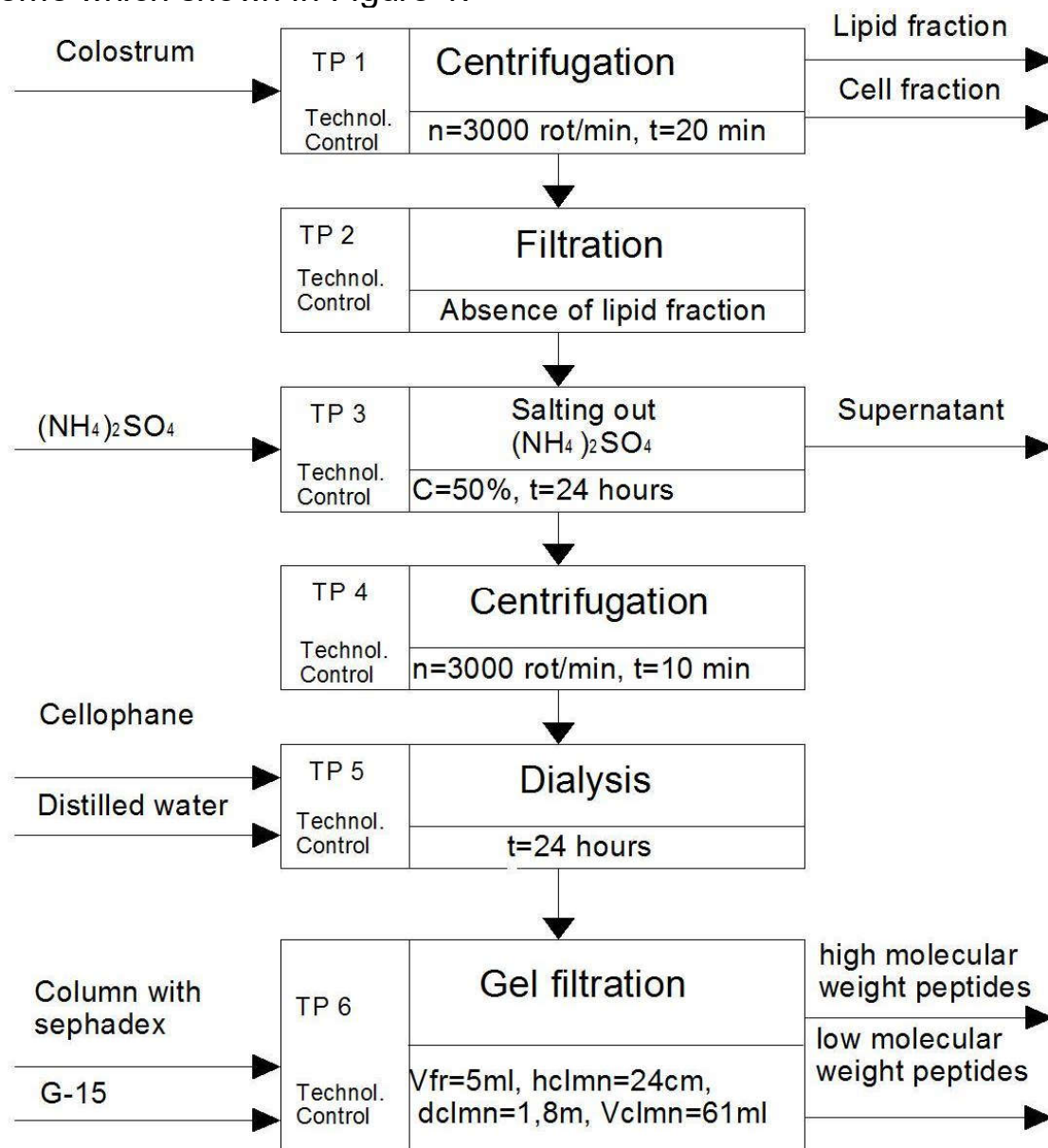


Fig. 1. Diagram for the extraction and refinement of the milk and colostrum bioactive fragments

During studies, we determined the density of samples in accordance with DSTU 3625-84 by the method of hydrometry using an AMT hydrometer. Determination of titratable acidity by titerometric analysis was carried out in accordance with DSTU 3624-92. The protein mass fraction in colostrum was determined in accordance with DSTU 25179-90 using AM-2 refractometer.

As the bacterial test cultures were used five types of bacteria: *Escherichia coli* IEM-1, *Bacillus subtilis* BT-2, *Staphylococcus aureus* BMS-1, *Acinetobacter calcoaceticus* K-4, *Enterobacter cloacae*, and two yeast cultures: *Candida albicans* D-6 i *Candida utilis*.

**Results.** The study of the density of cow's colostrum showed that the density of the first sample (the first day of calving) was the highest – 1055 kg m<sup>3</sup>, but the density was reducing by the day. These results suggest that the aforementioned samples contain a large amount of solids, such as proteins, fats, carbohydrates, microelements, which have a high nutritional value.

The next step of the study was to determine the titratable acidity of colostrum, which shows the freshness of the product. The titratable acidity of the 1st sample was 47°Th, 2nd – 35°Th, 3d sample – 28°Th.

Research shows that the protein mas fraction colostrum that protein mass fraction on the first day after calving was 5 times more than the control sample and was 15%, but the studied parameters decreased day by day and thereby the protein concentration was aligned, respectively: the protein content on the 2nd day was 8.8% and on the 3d day – 6.8%. Summarized results are presented in Table 1.

Table 1

### Physical and chemical properties of bovine colostrum and milk

Sample	Density, kg/m <sup>3</sup>	Titratable acidity, °Th	Protein mass fraction, %
1. 1st day (day of calving)	1055±5	47±3	15±1.5
2. 2nd day	1043±3.5	35±2	8.8±1
3. 3d day	1040±3.5	28±2	6.8±1
Control (milk according to DSTU 2661:2010)	1027	21	2.8

Based on the results obtained from the table above, it is safe to assert that in the colostrum contains several times more bioactive fragments required to maintain immunity, than milk (Fig. 2.). Therefore, the next stage of our work was the study of antimicrobial properties of bioactive components of cows' colostrum.

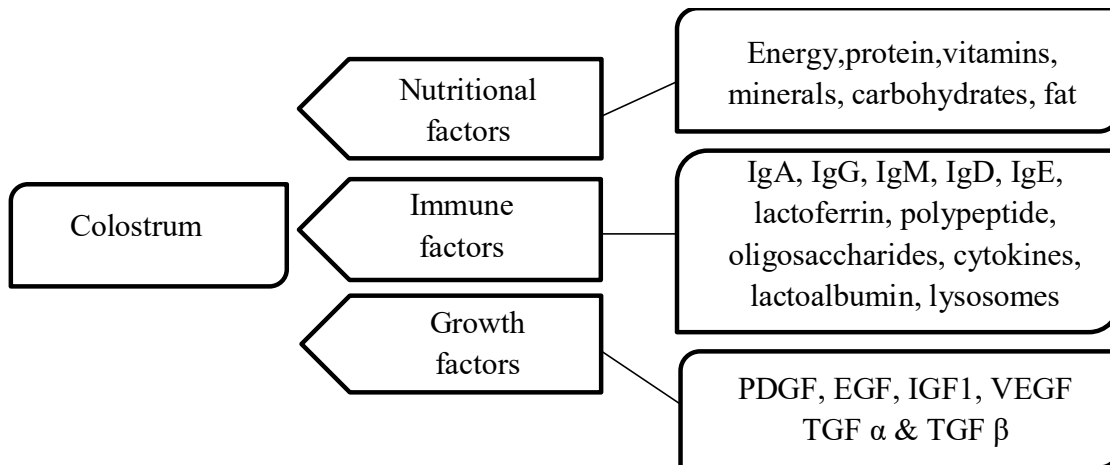


Fig. 2. Composition of Colostrum

Investigation of antimicrobial properties of colostrum based on the indicator of MIC showed that inhibition of Gram-negative test cultures is better – *E. coli* IEM-1 MIC was 39  $\mu\text{g/ml}$ , *Acinetobacter calcoaceticus* K-4 – 29  $\mu\text{g/ml}$ , *Enterobacter cloacae* – 19  $\mu\text{g/ml}$ .

Accordingly, the gram-positive microorganisms of the MIC are less susceptible, for which – *Staphylococcus aureus* BMS-1 – 58  $\mu\text{g/ml}$ , *Bacillus subtilis* – 160  $\mu\text{g/ml}$ . Inhibition of yeast cultures by peptides in cows' colostrum was not observed, which indicates non-susceptibility of *Candida albicans* D-6 and *Candida utilis* to the action of this drug. Summarized results are presented in Fig 3.

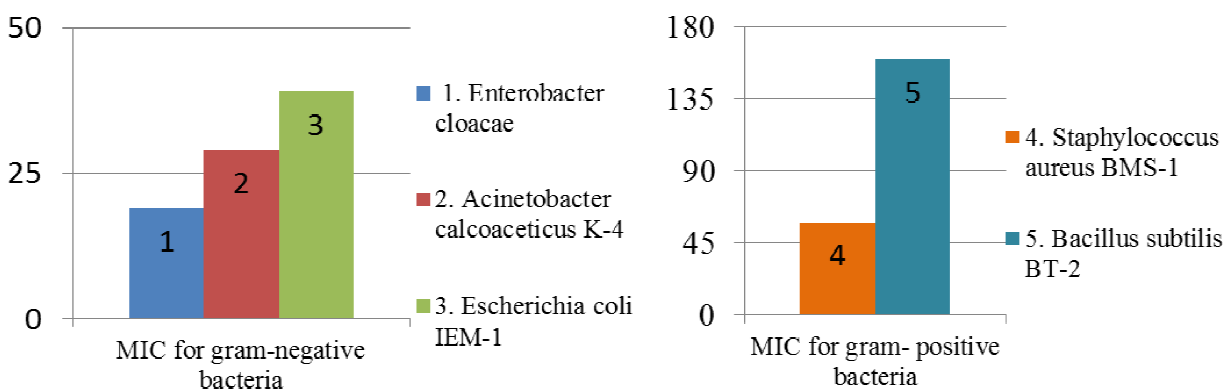


Fig 3. Influence of a mixture of biologically active peptides on microorganism cells

**Conclusions.** So, summing up the results it should be noted that the obtained results demonstrate the direct inhibitory effect of the mixture of bioactive fragments of colostrum on the cells of microorganisms, which leads to inhibition of their growth and development in vitro. In addition, it suppresses the development of pathogenic microorganisms due to the high acidity and due to the content of lysozyme, which dissolves the membranes of microorganisms. Thus, this study confirms the prospect for further study of the interaction of biologically active fragments with macroorganism under in vivo conditions, the creation of antimicrobial and prophylactic protein preparations of natural origin on the basis of colostrum, to which there is no resistance that will not cause allergic reactions, and will be safe even for children.

In addition it should be noted that it is possible to create lyophilized formulations or baby food products on the basis of bovine colostrum, as this valuable product contains a large amount of biologically active fragments, which are easily to digest and ensure creation of passive immunity for newborn.

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