

## FYZIOLOGIE ČLOVĚKA A ZVÍŘAT

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### THE ROLE OF COLOSTRUM IN NATIVE IMMUNITY

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 2 – 3 days after the delivery. It contains:

- various classes of immunoglobulins – IgA, IgG, IgD, IgE, IgM, 90% of which are IgA, catalytically active antibodies abzymes;
- cytokines providing intercellular interaction in the immune system (e.g., interferon)
- growth factors (epithelial, insulin-like, platelet-derived), that stimulate the growth of various tissues;
- lactoferrin preventing the growth of microorganisms [1], enhancing phagocytosis and increasing the effectiveness of the cytokines;
- nonspecific immunity factors (lysozyme)
- amino acids (proline is important for the regulatory peptides of immune system, taurine is necessary for brain development);
- proteins, fats, carbohydrates, vitamins (A,  $\beta$ -carotene, E, B<sub>12</sub>, D), minerals and other substances.

The consumption of colostrum provides forming the own immune system and passive immunity in the newborn's body. Such immunity persists as long as received antibodies circulate in the body, but this time is enough to make a child's immune system strong enough to cope with pathogenic agents and allergens on its own.

The bovine (cow) colostrum is not only energetically valuable product of immunonutrition, but also a good prevention of colds, that strengthens the immune system, helps to relieve the symptoms in case of joints diseases, osteochondrosis, sclerosis, diabetes, diseases of the digestive and cardiovascular systems, inflammation of the urinary tract, chronic fatigue syndrome, Alzheimer's disease.

In addition, the therapeutic properties of bovine colostrum are manifested in the aging processes, namely the bovine colostrum provides the human body with growth hormones and stimulates their production in the body in order to improve skin health and regeneration of cells and tissues. Colostrum also improves the intestinal tract health. Immunoglobulins and other substances containing in this biologically active substance, penetrate freely into the cell without being destructed. The growth factors inhibit inflammatory processes and restore the damaged cells in the intestine walls. The

healing process leads to the fact that the number of toxins entering the bloodstream through the intestinal wall is reduced, thereby improving the absorption of nutrients that provide the body with the necessary energy.

The bovine colostrum helps to neutralize harmful factors, thereby enhancing the immune system. The studies available for the present evidence of its positive influence in anti-tumor therapy, as its multifunctional structure inhibits the growth of cancer cells, facilitates the process of chemotherapy and improves its efficiency. In addition, the colostrum contains proteins, which prevent the formation of cancerous tumors – BC-1, BC-2.

Therefore, the bovine colostrum is recommended to take in order to preserve and maintain a healthy lifestyle, so its medicinal properties could help healing the body and support the immune system.

**The aim** of our study was to confirm the nutritional value of colostrum by determining the physico-chemical parameters (protein content, density, titratable acidity) of the bovine colostrum, as well as the implementation of a comparative analysis of the results obtained with the physico-chemical parameters of milk «Prostokvashyno» manufactured according to DSTU (State Standards of Ukraine) 2661:2010.

**Materials and methods used** in our study. Test samples were prepared from bovine colostrum. The samples were taken every morning starting from the first day of calving and for 3 days.

During the studies, we determined the density of the samples in accordance with DSTU 3625-84 by hydrometer method using AMT hydrometer with the scale graduation value of 1.0 kg/m<sup>3</sup>. Determining of the protein acidity (titratable acidity) by titrimetric analysis was performed according to DSTU 3624-92. The protein mass fraction in colostrum was determined in accordance with DSTU 25179-90 using AM-2 refractometer.

**Results and discussion thereof.** Density is one of the important indicators of the milk quality, which represents its naturalness. It is measured in g/cm<sup>3</sup>, kg/m<sup>3</sup> and hydrometer (H) degrees, a standard unit, which corresponds to the hundredths and thousandths of density expressed in g/cm<sup>3</sup>, kg/m<sup>3</sup>. The density of the control sample («Prostokvashyno» milk) in accordance with DSTU 2661:2010 is 1027 kg/m<sup>3</sup>. Before determining the density, the colostrum samples were heated to 35 ± 5 °C to melt the fat, then stirred, cooled to 20 ± 2 °C, and then the density was measured using a hydrometer. The study found that the density of the first sample (the first day of calving) was 1055 kg/m<sup>3</sup>, the sample No.2 (the second day after calving) – 1043kg/m<sup>3</sup>, and of the third sample (three days after calving) – 1040 kg/m<sup>3</sup>. 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, but the density is reduced by the day, so that the concentration of these substances gradually aligns.

The next step of the study was to determine the titratable acidity of milk. This indicator shows the freshness of the product. The acidic reaction is determined by the presence of proteins, acids salts of phosphoric, citric and other organic acids and gases dissolved in the milk. The acidity of the milk is measured in Therner degrees (°Th), which means 0.1 mol/dm<sup>3</sup> of aqueous sodium hydroxide solution required to neutralize

100 cm<sup>3</sup> of the product. The acidity of the test sample in accordance with DSTU 2661:2010 should be 21°Th. The following results were obtained during the experiment: the titratable acidity of the 1st sample is 47°Th, 2nd – 35°Th, 3d sample – 28°Th. This can be explained by the fact that along with decreasing of titratable acidity the amount of solids is reduced as well.

The third step of our study was to determine the most important indicator of the nutritional value – a mass fraction of milk protein. Milk proteins are some of the most important milk components, which are an indispensable part of the human diet and perform the function of a cell-building material for the whole body. Milk proteins are divided into two main components: casein – milk protein, which is about 80% of the total protein content and serum proteins representing about 20% of total protein. According to DSTU 2661:2010, the protein mass fraction of the milk «Prostokvashyno» (control) corresponds to 2.8%. Taking into account the results obtained, it should be noted that protein mass fraction on the first day after calving is 5 times more than the control sample and is 15%, but the studied parameters decreased day by day and thereby the protein concentration was aligned, respectively: the protein content on the 2nd day is 8.8% and on the 3d day – 6.8%. That is, it could be explained by the fact, that the colostrum contains several times more biologically active fragments required to maintain immunity, than milk. Summarized results are presented in Table 1.

Table 1

**Physico-chemical parameters 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 «Prostokvashyno»)	1027	21	2.8

**Conclusions.** Summarizing the results obtained, it should be noted that it is possible to create lyophilized formulations or baby food products on the basis of bovine colostrum for children who need artificial feeding, as such a valuable product contains a large amount of biologically active antibodies and abzymes, which are not only easily to digest, but also ensure creation of passive immunity of the newborn. In addition, the bovine colostrum has a bactericidal action due to the content of lysozyme, which dissolves the membranes of microorganisms. In addition, it suppresses the development of pathogenic microorganisms due to the high acidity and has a high nutritional value and exhibits excellent dietary properties.

Thus, colostrum is a kind of natural «vaccine» for children and people with weakened immune system against many viruses, bacteria and microorganisms, before which an immature immune system is absolutely helpless.

References:

1. Просеков А.Ю., Курбанова М.Г. Анализ состава и свойств белков молока с целью использования в различных отраслях пищевой промышленности // Техника и технология пищевых производств. – №4. – 2009. – с. 68-71.