

## STUDYING EFFECT OF FREEZE DRYING ON THE CHEMICAL COMPOSITION OF COW COLOSTRUM

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The article presents studies of the quality of cow colostrum. To date, a promising direction in the development of food functional products technology is the processing of cow colostrum as an additional source of protein, immunoglobulins, lipids, vitamins, minerals and other biologically active substances. It has been established that the physico-chemical composition of colostrum depends on the time elapsed since the calving of the cow. According to the conducted studies, it was found that the protein content is significantly higher in colostrum obtained immediately after calving than in colostrum collected after 24 hours and 36 hours after calving. The article provides data on the study of dry cow colostrum obtained by freeze-drying. In this regard, the authors of the article investigated the chemical composition of dry colostrum, namely, the concentration of protein, fat and ash was determined depending on the time of collection of colostrum. The authors found that colostrum obtained immediately after calving also has low humidity, which makes it possible to increase the shelf life. The article substantiates the ways of its subsequent use in the production of food products with high nutritional and biological value and possible immunomodulatory effect.

**Key words:** cow colostrum, dry colostrum, biologically active substances, proteins.

## ИССЛЕДОВАНИЕ ВЛИЯНИЯ СУБЛИМАЦИОННОЙ СУШКИ НА ХИМИЧЕСКИЙ СОСТАВ КОРОВЬЕГО МОЛОЗИВА

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В представленной статье рассмотрены исследования качества коровьего молозива. На сегодняшний день перспективным направлением развития технологии пищевых функциональных продуктов является переработка молозива коров как дополнительного источника белка, иммуноглобулинов, липидов, витаминов, минеральных и других биологически активных веществ. Установлено, что физико-химический состав молозива зависит от времени, прошедшего с момента отела коровы. В соответствии с проведенными исследованиями обнаружено, что содержание белка существенно выше в молозиве, полученном сразу после отела, чем в молозиве собранном после 24 часов и 36 часов с момента отела. В статье приводятся данные по исследованию сухого коровьего молозива, полученного методом сублимационной сушки. В связи с этим авторами статьи исследован химический состав сухого молозива, а именно определена концентрация белка, жира и золы в зависимости от времени сбора молозива. Авторами установлено, что молозиво, полученное сразу после отела имеет также низкую влажность, что дает возможность увеличения сроков хранения. В статье обоснованы пути последующего его использования в производстве пищевой продукции с высокой пищевой и биологической ценностью и возможным иммуномодулирующим действием.

**Ключевые слова:** коровье молозиво, сухое молозиво, биологически активные вещества, белки.

## СУБЛИМАЦИЯЛЫҚ КЕПТІРУДІҢ СИЫР УЫЗЫНЫҢ ХИМИЯЛЫҚ ҚҰРАМЫНА ӘСЕРІН ЗЕРТТЕУ

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Ұсынылған мақалада сиыр уызының сапасы туралы зерттеулер қарастырылған. Бүгінгі таңда тағамдық функционалды өнімдер технологиясын дамытудың перспективалы бағыты сиырдың уыз сүтін ақуыздың, иммуноглобулиндердің, липидтердің, дәрумендердің, минералды және басқа да биологиялық белсенді заттардың қосымша көзі ретінде өңдеу болып табылады. Уыздың физика-химиялық құрамы сиырды төлдегеннен кейінгі уақытқа байланысты екендігі анықталды. Жүргізілген зерттеулерге сәйкес, ақуыздың мөлшері төлдегеннен кейін бірден алынған уыз сүтінде төлдегеннен кейін 24 сағат 36 сағаттан кейін жиналған уыз сүтіне қарағанда айтарлықтай жоғары екендігі анықталды. Мақалада мұздатып кептіру әдісімен алынған құрғақ сиыр уызын зерттеу туралы мәліметтер келтірілген. Осыған байланысты мақала авторлары құрғақ уыздың химиялық құрамын зерттеді, атап айтқанда уыз сүтін жинау уақытына байланысты ақуыз, май және күл концентрациясы анықталды. Авторлар төлдегеннен кейін бірден алынған уыздың ылғалдылығы төмен екенін анықтады, бұл сақтау мерзімін ұзартуға мүмкіндік береді. Мақалада оны кейіннен тағамдық және биологиялық құндылығы жоғары және иммуномодуляциялық әсері бар тамақ өнімдерін өндіруде қолдану жолдары негізделген.

**Түйін сөздер:** сиыр уызы, құрғақ уыз, биологиялық белсенді заттар, ақуыздар.

**Introduction.** The nutraceuticals and functional foods market shows significant progress aimed to meet consumer demand. Nowadays, people are looking for new and safer food ingredients that become not only a source of nutrients, but also benefit health and ensure well-being. This concept draws consumers' attention to dietary biologically active compounds, nutraceuticals and functional foods.

One of the underestimated biologically active product with great potential is cow colostrum. Nowadays it is of great interest of scientists from all over the world [1]. Cow colostrum is a feed or abnormal milk, that rich in immunological agents, play the role of passive immunity in a newborn calf, guarantee of protection and help in the development of the gastrointestinal system [2]. Its composition rich in dry substances, proteins, immunoglobulins, fats and growth factors, which arouses interest in their use in the development of both pharmaceuticals and food derivatives [3].

A.G. Khramtsov et al. studied protective substances (antibacterial factors) of cow colostrum. The authors believe that colostrum is useful not only for newborn calves, but also for children, athletes, the elderly, patients with tuberculosis, stomach ulcers and diabetes [4]. It is known that colostrum contains in its composition a significant amount of

lactoferrin, lactoperoxidase and lysozyme, which have antimicrobial and antiviral properties. Lactoperoxidase affects the binding of liposaccharides by regulating bacterial growth, while lactoferrin has toxic properties for several gram-positive and negative bacteria, as well as antiviral properties. Meanwhile lysozyme affect to the health by attacking the peptidoglycan component of gram-positive bacteria, causing bacterial lysis [5]. By gaining such positive effects colostrum allow to destruct certain pathogenic microorganisms such as E. coli, rotavirus and cryptosporidium [6].

The use of colostrum remains limited not only due to insufficient research of this biologically active substance, but also due to its short shelf life. The technology of deep processing and obtaining acid preservation, dry concentrate on its basis, or isolation and purification of individual fractions without significant changes in composition and quality are expensive and time-consuming [7]. Due to the development of mini-refrigerators, the preservation and transportation market of colostrum, the processing point is not technically difficult anymore and ensures the preservation of all biologically valuable substances [8].

Thus, the above discussion approved that the direction of scientific research as the development of food products based on milk colostrum becomes

relevant.

The aim of the work was to study the physico-chemical parameters of colostrum of Simmental cows and compare the composition of natural colostrum and colostrum powder obtained by freeze drying.

**Materials and methods.** This part should consist of a description of the materials, the progress of the work, as well as a complete description of the used methods. The characterization or description of the research material includes the presentation of the specified material in qualitative and quantitative terms. The characteristic of the material is one of the factors determining the reliability of the conclusions and research methods.

Objects and methods of research

- colostrum of Simmental cows obtained after calving, after 24 hours and 36 hours

- dry colostrum obtained by freeze-drying in the laboratory.

The research of the physico-chemical composition was carried out in the research laboratory of the Food Technology and Processing Products department of the S. Seifullin Kazakh Agrotechnical Research University.

The following methods were used in the process of conducting the study:

- titrated acidity – according to State Standart 3624-92 "Milk and dairy products. Methods for determining titrated acidity"; [9].

-protein content in natural and dry colostrum – according to State Standart 25179-2014 "Milk and dairy products. Methods for determining the mass

fraction of protein";[10].

- fat content – according to State Standart 5867-90 "Milk and dairy products. Methods for determining fat";[11].

- moisture content on moisture meters RADWAG MA -60.3;

- lactose and solids content – on the TANGO BRUKER spectrophotometer with a measuring range of 11500-4000  $\text{cm}^{-1}$ .

**Results and discussion.** In order to determine the physico-chemical composition of cow colostrum, raw material were taken from the most common Simmental cow breed in the Akmola region. For the purity of the experiment, cows kept under equal conditions and received the same amount of feed while milking.

It has been established that cow colostrum is a breast milk of the mammary gland, produced after calving for enhanced feeding of the calf in the first days of life and providing it with a large number of antibodies for the formation of natural immunity. It is produced in the postpartum period during the next 7-10 days after calving. Young animals that received the first portion of colostrum within 1.5 hours after birth, up to 2 weeks, show relatively better growth rates and are immune to general dyspepsia and bronchopneumonia [12].

The first batch of colostrum was received within 3 hours after calving, then the second batch after 24 hours and the third batch after 36 hours. Visually, natural colostrum is a yellow-brown liquid on the first day of milking, which by the third day approaches the color of milk. The physico-chemical composition of natural cow colostrum is presented in Table 1.

Table 1- Physico-chemical composition of natural cow colostrum

№	Parameters	Colostrum after calving	Colostrum after 24 hours	Colostrum after 36 hours
1	Titrate acidity, 0 T	58	40	32
2	pH	4,92	6,41	6,49
3	Dry matters, %	19,17	10,8	10,04
4	Protein content, %	13,34	7,54	3,95
5	Lactose, %	5,54	4,76	4,51
6	Fat content, %	5,08	4,48	2,95
7	Moisture, %	63,976	78,588	79,731
8	Purity (group)	No less than II		
9	Temperature, 0 C	4*/-2		

According to the data given in Table 1, it was found that the results comply with State Standart R – 71167-2023 "Cow colostrum (raw materials).

Technical conditions"[13]. The data shows that the chemical composition of colostrum depends on the time of the cow's calving. According to the data,

after calving, the percentage of protein, fat and lactose is 13.34:5.08:5.54% compared with colostrum obtained on the second day of milking, which is 10.8:4.48:4.76%. According to the analysis data and based on the organoleptic properties, it was found that colostrum obtained after 36 hours after calving is close to the indicators of cow's milk and thus its study has no scientific interest.

Considering that colostrum can be stored at a temperature from 0 °C to 4 °C for up to 8 days, subject

to sanitary requirements, without significantly changing the nutritional value of colostrum. Colostrum was freeze-dried to preserve the biological and nutritional properties. Drying was carried out in laboratory conditions in Vacuum freeze-drier LG -06 at a temperature of - 50 °C and a pressure of 10 MPa.

In the resulting dry colostrum physico-chemical composition were assessed. The data are shown in Table 2.

Table 2 - Physico-chemical composition of dry cow colostrum

№	Parameters	Colostrum after calving	Colostrum after 24 hours	Colostrum after 36 hours
1	Titrate acidity, 0 T	57	42	35
2	Protein content, %	37,3	32,2	29,2
3	Lactose, %	5,5	4,7	4,1
4	Ashes, %	6,9	5,4	5,2
5	Fat content, %	39,7	32,2	28,3
6	Moisture, %	3,51	3,92	3,91

The resulting dry colostrum has real prospects for use as a functional ingredient in food products.

**Conclusions.** The results of studies of the chemical composition of colostrum prove the prospects of its use in the food industry as a source of protein of animal origin. However, it should be borne in mind that the maximum amount of biologically active substances is

stored in colostrum in the first hours after calving.

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