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B. Bimbetov[1], A. Zhangabylov[2], S. Aitbaeva[3], V. Benberin[1], H. Zollmann[4], A. Musaev[5], M. Rakhimzhanova[5], G. Esnazarova[2], A. Bakytzhanuly[3], N. Malaeva[1]

[1]RSE "Hospital of the Medical Center" of the Department of Affairs President of the Republic of Kazakhstan, Nur-Sultan, Kazakhstan,
[2]Kazakhstan-Russian Medical University, Almaty, Kazakhstan,
[3]JSC "Medical University of Astana", Nur-Sultan, Kazakhstan,
[4]"Kurgestüt Hoher Odenwald", Waldbrunn-Mülben, Germany,
[5]S. D. Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan,
[6]Corporate found of "University Medical Center", Nur-Sultan, Kazakhstan.
E-mail: bimbetov2010@mail.ru; czhanak@mail.ru; s.potai95@mail.ru; valeriy-benberin@mail.ru; h.zollmann@kurgestuet.de; musaev.dr@mail.ru; rakhimzhanova.m@gmail.com; esnazarova54@gmail.com; mantitort@mail.ru; nazga888@mail.ru;

MARE'S MILK: THERAPEUTIC AND DIETARY PROPERTIES (Review article)

Abstract. The review article is devoted to therapeutic and dietary properties of mare's milk. Literature review is carried out, historical facts of application of this product at various diseases and conditions are resulted, qualitative composition of milk and the research conducted by foreign and domestic authors about application of mare's milk medical-dietical product are described. Large-scale production of sublimated pasteurized mare's milk in Kazakhstan will give a new impetus to the expansion of clinical trials in various aspects and the use of this product with a long shelf life.

Keywords: mare's milk, therapeutic and dietary properties of mare's milk, sublimated mare's milk.

The unique health-improving properties of mare's milk and its derivatives have been known to people for a long time. Since ancient times, nomads called fresh mare's milk "Saumal" (Saumal in Kazakh language means fresh, paired milk). In addition to traditions and legends, confirmation of the unique beneficial properties of mare's milk and its derivatives are noted in ancient chronicles and medical treatises of Hippocrates and Abu Ali Ibn Sina, known in the west as Avicenna [1].

A team of British archaeologists reported that horses were domesticated a millennium earlier than previously thought. It was about 3500 BC on the territory of northern Kazakhstan. Scientists have found traces of mare's milk fat on ceramic dishes, which is proof that they even then used mare's milk as food. Saumal was not only drink by adults, but it also given to children. No only adults drunk Saumal, but it was aslo given to children [2, 3].

It was considered a healing and sacred product 3000 years ago in China. Hippocrates (circa 460-377 BC) also attributed the product its therapeutic properties, in particular, he considered it an effective remedy for consumption, i.e. tuberculosis. In the East, it was called "medicine blessed by Allah." Avicenna noted the healing effect and properties of mare's milk, together with its "amazing similarity to human nature" [1].

Legend has it that Cleopatra bathed in donkey's milk to soften and whiten her skin [4]. Recently, scientists have discovered that donkey milk is indistinguishable from mare. "Mare's milk is the strength of my warriors, the beauty of my women and the health of my children," said Genghis Khan [4]. There was even a special order issued by Chinghiz Khan: when his soldiers went on a campaign, they had to take two

water skins with them: with milk and koumiss. They drunk koumiss and added milk, which immediately began to ferment [5].

European literature considers mare's milk as a balm for digestive problems, an elixir for the liver, and a tonic for general malaise. It is a healthy food, which can reduce or completely prevent the symptoms of many diseases. It strengthens the body, boosts immunity, increases energy and stamina, which provides a better quality of life [4].

The value of the product is determined, first of all, by its chemical composition similar to that of maternal breast milk [4, 5]. In the 19th century, Russian doctor A.A. Ostorumov believed that mare's milk, as approaching in its composition to breast milk, is better assimilated. This is the basis for breastfeeding infants with mare's milk. During the Great Patriotic War in the sanatorium "Mtsyri" it was used to feed infants [6].

Freshly milked mare milk is a natural food product of bluish-white color, with a neutral reaction (pH 7.0-7.2), slightly tart and sweet taste, possessing high dietary and medical properties. In terms of protein quality, mare's milk, like breast milk, belongs to the so-called "albumin milk" because of the high content of albumin in relation to casein, according to different data, respectively, an average of 45:55, while in cow's milk this ratio is 15:85. Therefore, the coagulation of mare's milk does not form a dense clot, the protein falls into the sediment in the form of delicate small flakes [1].

The composition of mares' milk varies throughout the year and depends on the stage of lactation, feeding conditions and maintenance, as well as a number of other external factors, and is most complete in midsummer [1].

The total amount of protein in mare's milk is equal to 1.85-2.20%, and casein of mare's milk, unlike cow's milk, is easily dissolved in water, which indicates better digestibility, absorption and digestibility [1,4]. In addition, mare's milk proteins are well balanced in terms of amino acid composition, and there is no allergic reaction to it [7,8]. The amino acid composition of mare's milk is presented in table 1.

Table 1 – Amino Acid Composition of Mare's Milk Proteins

Indicators	Content (g/100 g protein)
Total Protein	1,93
Essential Amino Acids:	37,62
Lysine	8,24
Threonine	4,81
Valin	5,88
Methionine	0,65
Isoleucine	5,14
Leucine	7,56
Phenylalanine	5,34
Nonessential Amino Acids:	62,38
Histidine	2,72
Arginine	9,45
Asparagic acid	9,64
Serine	6,44
Glutamic acid	15,30
Prolene	7,20
Glycine	2,14
Alanine	4,63
Cystine	следы
Tyrosine	5,86
Total Amino Acids	**100,00**

Mare's milk also contains lactoferrin, lysozyme and immunoglobulin. Lysozyme and lactoferrin, which are components of the body's immune system, protect against pathogens and destroy them in the milk itself and the digestive system. In particular, lysozyme, which is 5% of total protein, plays a decisive role in the bactericidal action of mare's milk. In contrast, cow's milk contains six times less lysozyme. The content of lysozyme (mg / 100 ml): mare's milk - 80, breast milk - 50, cow's - 13. In addition to its enzymatic effect, lysozyme has anti-inflammatory, antiviral, immunostimulating, antitumor and anti-cancer properties [9, 10].

The study of lysozyme and amylase content in mare's milk showed their identity in breast milk, and in cow's milk, there were only traces of them (*t*able 2) [1, 4, 10].

Table 2 – Enzyme Composition of Milk

Dairy Product	Lysozyme, mg/l	Amylase, unit.
Breast Milk	60–250	26–98
Mare's Milk	64–126	32–64
Cow's Milk	Traces	–

In addition to lysozyme, mare's milk also containes other enzymes: amylase, catalase, lipase, peroxidase, phosphatase, malate and lactate dehydrogenase, lactotransferrin, which contribute to the digestive process and support the body's defense system. Lactoferrin in milk has an antibacterial and antioxidant effect, as well as a positive effect on inflammation and has an immunoregulatory function [9, 10].

Immunoglobulins – proteins of complex structure, which perform the function of immune protection of the body. Depending on the structure and properties of the immunoglobulin (Ig) contained in milk, divided into 5 main classes: Ig D, Ig E, Ig M, Ig A, Ig G. Milk is dominated by the fractions of the last three classes, which neutralize by viruses and toxins, prevent the fixation of bacteria on the surface of the epithelium and activate leukocyte phagocytosis [9,10]. The content of different Ig in milk varies and depends on the type of mammal, its age and other factors. For example, mare's milk contains about 20% Ig, which is 1% more than breast milk [10].

The composition of fat in mare's milk also differs in a number of ways. The fat of mare's milk is characterized by a higher biological value than that of cow's milk. Nutritionists have found that the lower the melting point of fat, the more fully it is absorbed and digested (the melting point of mare's milk's fat is 30 ° C, and of cow's milk's is 34 ° C). The fat of mare's milk is not stable, it is quickly oxidized and has a relatively high iodine number (Gyuble number) - 71.5. The iodine number of cow's milk varies between 25 and 35, depending on the type of feed, which also indicates the high therapeutic value of mare's milk lipids [11, 12].

All the above properties of mare's milk are conditioned by the fact that the fatty balls contained in it are rich in polyunsaturated acids (PUFAs), which are mainly represented by the essential fatty acids linolenic and linoleic. Their specific weight in the total fat molecule is 10-12%. Table 3 shows that these acids predominate in mare's milk, and then in breast milk. They are essential fatty acids and are not synthesized in the human body, and enter the body only with food [10, 11, 13].

Of the mono- and polyunsaturated fatty acids, the highest content in mare's milk was linoleic, linolenic, oleic, and palmitic acids (*t*able 3).

Table 3 – PUFA Content of Differnt Types of Milk
(in % of total fatty acids)

	Breast Milk	Mare's Milk	Cow's Milk
Linoleic Acid	13,0	14,9	2,4
Linolenic Acid	1,4	12,6	0,8

The content of monounsaturated fatty acids (MUFAs) is approximately equally represented in breast and mare's milk (table 4). MUFAs are partially synthesized in the human body. However, for the full course of metabolic processes, it is important to eat them daily with food [13, 14].

Table 4 – The content of monounsaturated fatty acids in various types of milk (in % to the total amount of fatty acids)

	Breast Milk	Mare's Milk	Cow's Milk
Palmitoleic Acid	5,7	7,8	2,3
Oleic Acid	46,4	20,9	29,8

The content of saturated fatty acids (SFAs) in higher in cow's milk than in mare's and breast milk (table 5).

Table 5 –Milk content of MFR in different typess of milk
(in % of total fatty acids)

	Breast Milk	Mare's Milk	Cow's Milk
Oil Acid	—	—	3,3
Capron Acid	traces	traces	1,6
Caprylic Acid	traces	1,8	1,3
Capric Acid	1,3	5,1	3,0
Lauric Acid	3,1	6,2	3,6
Myristinic Acid	5,1	5,7	9,5
Palmitin Acid	20,2	23,8	26,3
Stearic Acid	5,9	2,3	14,6

Thus, the qualitative differences in the physical properties of fat and fatty acid composition of mare's milk compared with cow's milk are more noticeable. This is especcially true for the physical properties of mare's milk fat, density, melting point and solidification, which are very important in nutrition, as well as for the content of mono-, polyunsaturated fatty acids, which characterize the high therapeutic value of milk fat. Their presence in the human diet is extremely important, since they are not synthesized in the body and have therapeutic and vitamin properties. Such fat in the stomach, intestines is easily emulsified, easier to digest, assimilate, the tension of digestive glands decreases [1, 13, 14].

Carbohydrates in mare's milk are mainly lactose, but a number of monosaccharides, particularly, glucose and maltose have been found in mare's milk during chromatography. It is known that milk sugar also differ in the structure of lactose. For example, breast milk predominantly contains β-lactoses, while cow's milk containes α-lactose. Thinking into account the similarity of mare's milk and breast's milk in terms of the total amount of carbohydrates, as well as other parameters of physicochemical properties, we can conclude that lactose of mare's milk consists mainly of β-lactoses [1, 15].

Table 6 – Lactose Content of Different Types of Milk (g/100 g)

	Lactose Content
Breast Milk	6,5
Mare's Milk	5,2

β-Lactose in the small intestine, in contrast to α-lactose, is absorbed more slowly, therefore it has time to enter the large intestine, where it stimulates the growth of microflora, mainly Gram-positive bacteria, characteristic of the intestine. Thus, β-lactoses in mare's milk has a bifidogenic effect, normalizing the microecological status of the intestine and is actually a bifido- and lactogenic prebiotic [1].

Mare's milk is unique for its vitamin and mineral composition, which is closest to the maternal breast milk. Saumal is rich in A, B, D, E vitamins, as well as vital trace elements (Ca, K, Na, I, Co, Zn, Mn, Cu, Fe, Al). It is the champion among animal products in terms of vitamin C content (250 ml is the daily dose for humans) [11]. Besides, Croatian scientists proved the presence of Cr, Li, Mo, Sb, Sr and Fr in the composition of Saumal [16].

Mare's milk contains more vitamins E, B, B12, and niacin than cow's milk. The physiological combination of these vitamins with ascorbic acid is probably one of the mechanisms of the beneficial effect of Saumal on chronic diseases [1, 10].

Thus, the above mentioned qualitative composition of mare's milk allows to make a conclusion that the unique and optimally balanced composition of biological components of Saumal makes this product an important complex component of the prevention and treatment of a wide range of diseases with different etiologies. Saumal can contribute to the restoration of impaired functions of damaged organs, tissues, and play a pathogenetic role, especially in chronic diseases of the digestive system.

According to the leading scientists of Kazakhstan and European countries, Saumal has an incredible potential in the treatment of the most common diseases of the digestive system. It is considered a therapeutic product and is used in the treatment of metabolic disorders, as a means of preventing colds and curing cancer. Mare's milk improves blood circulation, increases male potency, accelerates the process of organ regeneration, increases hemoglobin, regulates the immune status, slows down the aging process.

Healing drink is recommended for diseases of the stomach, liver, intestines, skin, immune system disorders, treatment of peptic ulcer disease. Positive results were obtained by using whole mare's milk in the treatment of patients with chronic hepatitis.

Further, we present examples of recent clinical studies on the therapeutic properties of mare's milk. In 2005, a study was carried out with patients suffering from eczema at the Jena University Dermatological Clinic (Germany). The effect of mare's milk on the severity of eczema, intestinal microflora and on immunological parameters was studied. Patients took 250 ml of Mare's milk daily in control from placebo for 16 weeks. As a result, the symptoms (itching and hyperemia) of the disease faded in 1/3 of the study participants up to 30–55%. In these patients, the proportion of bifidobacteria in the stool increased 8 times. Thanks to regular consumption of mare's milk, some patients were able to reduce or even stop taking their medicine [10, 12].

In 2009, patients with Crohn's disease and ulcerative colitis (University of Jena, Germany) participated in the clinical study. During 8 weeks the young participants took 250 ml of mare's milk two times a day in the control with placebo. As a result, mare's milk helped to calm the pain, reduce the amount of blood in the stool, and reduce the consumption of essential medicines [10, 12].

In an anonymous questionnaire survey on the intake of mare's milk from 500 respondents who regularly took Saumal for a long time, doctors confirmed the efficacy of mare's milk intake in skin and intestinal diseases. Consumers with skin diseases in 91% of cases showed improvement: inflammation decreased, itching calmed down, and sleep improved. Also, 74% of patients with intestinal, respiratory, liver, cancer, cardiovascular and other diseases had positive effects. Thanks to regular consumption of mare's milk, some patients were able to reduce or even stop taking their medication [10, 12].

European experts state on the basis of research that “Mare's milk is one of the healthiest and most nutritious and healthy drinks that nature has to offer us”.

Despite the fact that mare's milk is recognized as a dietary and therapeutic product all over the world, there are currently no large-scale clinical and research works on therapeutic properties of mare's milk in the literature. The possibilities of using mare's milk in the diet therapy of specific nosological forms have not been studied at all, in particular, in the pathology of the cardiovascular system, digestive organs, hepatobiliary system and urological diseases [1]. The reason for this may be not only the poor awareness of the therapeutic properties of mare's milk among the medical and scientific community, but also the instability of the product itself. Mare's milk after milking, when exposed to air, begins to oxidize, and after 3-4 hours (at room temperature) it becomes no longer suitable for consumption [1]. Therefore, new technologies for the production of mare's milk are now required, while preserving therapeutic and dietary qualities of the product for the long term.

The solution to this issue is to create a sublimated pasteurized mare's milk, which has a long shelf life, even at room temperature. The process of sublimation is that the mare's milk is frozen at a temperature of -55 °C, and then ice under certain conditions, bypassing the liquid phase, evaporated, i.e. there is a certain canning of mare's milk with the help of negative temperatures. At the same time, the qualitative composition of mare's milk is preserved to the maximum extent, respectively, and its therapeutic property. In addition, the dried mare's milk quickly recovers when dissolved in water in certain proportions.

Pasteurization helps to ensure product safety not only for adults, but also for children and pregnant women. Currently, this sublimated mare's milk is produced by Kazakhstani entrepreneurs of Eurasia Invest Ltd LLP, which is implementing a large-scale program for the production of mare's milk with the participation of a large German horse-breeding company Hans Zollmann. Each process of production of biomilk in this company is certified, and the products fully comply with European quality standards [17].

The benefits of Sublimated Mare's Milk (SMM) have been proven by numerous clinical and laboratory studies by reputable international medical organizations. National Research Medical Organizations of Kazakhstan confirm the conclusions of their foreign colleagues. Clinical studies of the therapeutic and dietary properties of SMM in non-alcoholic steatohepatitis, cirrhosis of the liver of various etiologies, psoriasis, and pediatrics are currently being conducted in the country. The results of the study after the completion will be published in domestic and foreign literary sources.

People who have already tried SMM note its effective impact in everyday life in the form of the normalizing the stool, improving the quality of sleep and appetite, and feeling vivacity. The general tonic effect of mare's milk allows it to be used in the so-called “chronic fatigue syndrome”, in recovery from injuries, operations (or in preparation for them), intensive sports training, etc.

SMM is also applicable in cosmrtology – regular consumption of mare's milk strengthens the hair follicle, improves hair structure, gives shine and volume, accelerates growth. Regulat consumption of the product normolizes the function of the sebaceous glands, improves skin elasticity and color.

Thus, the study of therapeutic and dietary properties of mare's milk will continue not only abroad, but also in its historical homeland – Kazakhstan. Systematic ingestion of mare's milk in the diet can increase the effectiveness of treatment and prevention of various diseases, improve the immune system function, prevent cancer and prolong active longevity.

Б. Р. Бимбетов[1], А. К. Жангабылов[2], С. Е. Айтбаева[3], В. В. Бенберин[1], Г. Цольман[4], А. Т. Мусаев[5], М. К. Рахимжанова[6], Г. С. Есназарова[2], А. Бақытжанұлы[3], Н. С. Малаева[1]

[1]РГП “Больница медицинского центра» Управления делами Президента РК, Нур-Султан, Казахстан,
[2]Казахстанско-Российский медицинский университет, Алматы, Казахстан,
[3]АО «Медицинский университет Астана», Нур-Султан, Казахстан,
[4]"Kurgestüt Hoher Odenwald", Вальдбрунн-Мюльбен, Германия,
[5]Казахский национальный медицинский университет
им. С. Д. Асфендиярова, Алматы, , Казахстан,
[6]Коорпоративный фонд «University Medical Center», Нур-Султан, Казахстан

КОБЫЛЬЕ МОЛОКО: ЛЕЧЕБНО-ДИЕТИЧЕСКИЕ СВОЙСТВА
(обзорная статья)

Аннотация. Обзорная статья посвящена лечебно-диетическим свойствам кобыльего молока. Проведен литературный обзор, приведены исторические факты применения данного продукта при различных заболеваниях и состояниях, описаны качественный состав молока и проведенные научные исследования зарубежных и отечественных авторов о применении кобыльего молока как лечебно-диетического продукта. Масштабное производство сублимированного пастеризованного кобыльего молока в Казахстане даст новый толчок в расширении проведения клинических исследований в различных аспектах и применении данного продукта с длительным сроком хранения.

Ключевые слова: кобылье молоко, лечебно-диетические свойства кобыльего молока, сублимированное кобылье молоко.

Б. Р. Биімбетов[1], А. К. Жанғабылов[2], С. Е. Айтбаева[3], В. В. Бенберин[1], Г. Цольман[4], А. Т. Мусаев[5], М. К. Рахимжанова[6], Г. С. Есназарова[2], А. Бақытжанұлы[3], Н. С. Малаева[1]

[1]ҚР Президенті Іс басқармасының РМК «Медициналық орталық ауруханасы», Нұр-Сұлтан, Қазақстан,
[2]Қазақстан-Ресей медицина университеті, Алматы, Қазақстан,
[3]«Астана медицина Университеті» АҚ, Нұр-Сұлтан, Қазақстан,
[4]«Kurgestüt Hoher Odenwald», Вальдбрунн-Мюльбен, Германия,
[5]С. Д. Асфендияров атындағы Қазақ ұлттық медицина университеті, Алматы, Қазақстан,
[6]«University Medical Center» Коорпоративтік қоры, Нұр-Сұлтан, Қазақстан

БИЕ СҮТІ: ЕМДІК ҚАСИЕТТЕРІ (шолу мақала)

Аннотация. Мақала бие сүтінің емдік қасиеті жайында, әдеби шолу жасалған. Саумалды әртүрлі сырқаттар мен жағдайлар кезінде қолдану жөнінде маңызды тарихи деректер келтірілген. Бие сүтінің құрамы

мен ол жайында отандық және шет елдік ғалымдардың оның емдік қасиеті жайында жүргізген ғылыми зерттеу жұмыстары жайында мәліметтер келтірілген. Қазақстанда ірі көлемде сублимацияланған және пастерленген құрғақ бие сүтін өндіру зор маңызға ие. Бұл технология саумалдың сақтау мерзімін ұзартып қана қоймай, әр түрлі саладағы клиникалық зерттеу жұмыстарын кең көлемде жүргізуге септігін тигізеді.

Түйін сөздер: бие сүті, бие сүтінің емдік қасиеті, сублимацияланған бие сүті.

Information about authors:

Bimbetov Bakytzhan Riskulovich, MD, professor. RSE "Hospital of the Medical Center" of the Department of Affairs President of the Republic of Kazakhstan, Nur-Sultan, Kazakhstan; bimbetov2010@mail.ru

Zhangabylov Abay Zn., MD, professor, head of the Department of internal diseases of Kazakh-Russian medical university, Almaty, Kazakhstan; czhanak@mail.ru; https://orcid.org/0000-0002-0803-9802

Aitbaeva Saule E., PhD, docent of the Department of preventive medicine and nutrition of JSC «Medical University of Astana», Nur-Sultan, Kazakhstan; s.potai95@mail.ru; https://orcid.org/0000-0002-1309-286X

Benberin Valery V., MD, professor, Head of the «Hospital of the Medical Center of the Department of Affairs President of the Republic of Kazakhstan», Nur-Sultan, Kazakhstan; valeriy-benberin@mail.ru; https://orcid.org/0000-0002-7286-1593

Zollmann Hans, Head of the Company «Kurgestüt Hoher Odenwald», Waldbrunn-Mülben, Germany; h.zollmann@kurgestuet.de; https://orcid.org/0000-0003-4304-1905

Musaev Abdugani T., professor of "Emergency Medical Care" S.D. Asfendiyarov Kazakh National Medical University, Almaty, Kazakhstan; musaev.dr@mail.ru; https://orcid.org/0000-0001-7782-6255

Rakhimzhanova Marzhan K., therapist of the Corporate found of «University Medical Center», Nur-Sultan, Kazakhstan; rakhimzhanova.m@gmail.com; https://orcid.org/0000-0001-5127-9599

Esnazarova Gulnar S., docent of the Department of internal diseases of Kazakh-Russian medical university, Almaty, Kazakhstan; esnazarova54@gmail.com; https://orcid.org/0000-0002-4624-8357

Bakytzhanuly Abay, therapist, doctoral student PhD of the JSC "Medical University of Astana", Nur-Sultan, Kazakhstan; mantitort@mail.ru; https://orcid.org/0000-0001-7816-7327

Malaeva Nazgul S., gastroenterologist of the Hospital of the Medical Center" of the Department of Affairs President of the Republic of Kazakhstan, Nur-Sultan, Kazakhstan; nazga888@mail.ru; https://orcid.org/0000-0003-4976-9526

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