

# HEALTH RESOURCE OF THE CAUCASUS: KOUMISS

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## ABSTRACT

Koumiss (Koumiss, koumiss, or kumys) has been popular in Kyrgyzstan, Kazakhstan, Mongolia, and the Turkic, Mongolian, and Caucasian peoples of Russia: Altay, Bashkortostan, Buryatia, Dagestan, Kabardino-Balkaria, Kalmykia, Karachaevo-Cherkessia, Tatarstan, Tyva, Chuvashia, and Saha (Yakutia). Koumiss therapy services is offered in many countries of several Central Asian nations by small and medium-sized accommodation enterprises which are especially active in rural locations.

Koumiss was considered a functional food, not only providing rich nutrients, but also due to its medicinal properties. It has a very high nutritional value, as it contains fat, protein, vitamins, amino acids, carbohydrates, and minerals. Consumption of Koumiss has a number of health benefits, including being high in probiotics, having antibacterial and antifungal properties, regulating immunity, maintaining a healthy gastric-intestinal system, regulating cholesterol (CHOL) and sugar levels, regulating blood pressure, attenuating lactose intolerance, and inducing the production of some essential vitamins. The purpose of this review is to provide a concise overview of koumiss' health advantages.

*Keywords: mare milk, beneficial, health, koumiss,*

## 1. INTRODUCTION

Koumiss has long been regarded as a valuable food item and a beverage with powerful therapeutic effects. The Mare appeared more than 5000 years after the domestication of horses by nomadic tribes. Archaeological expeditions carried out in Mongolia, and Central Asia revealed leather remains with Mare's milk remnants. However, they kept the secret of the Koumiss for a long time, and strangers who accidentally learned the technology of preparation of the drink were blinded. Koumiss is a traditional drink and folk medicine in Bashkiria, Kazakhstan, Mongolia, Uzbekistan, Kyrgyzstan, Tatarstan, Kalmykia, and Yakutia. A koumiss-like product in Europe and North America is made from full or skimmed cow's milk [1, 2]. According to the Central Asian Turks, Koumiss is a drink that increases the courage of the brave, inspires the poets, uproots hopelessness and bad thoughts, and gives vigor and joy to the body. The Kyrgyz expressed the importance of Koumiss in terms of health by saying that "whoever drinks Koumiss will not even have cold sores." It is reported that it was accepted as "the drink of the gods" by the Turks and served to the gods [3, 4, 5].

Franciscan friar Plano Carpini pointed to mare's milk – koumiss in nutritional Mongols in the XIII century. William de Rubruck also gave a detailed description of koumiss, which he called «cosmos.» Marco Polo called koumiss «milk-wine». In France, koumiss is called «milk-champagne» because of gas, which made koumiss brilliant. The end of the seventeenth

century saw a resurgence of interest in Koumiss throughout Western Europe. In the 2nd half of the XIX century, mare's milk as a product of opening Western travelers often uses Russian doctors to treat tuberculosis and diarrheal diseases. Koumiss' medicinal use in Europe and France began in the 1870s[6].

Foreign researcher's origin of the word «koumiss» interpreted as follows: «The etymology of word koumiss seems to date back to the word «Cumans» militant nomadic peoples who inhabited the area between Tibet and Bukhara, on the banks of the Kuma River. The people, the Mongols conquered, inherited many of the traditions and customs, including and use koumiss». Vary the spelling and pronunciation of the word: «chumis, chemius, koumys, koumis, koumiss, kumis, krumis» [6].

The nutritional components of koumiss are very rich and include fat, protein, vitamins, amino acids, carbohydrates, and trace mineral elements [7]. Traditionally, it was considered a functional food, not only providing rich nutrients, but also due to its medicinal properties. It is considered to be beneficial in postoperative care [8]. Koumiss is sour, bubbly, mildly alcoholic. The lactic acid bacteria that convert lactose to lactic acid and the yeast that convert sugar to carbon dioxide and ethyl alcohol are the most important microorganisms in koumiss. This beverage usually contains about 2% alcohol, 0.5–1.5% lactic acid, 2-4% lactose, and 2% fat [9,10,11,12,13]. Carbon dioxide formed from fermentation gives the product a foamy structure similar to soda or champagne [14,15]. It is also high in vitamins C, A, E, D, B<sub>1</sub>, B<sub>2</sub>, B<sub>12</sub>, as well as trace minerals and antibiotics [10, 16].

## **2. KOUMISS TREATMENT PRACTICES AROUND THE WORLD**

Today, Koumiss therapy services is offered in many countries of several Central Asian nations by small and medium-sized accommodation enterprises which are especially active in rural locations. In this regard, one of the primary travel objectives for tourists seeking koumiss treatment is to seek medical treatment in order to find a solution to their varied discomforts. As a result, it is not incorrect to classify koumiss treatment as a phenomenon falling under the purview of medical tourism [17].

In Kyrgyzstan, Kazakhstan, China, Mongolia, Tatarstan, and Russia, the "Koumiss therapy method" and "Koumiss therapy center" were established to aid in treating hepatitis, chronic ulcers, and tuberculosis. The koumiss treatment centers in these countries have been observed to boost their activity, notably during the spring months. Patients with liver and stomach diseases from other nations are housed in hotels near small horse farms on the tablelands. They take koumiss treatment for one week by drinking four times a day horse milk. However, Koumiss therapy is not as common today as it was 100-150 years ago [17, 18, 19]

In Kyrgyzstan, Koumiss treatment or Koumiss therapy begins in the second part of May and lasts two to four months. Kyrgyzstan has about 17 koumiss treatment clinics. Koumiss therapy is predominantly found in the Chuy area, which also contains Bishkek. The cost of these services is dependent on the level of service provided. Daily prices in a typical facility range from 1500 to 2000 Som (about 21 to 29 dollars), with fees as high as 19000 Som (approximately 280 dollars). These prices are per person and include a package that includes lodging, three meals each day (breakfast, lunch, and dinner), and five times daily koumiss consumption. 7-10 days is the suggested treatment period for koumiss therapy to be effective [20, 21].

In Kazakhstan, another Central Asian country, the first koumiss treatment hospital was established in Bogdanovka village in Samara state in 1854. The use of koumiss for treatment was discovered in Kazak steppes dating back 5500 years. Nomads have been

developing koumiss technology for generations, but it has been kept secret. During the antique period, Kazakhs were known to employ kumiss to treat tuberculosis. Bashkortostan, Chernobinskiy Region, Southern Ural, Volga Region, and Salsk Steppe have all seen an increase in Koumiss treatment clinics. A good example is the Yumatova sanatorium in Bashkortostan. This kumiss institution, which first opened in 1934, has managed to stay in business until now [22].

In Inner Mongolia of China and other countries, such as Bashkortostan, Kazakhstan, Krygzstan, Uzbekistan, and Ukraine, they are nursing homes or medical centers treating patient with koumiss [23]. There were centers effectively using koumiss therapy to treat lung ailments, notably tuberculosis, and to strengthen the body in the middle of the 19th century in south Russia, primarily in the region of Samara and Orenburg, as well as Moscow and Saint Petersburg [8].

In Europe, there are also Koumiss therapy examples. During World War II, the German B. Zollman was kidnapped by the Russians and contracted tuberculosis at the Karlag work camp in Russia. When Zollmann was close to dying of tuberculosis after being liberated, a Kazakh shepherd took him to a village and treated him with koumiss. In Germany, Zollmann developed a farm with 400 mares and began producing koumiss. Furthermore, another German soldier, R. Storch, who Russians captured during World War II, reported that he witnessed sanatoriums in Russia where koumiss was used to cure ailments including tuberculosis and pneumonia. Storch bought a mare and constructed a koumiss sanatorium when he returned to Germany [22].

### **3. HEALTH BENEFITS OF KOUMISS**

As a functional food ingredient, Koumiss has sparked increased interest at the industrial level due to its favorable effects in treating a variety of health conditions [15,24].

The koumiss cure's origins can be traced back to the late eighteenth century when Russian and Western European physicians were interested in koumiss as a tuberculosis treatment. Koumiss treatments were used on Anton Chekhov and Count Leo Tolstoy. Chekhov was pessimistic about the prospect. Chekhov chose the steppe koumiss cure after a professional told him his illness was so bad that he had to choose between death, a Swiss sanatorium, or a steppe koumiss cure in 1901 [25].

The report published by the Scotchman Griwin 1784, who was in charge of the Russian army, was the first scientific understanding of the chemical structure of Koumiss. However, before this account, W. Rubrikas, a Frenchman who journeyed to the region where Tatar Turks lived in 1253, provided information on how Koumiss was manufactured, its flavor, intoxicating properties, and health consequences. Before this, When discussing the Scythians, Herodotus asserted that they acquired spirit from mare's milk. However, following Herodotus, no Western source mentions Koumiss until the 12th century. Thus, Koumiss was first recorded in Russian chronicles after the 12th century [17, 26].

Koumiss has been utilized to treat anemia, emaciation, and tuberculosis sickness for over a century. During the 1800s, Koumiss became known worldwide as a wonder drug, and koumiss treatment sanatoriums were constructed in Russia[26].

Koumiss is a traditional beverage made from unpasteurized fresh mare milk fermented by yeasts and other microorganisms, and has beneficial influences on treating several diseases, such as cardiovascular disease, digestive disease, tuberculosis, diabetes and

diarrhea [27, 28]. Yeasts are the main microorganisms in Koumiss, playing an important role in Koumiss fermentation and endowing them with its therapeutic effects [29, 30].

### **3.1 TREATING TUBERCULOSIS**

During the Union of Soviet Socialist Republics, sanatoriums were known to adopt treatments in which a few liters of koumiss were drunk daily to treat tuberculosis sickness. After his investigation, which looked into the therapeutic effect of Koumiss for nausea and vomiting, Tegin and Gonulalan[15] concluded that koumiss can be used effectively to treat nausea and vomiting.

In the former Soviet Union, Koumiss is used as a therapeutic drink, mostly to treat tuberculosis. N. Zeland, a military doctor, described its anti-tuberculosis action in 1861 [4].

Postnikkov opened the first hospital (sanatorium) to provide treatment with Koumiss in Samara in 1858. Berlin [31] reported that 1000 patients were cured with Koumiss in nearly 50 sanatoriums in the former USSR in 1962, and 3500 mares were fed in sanatoriums for this purpose.

Mongolian doctors initially utilized Koumiss to treat tuberculosis and incorporated it into their clinical methods. Every summer and autumn at the Ximeng Mongolian Medical Research Institute, Koumiss effectively used to heal tuberculosis. The use of Koumiss in clinical practice to treat tuberculosis patients has resulted in a 60-91 percent rate of recovery, which has been confirmed by lab procedures such as X-rays and tuberculosis tests, and the elimination of symptoms is an indication of good treatment [32].

### **3.2. TREATING CARDIOVASCULAR DISEASES**

Koumiss is used to treat cardiovascular illnesses in Europe, mainly in France, Italy, Hungary, the Netherlands, Russia, and Mongolia [33].

Akhmetova and Enikeeva (1980)[34] investigated the use of Koumiss in the treatment of individuals with cardiovascular blockage. Individuals who consumed Koumiss had their cholesterol levels drop by 10%, whereas those who did not drink it decreased by 6.9%. Furthermore, because Koumiss is high in anti-arteriosclerosis amino acids, including lysine, tyrosine, tryptophan, and glutamic acid, it is a substance used to treat cardiovascular problems [4, 35,36,37]

High blood pressure is linked to the development of cardiovascular and renal end-stage illnesses. According to Zha et al. [38] regular use of Koumiss lowers blood cholesterol levels and regulates the growth of blood lipids. In addition, Chen et al.[39] discovered four new angiotensin I-converting enzyme-inhibitory peptides in Koumiss, which could help to boost the favorable effects on cardiovascular health.

### **3.3.TREATMENT OF DIGESTIVE SYSTEM DISEASE**

Koumiss was used to treat 130 patients with stomach and 28 duodenal ulcers in the Yumatova Sanatorium between 1966 and 1974. As a result of the studies, it was determined that the patients who used Koumiss in their treatment recovered faster [40].

Consumption of Koumiss increases the secretion of gastric juices and accelerates stomach and intestinal movements. For this reason, individuals who drink Koumiss increase their

appetite, increase the level of benefiting from nutrients, and have a desire to urinate more [41].

On the walls of the stomach and intestine, the bacteria in Koumiss create a biological barrier. As a result, the microecological environment stops hazardous bacteria from growing. In addition, microorganisms produce an antibiotic substance that can clean and kill bacteria that have been degraded [42].

### **3.4.TREATMENT CHRONIC ATROPHIC GASTRITIS**

Chronic atrophic gastritis (CAG), a chronic inflammation of the stomach mucosa, is distinguished by the replacement of gastric glandular cells by intestine-type epithelia, pyloric-type glands, and fibrous structures. CAG is a common but hazardous gastrointestinal condition that can lead to major problems such as stomach bleeding, anemia, peptic ulcers, and even peptic cancer [43].

The current study involved 10 female patients aged 41-55 to explore the therapeutic efficacy of koumiss on CAG. Each patient consumed three daily servings of koumiss during the 60-day therapy period (each of 250 ml). We first confirmed that koumiss treatment was successful in reducing the patients' symptoms and maybe improving CAG based on the patients' symptoms ratings. The current study next looked at the koumiss microbiome, as well as changes in the fecal microbiota and several blood markers in CAG patients before and after koumiss treatment [42]

Since 2013, the Inner Mongolia XilinGol League Mongolian Hospital has undertaken long-term clinical trials, giving koumiss to CAG patients on a voluntary basis, and has noticed a strong therapeutic efficacy in lowering CAG [42].

### **3.5.TREATMENT OF NEUROLOGICAL DISEASES**

Koumiss contains a number of important and uncommon chemicals (B1, B2, and C vitamin) that are required for the proper functioning of neurological systems. Furthermore, Koumiss can improve blood circulation and blood supply functions in the brain. As a result, it can be used to treat a wide range of neurological and intestinal conditions[44].

### **3.6.TREATMENT of DIABETES**

Diabetes mellitus is a metabolic condition marked by hyperglycemia, or elevated blood glucose levels, caused by insulin secretion, insulin action, or both. Long-term damage, oxidative malfunction, and failure of different organs, particularly the eyes, kidneys, nerves, heart, and blood vessels, are all linked to type 2 diabetes' persistent hyperglycemia. Hyperglycemia has also been connected to high blood pressure [45].

The current research indicates that koumiss therapy is beneficial to people with hyperlipidemia. These positive benefits were linked not only to the composition, microbiota, and metabolites of koumiss, but also to the role that koumiss played in rebuilding the gut microbiota of the patients[46].

Since 2013, clinical trials at the Inner Mongolia XilinGol hospital have provided koumiss to hyperlipidemic patients on a voluntary basis, with symptom alleviation outcomes. According to the results of a small-scale pilot clinical investigation involving 11 hyperlipidemic patients, drinking fresh mares' milk did not have similar therapeutic effects (unpublished data). Koumiss is a fermented product with a wide variety of microorganisms and microbial

metabolites. Thus, the koumiss microbiota and metabolome delivered therapeutic effects via alteration of the hostgutmicrobiota[47]. Koumiss regulates sugar metabolism by lowering blood sugar levels and increasing insulin secretion [12]

### 3.7.TREATMENT OF CHLOASMA

Koumiss is used not only internally but also externally. They can cure boils, acne, and festering wounds. Koumiss also improves the overall condition of problem skin and even has a rejuvenating effect, especially for the face and neck. Koumiss has a beautiful impact as well. It can be used to moisturize the skin, remove dark scars and spots, smooth the skin, and make it white and silky. To treat chloasma, Inner Mongolia Hospital used koumiss to manufacture face lotions and masks. The skin of the patient became soft, white, smooth, and flexible after using Koumiss. It has a high level of efficiency on the skin, with total effectiveness of 95% [48].

### 3.8. ANTIMICROBIAL PROPERTIES

The yeast *Saccharomyces cerevisiae* from koumiss has been shown to have antibacterial effects on *Escherichia coli*, possibly by producing antibacterial compound in metabolism. Koumiss has beneficial therapeutic effects on bacterial diseases. Four antibacterial compounds from yeasts (*Kluyveromyces marxianus* and *Saccharomyces cerevisiae*) in Koumiss were evaluated for their antibacterial effects against three Gram-negative bacteria, three Gram-positive bacteria and five pathogenic *Escherichia coli* strains[30].

Yeasts are the main microorganisms in Koumiss, playing an important role in koumiss fermentation and endowing them with its therapeutic effects. Some yeasts have been shown to have antibacterial effects on *E. coli* possibly by producing antibacterial compounds, such as killer toxins and organic acids in metabolism[49].

We have isolated *Kluyveromyces marxianus* and *Saccharomyces cerevisiae* from koumiss, and demonstrated that their antibacterial compounds had obvious antibacterial effects on *E. coli* O8. The four antibacterial compounds from yeasts in Koumiss had better antibacterial effects on Gram-positive bacteria and Gram-negative bacteria, possibly because of the antibacterial compounds from yeasts in koumiss had essential oil, thereby, their antibacterial effects being similar to Chinese herbal medicines [31,50].

Acetic acid, propionic acid, and formic acid, formed in small amounts together with lactic acid due to fermentation in Koumiss, increase the positive effect of this fermented milk product on health its antimicrobial properties [51]. Koumiss can be infected with *Escherichia coli*, *Mycobacterium tuberculosis*, *Bacillus mesentericus*, *Bacillus cereus*, *Bacillus subtilis*, *Serratiamarcescens*, *Bacillus mycoides*, *Bacterium prodigiosus*, *Mycobacterium citreum*, *Staphylococcus aureus*, *Shigellasonnei* etc. It has been reported that it has an antibiotic effect against bacteria [52].

According to Hrisanova[53], the antibacterial action of Koumiss is related to the Koumiss microbiota, as Koumiss made from cows' milk had the same antibacterial effect as Koumiss made from mare milk against *M. tuberculosis* (H36Rv strain).

### 3.9.INCREASE OF IMMUNITY

Fresh mare milk can increase the thymus and spleen index, improve macrophage capabilities, and increase the hemolysin ratio in blood serum. Fresh mare milk also improves the weight of rats' immune organs and boosts normal immunological functions, regulates cell immune capabilities, and regulates atypical body fluid immune systems [54].

Mare milk, according to Jirillo et al.[55], boosts the immune system. It was explained by the milk's high albumin and globulin content, which serve as building blocks for antibodies [56].

### **3.10.BENEFICIAL FOR LACTOSE INTOLERANT AND PROTEIN ALLERGY**

Children with a cow milk protein allergy will benefit from mare milk (CPMA). As a result, mare milk is sold as a substitute for powdered milk formula for babies in European nations such as France, Germany, Belgium, and Italy [23]. In addition, lactose-sensitive folks will appreciate Koumiss's low lactose content. Even though most Mongolians (88%) are lactose intolerant, they may consume Koumiss without difficulty [57]

### **3.11.TREATMENT OF CANCER**

Probiotics like Koumiss are thought to slow tumor growth by reducing carcinogenic substances and boosting the immune system [58]. Researchers have suggested that mare milk be used in cancer treatment because, in addition to its anti-tumor properties, Koumiss can help combat adverse chemotherapy effects[56,59].

### **3.12.THE TREATMENT OF HEPATITIS**

In a trial on the use of Koumiss in the treatment of hepatitis in children, 60 children aged 3 to 14 years were separated into two equal groups at different phases of the disease. One group was given medications alone, whereas the other was given 100 mL 5 times a day and drug treatment. As a result, 8-10 liters of Koumiss are supplied. The symptoms in the Koumiss group were said to vanish in a short period [4].

Koumiss is also successfully used to treat stomach infections, typhoid fever, para-typhoid fever, dysentery, and intestinal laziness. In addition, it is reported that Koumiss is a good medicine against anemia, asthma, hyperlipidemia, indigestion, nephritis, diarrhea, gastritis fatigue, and loss of appetite [4, 47, 60,61].

## **4. CONCLUSION**

Koumiss, which is considered one of the symbols of nomadic culture, is a fermented milk product that has gone through a long process ranging from traditional medicine to modern medicine in the light of scientific data, in the solution of many health problems from past to present.

Koumiss has appropriate amounts of organic acids like lactic, acetic, and citric acids, amino acids like leucine, glutamic acid, and phenylalanine, and micronutrients like zinc, magnesium, copper, and vitamin C. As a result, it is in terms of nutrients that nomadic communities require and are deficient in. It is necessary since it is a nutrient-dense food. Drinking koumiss has been said to offer healing properties for the gastrointestinal tract, metabolism, cardiovascular and neurological systems, endocrine glands, and kidneys. It promotes the development of immunity and has been used to treat anemia and weight loss.

Consumption of koumiss has a number of health benefits, including being high in probiotics, having antibacterial and antifungal properties, regulating immunity, maintaining a healthy

gastric-intestinal system, regulating cholesterol (CHOL) and sugar levels, regulating blood pressure, attenuating lactose intolerance, and inducing the production of some essential vitamins.

As a functional food ingredient, there has been an increasing interest in the production of Koumiss at the industrial level, as it has beneficial effects in the treatment of many health problems. Since the turn of the twentieth century, Koumiss has been the subject of numerous research. It has long been used to cure a variety of ailments.

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