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REVIEW

The Application of Mare's Milk in Medicine: Does It Hold a Potential Therapeutic Value?

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Abstract: This narrative review aims to consolidate and analyze the current body of scientific literature regarding the nutritional value and potential health benefits of mare's milk, focusing on its impact across various human organ systems. An extensive literature search was conducted across various scientific databases, including PubMed, Scopus, Web of Science, Cochrane Library, and Google Scholar. The search focused on studies related to the composition, nutritional value, and health effects of mare's milk. Eligibility included human and animal studies reporting health outcomes of mare's milk (composition-only papers excluded); findings were synthesized qualitatively by organ system with human vs non-human evidence distinguished and microbiological safety (raw vs pasteurized/fermented) summarized. Mare's milk exhibits a unique nutritional profile, distinct from more common dairy sources such as cow's milk. It is rich in essential fatty acids, probiotics, vitamins, and minerals. The review highlights potential health benefits across multiple organ systems, including the central nervous, gastrointestinal, respiratory, renal, cardiovascular, musculoskeletal, immune, and endocrine systems. Benefits range from improved cognitive function and gut health to enhanced immune response and potential regulation of chronic diseases. The review identifies mare's milk as a promising alternative dairy source with multiple potential health benefits. However, it also emphasizes the need for more extensive scientific research to validate these benefits. The findings suggest mare's milk's potential as a functional food and its therapeutic applications, warranting further investigation in clinical settings.

Keywords: Mare's milk, nutritional benefits, functional food, alternative dairy product, therapeutic applications

Introduction

The realm of nutritional science and alternative medicine has long been captivated by the exploration of non-conventional sources of nourishment and their potential therapeutic benefits. Among these, mare's milk, a relatively less explored alternative to more common dairy sources like cow's milk, has emerged as a subject of growing interest.[1]

Historically, mare's milk has been an integral part of the diet in several nomadic cultures across the world, particularly in Central Asia,[2] where it has been prized not only for its nutritional value but also for its perceived medicinal properties. Despite its longstanding use in traditional medicine, scientific research into the potential health benefits of mare's milk is still in a nascent stage. This review seeks to bridge this gap by collating and analyzing data from existing studies, both animal and human, to provide a more structured understanding of the role mare's milk can play in human health.

The intriguing aspect of mare's milk lies in its unique composition, which differs significantly from cow's milk and other dairy products commonly consumed in Western diets.[3] Rich in essential fatty acids, probiotics, vitamins, and minerals, mare's milk presents a unique nutritional profile that suggests a range of potential health benefits.[4] From its hypoallergenic properties and positive impacts on the digestive and immune systems to its role in managing chronic diseases and improving overall well-being, the scope of mare's milk in health and nutrition appears vast and varied.

Mare's milk differs meaningfully from cow's milk in composition and functional constituents. It typically contains lower total fat and a higher lactose fraction, with a whey-dominant protein profile compared with casein-rich bovine milk. Beyond macronutrients, mare's milk provides bioactive proteins—notably lysozyme, lactoferrin, and immunoglobulins—as well as vitamins (eg, C, D, A, E) and polyunsaturated fatty acids (linoleic and α-linolenic acids). Collectively,

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these components underpin antimicrobial, anti-inflammatory, and immunomodulatory plausibility reported in in-vitro and animal models.[1]

From a clinical standpoint, human evidence remains preliminary. Small randomized or cross-over studies have reported modest improvements in selected conditions—eg, atopic dermatitis (reduced SCORAD/pruritus over 16 weeks),[5] inflammatory bowel disease (short-term reductions in abdominal pain, rectal bleeding, and medication use),[6] and ADHD (short-term decreases in Conners' scores vs cow's milk),[7] with effects limited by small samples, heterogeneity, and short follow-up. Observational findings and non-human data provide mechanistic support but do not substitute for adequately powered clinical trials.

The objective of this narrative review is to synthesize and critically appraise evidence on (i) the nutritional composition and bioactive constituents of mare's milk; (ii) health effects reported in human studies, distinguished from experimental/preclinical findings; and (iii) microbiological safety considerations (raw vs pasteurized/fermented products). Our goal is to clarify what is supported in humans, identify gaps and contradictions, and outline priorities for future trials.

Materials and Methods

A comprehensive, systematic literature search was conducted across several databases including PubMed, Scopus, Web of Science, Cochrane Library, and Google Scholar. The search query included terms related to the studied intervention and outcomes of interest. These included ("mare's milk" OR "mare milk" OR "horse milk") AND (disease OR condition OR patient* OR cardiovascular OR respiratory OR neurological OR immunological OR renal OR hepatic OR allergic OR muscular OR vascular OR "central nervous system" OR neural OR cardiac OR gastrointestinal OR endocrine OR endocrinal OR reproduction OR brain OR lung OR heart OR muscle* OR nerve* OR pancreas OR sleep OR stomach OR intestines OR liver).

Eligibility included human and animal studies reporting health outcomes of mare's milk (composition-only papers excluded); reviewers screened articles independently, and findings were synthesized qualitatively by organ system with human vs non-human evidence distinguished and microbiological safety (raw vs pasteurized/fermented) summarized.

The database search was supplemented by a manual search through the reference list of relevant articles. Importantly, articles focusing solely on the composition of mare's milk without investigating any potential therapeutic values or potentials were excluded. In summary, a total of 179 articles were identified with the database search, of which only 37 were compliant with our criteria. To contextualize applicability to practice, we categorized findings by study design (large RCTs; small RCTs/cross-overs; observational; non-human) and highlighted outcomes supported by human randomized evidence versus mechanistic or preclinical data. Given heterogeneity and small samples, we did not compute pooled clinical effect estimates.

Results and Discussion

Composition

Mare's milk differs from cow's milk in appearance and taste and shows a distinct composition (Table 1): lower fat (1.21% vs 3.64% in human milk), higher protein (2.14% vs 1.42%), similar lactose (6.37% vs 6.71%), and lower energy (480 vs 677).[8]

Table 1 The Difference in Composition Between Mare's Milk, Human Milk, and Cow's Milk

Component	Mare's Milk	Cow's Milk	Human Milk
Fat (%)	1.21	3.61	3.64
Protein (%)	2.14	3.25	1.42
Lactose (%)	6.37	3.25	6.71
Ash (%)	0.42	0.76	0.22
Energy (kcal/kg)	480	674	677

Notes: The therapeutic potential of Mare's milk is further discussed below, outlining its proposed potential impacts on each body organ system.

Microbial and probiotic composition. In fermented mare's milk (koumiss), lactic acid bacteria (LAB) dominate the microbial community and are accompanied by fermentative yeasts. Regulatory benchmarks for fermented milks indicate LAB typically reach $\geq 10^7$ CFU/g, with additional microorganisms $\geq 10^6$ CFU/g and yeast $\geq 10^4$ CFU/g in compliant products; these levels are consistent with controlled koumiss production. During fermentation and subsequent cold storage, Enterobacteriaceae often fall to undetectable levels, Staphylococcus/Micrococcus similarly decline to undetectable by ~24 h, and overall mesophilic counts decrease during storage, paralleling the drop in pH and rise in titratable acidity/ethanol that characterize a successful lactic fermentation. Collectively, these dynamics support a microbiologically safer and probiotic-rich fermented product compared with raw milk.[9] Common probiotic LAB reported in fermented mare's milk include Lactobacillus, Lactococcus, Leuconostoc, and Streptococcus spp., with genera distribution varying by starter, geography, and process conditions; compositional immune markers (eg, IgG, selected cytokines) in the raw starting milk can provide context but do not by themselves imply clinical efficacy.[10] Fatty-acid and bioactive nutrient profile. Consistent with Table 1, mare's milk provides a higher proportion of unsaturated fatty acids relative to total fat—most notably linoleic (n-6) and α-linolenic (n-3)—alongside a whey-dominant protein profile and bioactive proteins such as lysozyme and lactoferrin. These constituents underpin antimicrobial, anti-inflammatory, and immunomodulatory plausibility while aligning compositionally with several health-relevant dietary patterns.

Below, we summarize potential health effects by organ system, emphasizing study design, sample size, and consistency (Table 1).

Central Nervous System (CNS) Benefits of Mare's Milk

Mare's milk provides omega-3/omega-6 fatty acids and antioxidant vitamins (C, E, D) that are biologically plausible neuroprotective agents.[11] Compared with cow's and human milk, differences in fatty-acid profile and unsaturated/saturated ratios may be relevant to neurodevelopment, though human evidence is limited (Figure 1).[1,12–15]

Additionally, mare's milk contains antioxidants such as vitamins C and E, which help mitigate oxidative stress associated with various neurological disorders. Studies have shown that mare's milk contains a spectrum of vitamins, including A, D3, E, K2, C, B1, B2, B3, B6, and B12, with its vitamin profile being comparable to that of cow's milk.[16–18] Mare's milk is particularly rich in vitamin C, providing enhanced nutritional value due to its stability against oxidation and anti-inflammatory properties. It has a similar amount of vitamin A compared to cow's milk but less than human milk. Recent research also indicates that mare's milk has higher levels of vitamin D compared to human milk.

Some evidence suggests that the consumption of mare's milk can have a positive effect on mood and mental health. In a small cross-over trial in children with ADHD (n = 30), mare's milk was associated with lower Conners' scores versus baseline and cow's milk; effects did not persist after washout, highlighting the need for blinded replication.[7] While signals for cognition/mood are hypothesized, available studies are small and heterogeneous.[19,20]

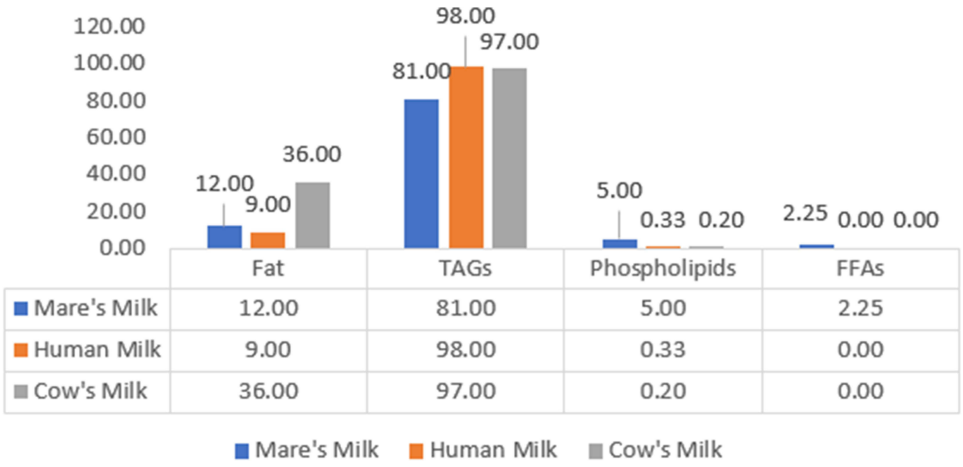

Figure 1 Fat composition in Mare's milk, human milk, and cow's milk.

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The compositional profile of mare's milk suggests several pathways by which it could influence the central nervous system. First, its polyunsaturated fatty acids—notably linoleic (n-6) and α-linolenic (n-3)—provide precursors that can be elongated/desaturated endogenously (with limited efficiency) to long-chain PUFA involved in neuronal membrane fluidity, synaptogenesis, and myelination; downstream lipid mediators (eicosanoids/resolvins) are implicated in neurotransmission and microglial signaling.[21] Second, antioxidant vitamins (eg, C and E) and vitamin D may mitigate oxidative stress and modulate neuroinflammatory cytokine pathways, while lactoferrin—through iron chelation and anti-inflammatory actions—may further limit redox-driven injury and support blood–brain barrier integrity.[22] Third, prebiotic oligosaccharides and, when consumed as fermented preparations (eg, koumiss), probiotic lactic acid bacteria, could act via the gut–brain axis by shaping microbial communities and short-chain fatty acid production, which are linked to vagal signaling, barrier function, and neuroimmune tone.[10] These mechanisms provide biological plausibility for neurocognitive and mood-related effects, but confirmatory evidence from large, blinded randomized trials is lacking; current human data remain small and short-term.

While preliminary findings suggest potential neurodevelopmental benefits of mare's milk, these studies were constrained by small sample sizes and short follow-up durations. Moreover, the absence of replication across independent cohorts and variability in outcome measures limits the strength of the conclusions. Conflicting evidence has also been reported in studies using different comparators, underscoring the need for further validation.

Gastrointestinal System Benefits of Mare's Milk

Mare's milk is known to possess natural probiotic qualities due to the presence of beneficial bacteria such as lactobacilli and bifidobacterial.[23] These microorganisms can promote a healthy gut microbiome, which is crucial for digestive health and overall well-being. Additionally, mare's milk contains oligosaccharides that act as prebiotics, fostering the growth of beneficial gut bacteria.

Literature analysis reveals that mare's milk has extensive antimicrobial and antiviral properties. Its antimicrobial effectiveness is attributed to components like lysozyme and lactoferrin. Lysozyme targets gram-positive bacteria, as it can access their peptidoglycan cell wall component, unlike gram-negative bacteria protected by a lipopolysaccharide layer.[24,25] Lysozyme also combats viruses like HIV, parasites (eg, Entamoeba histolytica trophozoites), and fungi like Candida albicans. Lactoferrin, an iron-binding glycoprotein, contributes significantly to mare's milk's antimicrobial activity, effectively against various bacteria, including acid-alcohol-resistant strains like Mycobacterium tuberculosis.[15] Figure 2 highlights the high concentration of lysozyme in mare's milk compared to other mammals, emphasizing its potent antiviral activity.[26] Mare's milk is now used for treating and preventing conditions like Tuberculosis, bacterial

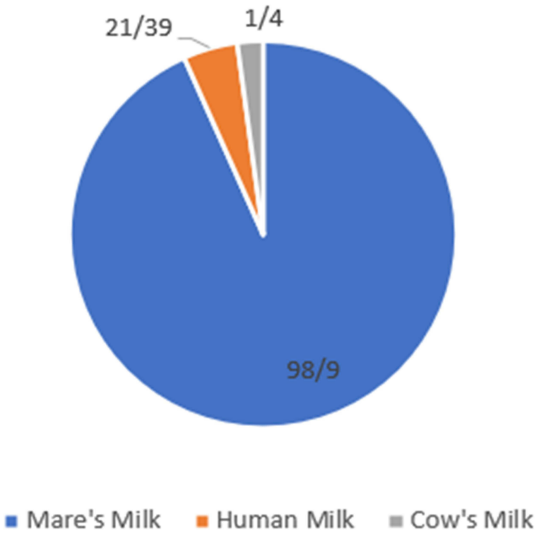

Figure 2 Concentration of lysozyme in the milk of different mammals.

infections, and as a supplement in infant nutrition. For example, in the study of Detha et al,[27] a fractionation analysis was performed to determine the antimicrobial properties of Mare's milk against bacteria causing subclinical mastitis, such as *Escherichia coli, Staphylococcus aureus, Streptococcus agalactiae*, and *Streptococcus pyogenes*. It was concluded that there were six fractions in the whey protein of Mare's milk that exhibited antimicrobial activities against causative bacteria of subclinical mastitis, with the highest inhibition zone diameter being observed in S. *agalactiae* and S. *pyogenes*. Another study[28] found that Lactoferrin, in Mare's milk, was protective against Salmonella Enteritidis showing a diameter of zone of inhibition similar to that of penicillin (mean of 19.2 vs 19.7), respectively.

There is evidence suggesting that mare's milk can alleviate symptoms of various gastrointestinal disorders, such as irritable bowel syndrome (IBS) and inflammatory bowel diseases (IBD). Its anti-inflammatory properties may help reduce gut inflammation and discomfort. The high lactose content, which is more easily digestible compared to cow's milk, makes mare's milk a potentially better alternative for individuals with mild lactose intolerance.[29]

In an indomethacin IBD rat model, Sumbawa mare's milk reduced inflammatory cells and TNF-α versus positive controls, with the highest dose approximating negative controls.[30] Some studies have explored the use of mare's milk in managing gastric ulcers due to its soothing properties and potential to promote healing of the gastric lining. For example, in the study of Sharmanov et al,[31] 164 patients with peptic ulcer disease were allocated to receive either mare's milk (59 patients), camel milk (40 patients), or cow's milk (65 patients). Mare's milk was observed to result in the greatest benefit in terms of secretory and motor function of the stomach with complete wound healing (93%), compared to camel (90%) and cow's milk (70%).

Mare's milk can influence the composition and activity of the gut microbiota, which is increasingly recognized as a key factor in overall health. A healthy gut microbiota is linked to improved digestion, enhanced immune function, and even mental health benefits.[32,33] This was confirmed in a randomized, placebo-controlled, double-blinded cross-over trial including 17 patients with inflammatory bowel diseases, namely Crohn's disease (eight patients) and ulcerative colitis (nine patients).[6] The study found that mare's milk was associated with lower abdominal and extraintestinal pain severity, as well as lower frequency of blood passing through the stool. Additionally, consuming mare's milk was associated with lower number of medications use to reach symptomatic relief compared to placebo.

Although some studies suggest beneficial effects on gastrointestinal health, results remain inconclusive due to methodological weaknesses, such as lack of blinding, reliance on subjective symptom scores, and variability in preparation methods (fresh vs lyophilized milk). Contradictory findings in other trials highlight the need for larger, rigorously designed studies before therapeutic claims can be supported.

Respiratory System Benefits of Mare's Milk

Mare's milk has been noted for its anti-inflammatory effects, which could be particularly beneficial for the respiratory system. Chronic inflammation is a key factor in many respiratory conditions, such as asthma and chronic obstructive pulmonary disease (COPD).[34] The presence of compounds like omega-3 fatty acids and antioxidants in mare's milk may help reduce inflammation in the respiratory tract.[35]

Some studies suggest that mare's milk might have a beneficial impact on asthma and allergy symptoms. The hypoallergenic properties of mare's milk, as compared to cow's milk, make it a potential alternative for individuals with milk allergies. The immunomodulatory effects of mare's milk, possibly due to specific proteins and immunoglobulins, could play a role in reducing allergic responses and asthma symptoms. The potential role of mare's milk in mediating immunological responses to atopic diseases, particularly atopic dermatitis was investigated by.[36] In their double-blinded, placebo-controlled trials, 23 patients with atopic dermatitis received either mare's milk (250 mL/day) or placebo for 16 weeks. The main outcome was the chance in the severity scoring of atopic dermatitis (SCORAD) index. In the mare's milk group, the SCORAD score significantly improved from baseline (mean score at baseline 30.1 vs mean score at 12 weeks 25.3, $p = 0.05$). Moreover, pruritis symptoms reduced by 30% during the study period ($p < 0.01$), while C-reactive protein (CRP) parameters was significantly reduced. These findings are hypothesis-generating; no large RCTs demonstrate reductions in asthma/COPD exacerbations or lung function endpoints.[37]

Renal System Benefits of Mare's Milk

Mare's milk is speculated to possess natural diuretic properties, which can aid in promoting kidney health by helping the body eliminate excess water and salts more efficiently. This diuretic effect could be beneficial in managing conditions like hypertension, which is closely linked to renal health. The antioxidants present in mare's milk, such as vitamins C and E, may play a role in protecting the kidneys from oxidative stress and damage. Oxidative stress is a significant factor in many kidney diseases. These antioxidant properties might also be beneficial in reducing the risk of chronic kidney disease (CKD) and slowing its progression.[38]

Owing to lower protein and balanced electrolytes, mare's milk is sometimes discussed in renal-diet contexts; however, clinical evidence for renal outcomes or stone prevention is limited, and diuretic effects remain speculative.[39,40]

Cardiovascular System Benefits of Mare's Milk

Mare's milk has several compositional features that are cardiometabolically relevant. Compared with cow's milk, it contains less total and saturated fat and a higher proportion of polyunsaturated fatty acids, notably linoleic (n-6) and α-linolenic (n-3), which—when substituting for saturated fat—are associated with lower LDL-cholesterol and reduced inflammatory tone. Its whey-dominant protein profile and antioxidant vitamins (C, E) together with vitamin D support endothelial and anti-inflammatory pathways, while the electrolyte balance (especially potassium) provides an additional blood-pressure rationale.[37,41,42] These features, alongside a favorable fat profile and lower glycemic impact, may be advantageous in individuals with diabetes, who are at heightened cardiovascular risk.[20,43]

Consistent with these mechanisms, a small randomized cross-over study in healthy adults reported reduced inflammatory cell activity (decreased chemotaxis and respiratory burst) with mare's milk (deep-frozen or lyophilized) compared with cow's milk over three weeks.[44] However, direct effects on clinical cardiovascular endpoints—blood pressure, serum lipids, or cardiovascular events—have not been demonstrated; to date there are no large, high-quality randomized trials of mare's milk for CVD prevention or treatment. Thus, the cardiovascular rationale remains biologically plausible but unproven, and claims should be interpreted cautiously.

Musculoskeletal System Benefits of Mare's Milk

Mare's milk is notably rich in essential minerals like calcium and phosphorus, which are fundamental for bone strength and health. The high bioavailability of these minerals in mare's milk enhances their absorption, making them particularly beneficial for bone development and maintenance.

Due to its high calcium content, mare's milk may play a role in the prevention and management of osteoporosis.[8] Mineral content (calcium, phosphorus), vitamin D, and complete proteins support general musculoskeletal nutrition; however, claims regarding bone density, fracture risk, or joint symptoms are not supported by robust randomized evidence at present.[45,46] The anti-inflammatory compounds in mare's milk might benefit joint health, potentially alleviating symptoms of conditions like arthritis. By reducing inflammation, mare's milk could help in managing joint pain and improving mobility.[47]

Immune System Benefits of Mare's Milk

Mare's milk contains significant levels of immunoglobulins, which are key components of the immune system.[36] Immunoglobulins and antimicrobial proteins (lactoferrin, lysozyme) provide a plausible basis for immunomodulatory effects.[48] In a randomized, placebo-controlled study in eczema, daily mare's milk for 16 weeks led to symptom improvements in a subset and increased stool bifidobacteria, with some participants reducing medications.[49] Medication reductions were reported in some participants; however, sample size, blinding, and duration constrain clinical generalizability. Vitamins/minerals (eg, C, A, zinc, selenium) may support barrier and cellular immunity, but causality for clinical endpoints remains unproven and studies are small.[50]

Blood System Benefits of Mare's Milk

Mare's milk has been associated with reduced levels of glucose in the blood, which could be beneficial for maintaining stable blood sugar levels. This aspect may be particularly important for individuals with insulin resistance or diabetes.[51] Consumption of mare's milk might contribute to a better lipid profile by reducing levels of insulin and leptin, which are hormones related to fat storage and metabolism. Improved lipid profiles are beneficial for cardiovascular health.

The presence of compounds that reduce inflammatory cytokines in the blood can lead to an overall reduction in systemic inflammation. This is significant because chronic inflammation is linked to many diseases, including heart disease, diabetes, and cancer. Mare's milk contains antioxidants that help reduce oxidative stress markers in the blood. Oxidative stress is a contributing factor to aging and various chronic diseases, so its reduction is beneficial for long-term health. These properties were highlighted in the study of Ellinger et al[44] who tested the effect of mare's milk, in both its deep-frozen and lyophilized forms, comparing it to cow's milk among 18 healthy individuals. Participants drank 250 mL of each intervention daily for 3 weeks. The authors noted that the deep-frozen form of mare's milk significantly modulated inflammatory processes by reducing chemotaxis and respiratory burst, suggesting its potential beneficial value in causing symptom relief in chronic diseases with recurrent inflammation (Figure 3).

Elevated levels of certain proteins, such as adiponectin, have been observed with the consumption of mare's milk. Adiponectin has anti-inflammatory effects and is involved in the regulation of glucose levels as well as fatty acid breakdown. It can enhance the body's response to insulin and has a protective effect against metabolic syndrome.

Mare's milk can promote an increase in ketone levels in the blood, providing an alternative energy source for the body and brain. Ketones are produced when the body breaks down fats, and they can serve as an energy source when glucose is less available, which can be particularly beneficial for brain health. With its unique composition, mare's milk can contribute to the overall nutritional balance, providing essential vitamins and minerals that support various bodily functions.[29]

Hepatic System Benefits of Mare's Milk

Mare's milk may play a role in glycogen management by aiding in the depletion and subsequent restoration of glycogen, which is essential for maintaining liver energy balance and stable blood sugar levels. This cyclical process is vital for overall body energy regulation. During periods of fasting or low carbohydrate intake, the liver produces ketones, an alternative energy source, especially for the brain. The unique composition of mare's milk might stimulate ketone production in the liver.

Evidence suggests that mare's milk can enhance insulin sensitivity, benefiting glucose metabolism and potentially lowering the risk of fatty liver disease linked to insulin resistance. Additionally, mare's milk may help reduce lipid accumulation in the liver, thereby mitigating the risk of non-alcoholic fatty liver disease (NAFLD).

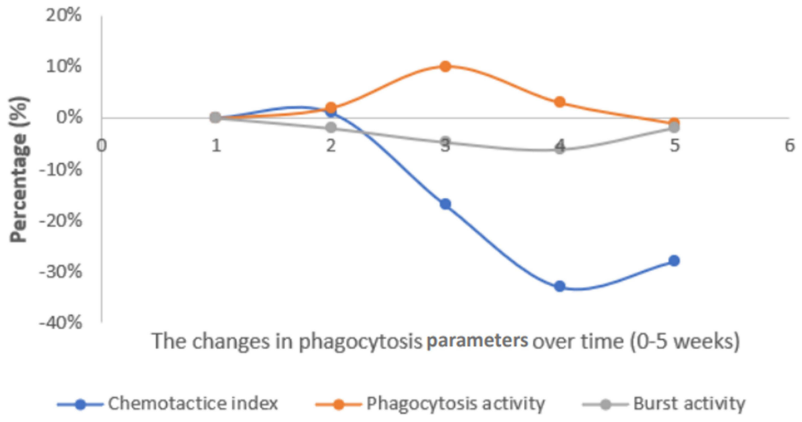

Figure 3 The changes in phagocytosis parameters with deep-frozen mare's milk.

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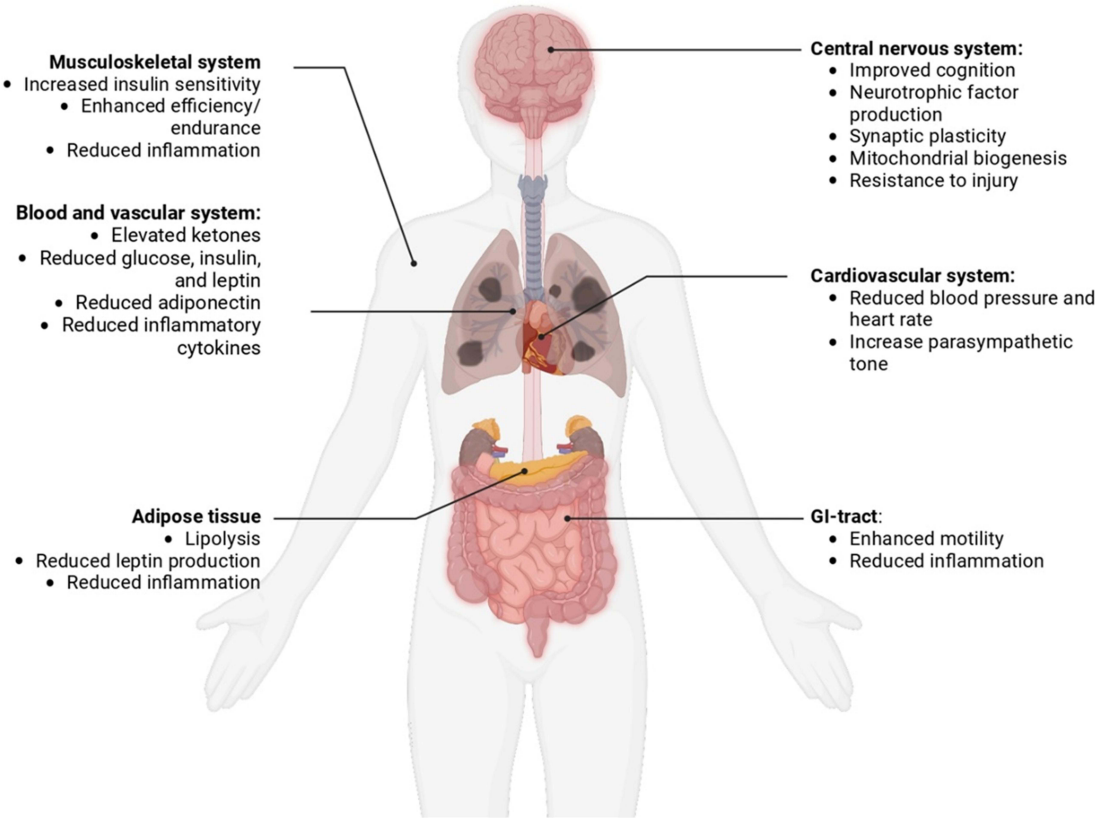

Figure 4 Proposed potential benefits of Mare's milk on the human body.

The antioxidants in mare's milk, such as vitamins C and E, offer protection against oxidative stress, which is associated with various liver diseases. Its anti-inflammatory properties might also protect the liver from chronic inflammation, which can lead to liver damage and diseases like hepatitis.

Mare's milk contains bioactive compounds that support liver metabolism, including protein synthesis and bile production for digestion. It may also aid in detoxification processes, though direct evidence is limited.

Highly valued in Russia and Western Asia for its health benefits, mare's milk is known for its antibacterial, antifungal, anti-inflammatory, and antiviral properties (Figure 4).[52–54] It has shown promise in treating cardiovascular diseases, diabetes, anemia, tuberculosis, gastric ulcers, enteric inflammation, chronic hepatitis B, psoriasis, and in post-chemotherapy and postoperative recovery. However, research into its effects on inflammation and rheumatic diseases is still limited. More studies are needed to confirm these benefits and understand the mechanisms behind them.

Evidence Limitations and Contradictory Findings

Despite encouraging signals across multiple health domains, the evidence base for mare's milk remains preliminary. Many cited studies are limited by small sample sizes, heterogeneous populations, short follow-up, and inconsistent outcome definitions. In certain areas, such as atopic dermatitis and gastrointestinal disorders, findings are contradictory between studies, with some reporting benefits and others showing no significant effect. Moreover, reliance on in vitro or animal studies for mechanistic plausibility cannot be extrapolated directly to human health outcomes. These methodological weaknesses and conflicting results necessitate cautious interpretation and underscore the importance of well-powered, standardized clinical trials to clarify the role of mare's milk in human nutrition and health.

Clinical Relevance—What Is Supported by Human Trials?

When considering the clinical applicability of mare's milk, it is important to distinguish between mechanistic plausibility and evidence derived from human trials. To date, no large, high-quality randomized controlled trials have established

definitive health benefits of mare's milk. The human evidence that does exist is limited to small, short-term studies with heterogeneous populations and outcomes. For example, in the field of dermatology, a double-blind, placebo-controlled trial in patients with atopic dermatitis reported modest improvements in SCORAD scores and pruritus among participants receiving mare's milk, although the clinical significance and durability of these effects remain uncertain.[5] Similarly, a randomized cross-over trial in a small cohort of patients with inflammatory bowel disease found reductions in abdominal pain, rectal bleeding, and medication use during mare's milk consumption, but the study's limited sample size and short follow-up period constrain the strength of the conclusions.[6] In the neurological domain, a cross-over study in children with attention deficit hyperactivity disorder suggested short-term improvements in Conners' scores compared to cow's milk, but these effects dissipated after a washout period.[7] Beyond these isolated examples, most human data remain observational or anecdotal, and many claims rely heavily on in vitro or animal findings that cannot be extrapolated to clinical practice. Taken together, the available evidence indicates that mare's milk may hold promise in select conditions, but its clinical relevance remains preliminary and unproven, underscoring the urgent need for well-designed, adequately powered randomized trials to confirm or refute these early signals. Finally, recent work on mare's milk during late lactation (cytokines and immunoglobulins) and on fermented mare's milk (koumiss) primarily provides compositional, microbiological, and immunologic readouts rather than patient outcomes. These studies are not clinical efficacy trials; they are valuable for safety and mechanism (eg, microbial load reduction during fermentation), but they do not validate clinical benefit in humans.[9,10]

Microbiological Safety: Raw vs Pasteurized Mare's Milk

As with other raw dairy, raw (unpasteurized) mare's milk can carry pathogenic microorganisms (eg, Campylobacter, Salmonella, Shiga toxin–producing E. coli, Listeria), posing disproportionate risk to young children, pregnant individuals, older adults, and the immunocompromised. Authoritative public-health sources recommend choosing pasteurized milk and dairy products to reduce illness risk, noting that pasteurization does not meaningfully diminish nutritional quality.[55] Regulatory criteria recognize the higher permissible total bacterial count for raw milk from species other than cows (EU Reg. (EC) No 853/2004: plate count at 30 °C ≤ 1,500,000 CFU/mL for non-cow species, vs ≤ 100,000 CFU/mL for cow's milk), underscoring the need for stringent hygiene and/or effective pathogen-reduction steps for non-bovine milks.[56] The European Food Safety Authority (EFSA) concludes that raw drinking milk "has a diverse microbial flora which can include pathogens transmissible to humans", and identifies raw milk consumption as a public-health risk; similar positions are held by US CDC and FDA.[57] In addition to pasteurization, fermented products derived from mare's milk (eg, koumiss) may offer a safer and practical alternative. In a controlled evaluation of koumiss prepared from raw mare's milk, Enterobacteriaceae became undetectable with fermentation, Staphylococcus/Micrococcus counts fell to undetectable levels by ~24 hours, and total mesophilic aerobic bacteria decreased during cold storage; these shifts tracked with the expected pH drop and rise in titratable acidity/ethanol.[9] Cytokine (eg, IFN-γ, IL-2, TNF-α) and IgG concentrations remained broadly stable across fermentation time, suggesting that probiotic activity and microbial-risk reduction can be achieved without marked loss of these immune markers in the finished product.[9] Complementary profiling of late-lactation mare's milk documents immunoglobulin and cytokine levels in the raw starting material, which is informative for safety/processing context but does not constitute clinical efficacy evidence.[10]

Given the above, we do not recommend raw mare's milk for general consumption. If mare's milk is consumed, it should be pasteurized (or processed using an equivalently validated pathogen-reduction technology) and sourced from producers adhering to good hygienic practices consistent with Codex guidance. Fermented preparations (eg, koumiss) produced under hygienic, controlled conditions can further mitigate microbial risks and enhance probiotic properties, but process control and quality assurance (eg, HACCP) remain essential. Although antimicrobial proteins (eg, lysozyme, lactoferrin) contribute to biological plausibility, they do not negate the need for pasteurization or validated pathogen-reduction steps for consumer safety.[55]

Conclusion

Mare's milk has a distinct nutritional and bioactive profile—whey-dominant proteins, lysozyme and lactoferrin, vitamins C/E/D, and a higher proportion of polyunsaturated fatty acids—that provides biologically plausible pathways for health

effects across gastrointestinal, dermatologic/allergic, and neurobehavioral domains. However, the current human evidence is limited to small, short-term randomized or cross-over studies with heterogeneous methods and outcomes, and no large, high-quality randomized trials have demonstrated durable clinical benefit. Accordingly, clinical use should be considered preliminary and not recommended as standard practice at this time.

From a public-health standpoint, raw (unpasteurized) mare's milk is not recommended because of microbial risk. Pasteurized or equivalently validated pathogen-reduced products, and hygienically produced fermented preparations (eg, koumiss), are the safer options. Priorities for research include standardizing processing and dose; preregistering adequately powered randomized trials with patient-important endpoints and longer follow-up; reporting formulation/comparator details to improve reproducibility; and incorporating safety monitoring (microbiological and clinical) throughout.

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Disclosure

The authors report no conflicts of interest in this work.

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