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Review Article

Nutritional benefits of camel milk in autism-A mini-review

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ABSTRACT

Camels are essential livestock for milk, meat, and transportation, particularly in arid regions.
Camel's milk is a staple diet worldwide due to its nutritional value, including lactoferrin, calcium, vitamins, peptides, zinc, and polyunsaturated fatty acids (PFA). It has therapeutic properties like anti-diabetic, bactericidal, anticarcinogenic, and anti-hypertensive effects. Camel's milk also increases carbohydrate metabolism, curing gastrointestinal disorders due to polyunsaturated fatty acids, vitamins, and anti-inflammatory proteins. Its low fat and cholesterol levels, vitamins, minerals, and insulin content make it a critical source of insulin, potentially helping treat diabetes.
This review article mainly emphasized the maximum nutritional benefit of camel milk consumption by children or adults suffering from autism spectrum disorders (ASD) after going through extensive reviews of published articles.
This article was conducted based on searches in open-source databases like Google Scholar, Embase, DOAJ, PubMed, etc., using specific keywords such as 'camel milk,' 'camel milk benefit,' 'camel milk future,' etc.
Camel's milk has been found beneficial for individuals with autism spectrum disorders in India, but further scientific research is needed to comprehend its nutritional and physiological benefits fully.

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1. Introduction

Camels are always considered essential livestock, especially in the arid region. They are used for milk, meat, and transportation, highlighting their multipurpose nature. So, they are righteously stated as the "Miracle of God" in the Holy Quran. Camel's milk is an essential part of a staple diet across the globe, especially in arid and semi-arid zones, for its nutritional virtue. Camel milk is a highly nutritious beverage containing abundant calcium, vitamins, peptides, zinc, fatty acids, etc. These components significantly impact the formation and development of bones, particularly in young children and older adults, especially women going through menopause, who are more susceptible to osteoporosis due to insufficient calcium levels,[1,2] Additionally, camel's milk has some therapeutic properties, which include antidiabetic, bactericidal, anticarcinogenic, and anti-hypertensive.[3–5] Camel's milk increases carbohydrate metabolism, resulting in the curing of gastrointestinal disorders owing to the presence of polyunsaturated fatty acids, vitamins, and anti-inflammatory proteins.[6] Camel milk, unlike bovine milk, offers numerous health benefits, such as anti-diabetic and anti-allergic properties, contrasting its composition, structure, and properties.[7] Camel's milk increases carbohydrate metabolism, resulting in the curing of gastrointestinal disorders owing to the presence of polyunsaturated fatty acids and vitamins along with anti-inflammatory proteins.[6] Aside from insulin management, such milk can benefit from fat and cholesterol levels,

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including minerals and multivitamins. Some studies reported that camel milk could be helpful in diabetes due to its low glycaemic index.[8,9]

This review article was conducted based on searches in open-source databases like Google Scholar, Embase, DOAJ, PubMed, etc., using specific keywords such as 'camel milk,' 'camel milk benefit,' 'camel milk future,' etc.

2. Discussion

Autism is characterized as lifetime impaired neuro-development. In camel milk, vitamins like A and E, ascorbic acid, and minerals such as Mg and Zn make it a potential food for reducing oxidative stress in autistic patients. There is often a big question about cows or other trending milk intolerances, so there is a need for alternative milk for autism. According to various research papers and other reviews, camel milk could be a great alternative. Camel milk contains minerals that promote the creation of glutathione and contains antibodies that resemble human immunological antibodies, which may contribute to the development of autistic behavior. The milk also possesses anticonvulsant and antioxidant characteristics. Additionally, the digestive process after ingestion produces bioactive peptides that function as natural antioxidants and angiotensin-converting-enzyme (ACE) inhibitors. Additionally, it is rich in lactoferrins, immunoglobulins, and iron-binding glycoproteins, which contribute to its efficacy in combating cancer cells.[10–12] The biochemical components act as antitumors by escalating RNA synthesis and inhibiting protein kinases and differentiation. Lactoperoxidase, a known anti-tumor agent and peptidoglycan recognition protein, highlights its potential against breast cancer metastasis.[13]

Autism spectrum disorder(ASD) is a developmental impairment characterized by communication challenges, stereotypical behaviors, and limited interactions. It is heritable and varies in presentation. The root cause is unclear, but it is strongly associated with autoimmunity, brain-specific autoantibodies, oxidative stress, genetic polymorphism, and neurogenic inflammation. The mechanism of autoantibody development has yet to be fully understood.[14–18] Autism, a disorder with abnormal brain function, affects children's communication, social, and behavioral activities. Symptoms typically appear in the first two years of life. People with autism spectrum disorder (ASD) should be mindful of their diet to improve their quality of life and prevent worsening conditions. Nutritional interventions can often alleviate digestive issues, but further research is needed to determine their effectiveness.[18] A systematic review and synthesis of randomized trials revealed that the consumption of raw or boiled camel milk has the potential to decrease neuroinflammation and autoimmunological reactions linked to autism spectrum disorders (ASDs). The distinctive combination of protective proteins, vitamins, and immunoglobulins in camel milk may lead to an enhancement in ASD symptoms and an overall improvement in the quality of life for individuals with autism.[19] However, evidence from randomized clinical trials highlights that camel milk consumption's potential benefits are limited.[18,19] This mini-review also highlighted the prospects and challenges of procurement of camel milk and processing into milk products. Although similar in composition to bovine milk, the milk's molecular structure and composition can lead to processing difficulties and inferior quality products. However, optimizing processing parameters could transform camel milk into functional products. The literature on camel milk's product design and functional potential needs to be more comprehensive, requiring multi and inter-disciplinary research to explore its functional and technological properties fully.[20] In chronic diseases, including cancer, camel milk has a significant benefit. Selective milk products boosting the immune system are cost-effective and accessible for societal health. Micronutrient-rich diets with camel milk can be a part of Neutropenic, Nordic, and traditional Asian diets, which have proven effective against HIV-induced cancers.[21] Dromedaries, once multi-purpose animals, have seen a surge in milk production due to health benefits. However, their increased numbers have increased disease susceptibility, affecting their nutrition and social behavior. Governments are working on improved food safety regulations and legislation to ensure dromedary welfare, but this is still preliminary, requiring scientific support to identify and correct illegalities.[21,22] Indian traditional knowledge systems, shaped by various customs and ways of life, are gaining popularity due to their ancient origins and contemporary advantages. Traditional remedies such as ayurveda, naturopathy, and nutrition are founded on extensive study. Overall, camel milk could be a great alternative shortly.[22] There is a connection between gastrointestinal sickness and symptomatic autism, where autistic children experience diarrhea more frequently than others. Feeding habits associated with autism reduced appetite, and autonomic nervous system reactions related to digestion are frequently observed. Studies indicate that breastfeeding may be a safeguard against the development of autism in children who are already diagnosed with autism. A study revealed that infants with autism had a longer duration of breastfeeding compared to typically developing children, potentially attributed to the protective effect against pneumonia. This implies that infants with autism may have a higher susceptibility to infection in the early stages of life, indicating a potential connection between nutrition and autism. Autism is a neurodevelopmental illness that impacts children's social interaction and communication abilities. It is becoming more prevalent globally. It strongly correlates with males and is attributed

to genetic, autoimmune, metabolic, and epigenetic causes. Current studies have concentrated on investigating the involvement of the opioid system in pathogenic processes.[23,24] Valproic acid (VPA) intoxication in breast milk impairs brain metabolism, resulting in heightened oxidative stress, neuroinflammation, and glutamate toxicity among babies. Goat milk consumption can reduce the harmful effects of VPA-induced neurotoxicity. However, additional investigations conducted in living organisms are necessary.[25] Exposure to valproic acid (VPA) during pregnancy raises the likelihood of autism in offspring. An imbalanced gut microbiota is a frequently occurring condition, and nutritional therapies are employed to enhance the composition of gut bacteria. Nevertheless, there is no agreement on the most effective dietary treatment. Various therapies are advised, such as gluten-free, casein-free, ketogenic, specialized carbohydrate diets, probiotics, and dietary supplements.[26,27] Someresearch papers indicated a correlation between the consumption of sugar-sweetened drinks and the occurrence of emotional and behavioral issues in usually developing youngsters, including sadness and hyperactivity. Sugar-sweetened beverages, also called SSBs, can contribute to the development of health conditions such as obesity, diabetes, and cardiovascular illnesses. Children diagnosed with ASD tend to eat a higher amount of sugar-sweetened beverages SSBs and sugars because of their unpleasant taste, which may lead to emotional and behavioral problems.[28–32]

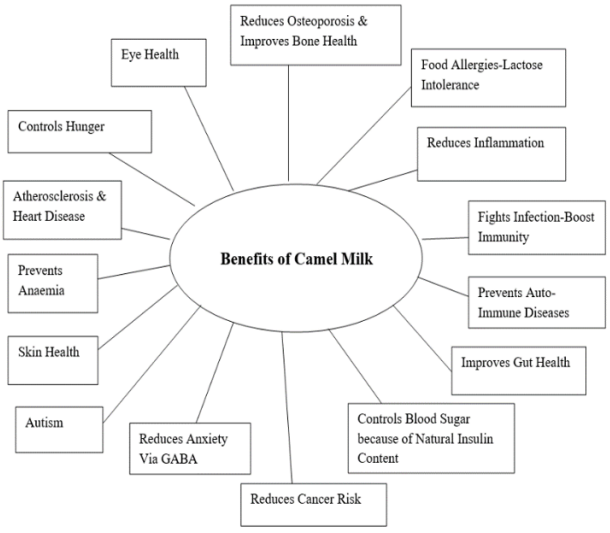

Figure 1: Various nutritional and health benefits of camel milk

Camel milk also exhibits promising therapeutic properties for conditions such as diabetes, hepatitis B, autism, and lactase deficiency. Due to its elevated lactoferrin levels, protective proteins, and absence of β-lactoglobulin and β-casein allergens, it has been employed as a therapy for children diagnosed with ASD. (Figure 1) shows multiple benefits camel milk provides for all ages. Camel milk possesses distinctive characteristics such as elevated vitamin C levels, little fat content, and reduced immunoglobulins, rendering it an optimal natural approach for intervening in ASD.[33–36]

3. Conclusion

Camels are essential livestock for milk, meat, and transportation, with their milk being a staple worldwide due to its nutritional value and therapeutic properties. It has anti-diabetic, bactericidal, anticarcinogenic, and anti-hypertensive effects. Camel's milk is also beneficial for children and adults with autism spectrum disorders, even in India, despite challenges in production and availability. More clinical trials are needed to determine its nutritional and other health benefits.

4. Source of Funding

None.

5. Conflict of Interest

None.

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