

REVIEW ARTICLE

Importance of camel milk for human health

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ABSTRACT

Camel milk is known in Asia and Africa for 5000 years for its benefits for human health. Therefore, it is not only consumed as food, but also as remedy. Many studies have reported, that camel milk has very high concentration of mono-and polyunsaturated fatty acids, serum albumin, lactoferrin, immunoglobulin's, vitamins C, and E, lysozyme, manganese and iron, as well as the hormone insulin. Therefore, camel milk can be prescribed as remedy in many human illnesses. It has been proven as a useful application in stomach and intestinal disorders, Diabetes-1, food allergy. In addition camel milk has been used to reduce cholesterol levels in the blood, to avoid psoriasis disease, to heal inflammation in the body, to assist patients with tuberculosis, helping to strengthen the human immune system, to reduce the growth of cancer cells and to cure autism. Even the patient can benefit from the biological factors in camel milk, it must be consumed raw, fresh and free of pathogens after a good machine milking. These potential health benefits of camel milk should be further study.

Keywords: Biological factors; Camel milk; Human disease

INTRODUCTION

Camel milk, used medicinally for centuries by nomadic people and in the last twenty years ago many studies have reported the use of camel milk in the treatment of human disease. In Kazakhstan, camel milk and fermented milk products (*Shubat*) can be used as medicament for stomach and intestinal diseases (Konuspayeva and Faye, 2011). This effect has been attributed of the presence of antimicrobial substances in camel milk, including lysozymes, hydrogen peroxide, lactoferrin, lactoperoxidase, and immunoglobulin's (Elagamy et al., 1992). Then the camel milk was much experienced about the healing properties and it has been used for the treatment of a number of health problems in humans (Sharmanov and Dzhangabylov, 1991; Agrawal et al., 2003; Shabo et al., 2005; Mal et al., 2006). Furthermore found Elagamy et al. (1992) that the lactoperoxidase camel milk acts as a bacteriostatic activity against Gram-positive strains and as bactericides against Gram-negative cultures. Scientists believe that antibodies in camel milk could be effective against cancer, HIV/AIDS, Alzheimer's disease and hepatitis C (Martin et al., 1997; Agrawal et al., 2003; Magjeed, 2005; Shabo et al., 2005; Habib et al., 2013). Currently, there are still many busy figuring out whether camel milk can also be effective prophylactic against diabetes and heart disease (Zagorski et al., 1998; El-Sayed et al., 2011; Malik et al., 2012;

Shori, 2015). Also in recent years, it was intensively researched of antibacterial lactoferrin in the camel milk (Al-Majali et al., 2007). In addition, probiotic lactic acid bacteria were isolated from camel milk (Yateem et al., 2008), which are important for the health of the people. These potential health benefits of camel milk are described individually in the following sections.

Camel milk against gastrointestinal disorders

Camel milk contains a high concentration of anti-inflammatory proteins, which have a positive health effect on the stomach and intestinal disorders. The high proportion of mono and polyunsaturated fatty acids and vitamin-rich composition provide improved carbohydrate metabolism (Karray et al., 2005; Konuspayeva et al., 2008). Moreover, it was found that fermented camel milk has an enzyme (Angiotensin I-converting enzyme, ACE) (Quan et al., 2008), which facilitates the digestion of the milk proteins (Alhaj et al., 2006). Recent reports on the application of camel milk for the health of the digestive system showed that camel milk has anti-diarrhea-properties and all children, who have taken camel milk and with the 20 bouts of diarrhea per day are cured with normal bowel movements (Yagil, 2013). Camel milk can also be used in small children who have diarrhea by food contamination with rotavirus, because camel milk is rich in anti-rotavirus antibodies (Yagil, 2013).

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Camel milk against sugar diseases

Camel milk is already being used to treat diabetes (Agrawal et al., 2007; Al-Haj and Al-Kanhal, 2010; Malik et al., 2012). Diabetes mellitus is a metabolic disorder that leads to increased blood sugar levels (hyperglycemia). Type 1 diabetes is caused by a deficiency of the hormone insulin. The insulin-producing cells in the pancreas (beta cells) are destroyed. In this form of the disease is the classical insulin-deficient diabetes, which usually begins in childhood or adolescence (Agrawal et al., 2003). Use of camel milk provides us an effective procedure for patients with diabetes type 1 (Agrawal et al., 2005). Several authors suggest caused by cross-reaction with cows' milk proteins autoimmune destruction of Langerhans islands cells of humans and thus triggered diabetes Type-1 (Sarugeri et al., 1999; Wasmuth and Kolb, 2000; Schrezenmeir and Jagla, 2000). The studies on diabetic rats have also shown that regular intake of camel milk for 30 days the blood sugar level is reduced (Sahani et al., 2005; Khan et al., 2013), while the camel milk in diabetic rabbits was more effective compared to sole insulin treatment and avoids the induced oxidative stress (El-Said et al., 2010). Similar results were reported on alloxan-induced diabetic dogs (Shoui et al., 2010).

Researchers determined that consuming camel milk significantly reduced insulin doses required. Two-year studies by Agrawal et al. (2011) in India, 24 type 1 diabetics were divided into two groups. Group I (n=12) received usual care, that is diet, exercise and insulin and Group II (n=12) received 500 ml camel milk in addition to the usual care. Insulin requirement was titrated weekly by blood glucose estimation. The results showed that daily drinking half liter of raw, fresh camel milk leads to improved blood glucose levels (from 118.58 ± 19 to 93.16 ± 17.06 mg/dl) and reduced insulin doses (32.50 ± 9.99 to 17.50 ± 12.09 U/day, $P < 0.05$). Out of 12 patients receiving camel milk, insulin requirement in 3 patients reduced to zero. Another study in Yemen on 50 patients type 1 diabetic clearly showed that camel milk mixed with insulin was indicated to be an effective supplementation, as adjunctive therapy in management of type 1 diabetes and the daily doses of insulin can be reduction up 66% (20 units/day) after 12 week of treatment (El-Sayed et al., 2011). The new studies have also shown that camel milk improves the liver and the kidney functions in diabetic rats (Hamad et al., 2011; Shori, 2015).

Camel milk contains higher concentrations of insulin (58.67 ± 2.01 UL) compared to cow's milk (17.01 ± 0.96 UL) (Hamad et al., 2011; Mullaicharam, 2014) and insulin-like growth factor-I (El-Khasmi et al., 2002), which are not destroyed in the stomach. It is a fact that only camel milk

remains unaffected by gastric acid and so passed to the intestine and there is absorbed (Abu-Lehia, 1989; Zagorski et al., 1998).

Usually, administration of insulin orally in diabetic patients is not effective, but it seems that insulin in camel milk can be an exception. Thus, a study of the literature suggests the following possibilities for the use of insulin in the camel milk (Malik et al., 2012):

- Insulin in camel milk possesses a special property that makes absorption into circulation easier than insulin from other sources or cause resistance to proteolysis.
- Camel insulin is encapsulated in nanoparticles (lipid vesicles), that make possible its passage through the stomach and entry into the circulation.
- Some other elements of camel milk make it anti-diabetic. Sequence of camel insulin and its predicted digestion pattern do not suggest differentiability to overcome the mucosal barriers before been degraded and reaching the blood stream.

This is probably also that camel milk contains insulin-like small molecule substances that mimic insulin interaction with its receptor.

Shori (2015) concluded that camel milk has a powerful effect in reducing blood glucose levels and insulin requirement and it limits diabetic complications such as elevated cholesterol levels, liver and kidney diseases; decreased oxidative stress and delayed wound healing.

It appears that additional scientific studies are needed to prove the effectiveness of camel milk for the treatment of diabetes.

Other studies of intolerant Patients to lactose have showed that the consumption of camel milk achieved good results and the acceptance was excellent by 23/25 patients. Therefore, camel milk can be considered an option for the individuals intolerant to lactose (Cardoso et al., 2010). Mullaicharam (2014) reported that lactose-intolerant patients often easily digest camel milk. This lower lactose intolerance could be linked to the high concentration in L-Lactate in camel milk, reverse to cow milk, rich in D-Lactate (Baubekova et al., 2015).

Camel milk against food allergy

Camel milk has been used to treat food-allergic children (Shabo et al., 2005; Elagamy et al., 2009; Al-Hammadi et al., 2010). It is known that some foods, such as milk and dairy products can cause allergies. The investigations of Elagamy et al. (2009) have shown that the immunological cross-reactions between camel and cow's milk proteins be lacking. In a previous studies from Restani et al. (1999) and

Elagamy et al. (2009) found that IgE of children who were allergic to cow's milk, only unreacted with camel milk. They lead back this to phylogenetic differences between camels and ruminants (Stahl, 2005).

Shabo et al., (2005) investigated the effect of consumed camel milk on eight children, which had severe food allergies. The children were given two weeks only camel milk as a substitute for all other foods. Within 24 hours after the start of treatment, the children would have had fewer symptoms and within four days, they had disappeared all the symptoms. In all eight cases, treatment resulted in rapid improvement of children's health, later followed by the ability to digest other foods. It is believed that immunoglobulin's in camel milk play a key role in reducing allergic symptoms in children. The investigations of Ehlayel et al. (2011) showed similar results. Thirty-Five children (23 males and 12 females), aged 4-126 months were used. Eighty % of the treated children, which were food-allergic, have positive results after using of camel, milk (negative skin-prick test to camels milk). These children with cow's milk allergy could safely take camels milk as an alternative nutrient. El-Agamy et al. (2009) indicated that the absence of immunological similarity between camel and cow milk proteins can be regarded as important points of nutrition for children allergic to cow milk.

According to presented results additional scientific research is needed to sufficiently prove the effectiveness of camel milk in treating allergies.

Camel milk to reduce high cholesterol in the blood

Elevated levels of cholesterol in the blood are regarded as a major risk factor for heart disease. It has been demonstrated that, administration of fermented camel milk has a hypocholesterolemic effect in rats (Elayan et al., 2008). Hypocholesterol mechanism of camel milk is still unclear, but different hypotheses were discussed, including: the interaction between bioactive peptides from camel milk and cholesterol levels is derived, which lead to cholesterol-lowering (Li and Papadopoulos, 1998) and the presence of orotic acid in camel milk (arises as an intermediate in the metabolism of the nucleic acids), which is considered responsible for the lowering of cholesterol levels in rats (Rao et al., 1981) and in humans (Buonopane et al., 1992).

Camel milk for treating psoriasis

In a study on the application of camel milk crème (preparation CAMELK-Psoralait with 40% raw camel milk) has been reported, that camel milk crème showed in psoriasis patients very good results. Twenty patients, 10 men and 10 women, ranging from 6 to 72 years old, with mild to moderate psoriasis were treated daily 2 x with camel milk crème during 4 weeks. They reported a pleasant cool,

reduced itching or other discomfort. The skin redness and dryness decreased significantly (Wernery, 2006; www.Zoe-acc.com, 2009).

Camel milk against Hepatitis C and B

Hepatitis C virus (HCV) is spread worldwide and so far no effective treatment is available. To combat the disease, often use the Egyptian patients traditional medicines, such as recording of camel milk, which contains lactoferrin Protein. Redwan and Tabll (2007) showed that incubation of human leukocytes with Camel lactoferrin then infected with HCV did not prevent the HCV entry into the cells, while the direct interaction between the HCV and Camel lactoferrin leads to a complete virus entry inhibition after seven days incubation. Today it represents the camel milk, which has the lactoferrin in slightly higher concentrations (Konuspayeva et al., 2006), as a primary biotechnology drug against HCV infection (Redwan and Tabll, 2007). It have also been documented that not only lactoferrin in the camel milk is responsible for HCV infection, but also camel IgG showed ability to recognize Hepatitis C virus peptides with a significant titer in comparison with human IgG which failed to do it (El-Fakharany et al., 2012). In addition, the influence of camel's milk on the immune response in chronic hepatitis B patient has been studied and demonstrated that camel milk can enhance the cellular immune response in the patient and inhibits the replication of virus DNA and promotes recovery of chronic hepatitis B patients (Saltanat et al., 2009).

Camel milk to strengthen the immune system

The use of camel milk to strengthen the immune system has been tested in many studies. It is known that serum of camel milk has a whole class of immunoglobulin's, which fundamentally differs from all other known antibodies. So, Elagamy et al., (2009) found that camel milk proteins have unique patterns that are totally different from cow and human milk. The study found that the lack of immunological similarity between camel and cow's milk proteins may be considered as an important criterion of the nutritional physiological and clinical aspects. This leads to improved immune function in the consumption of camel milk, this means increased immunity has a healthier and less sensitive organism and it can also protect other pathogens and better against external agents such as bacteria or viruses. Another studies indicated that camel milk contains immunoglobulin's (Ig) special in camels. The immunoglobulin's are the same structure as human immunoglobulin's but only one tenth the size (Mullaicharam, 2014). So that enables easy targeting and penetration of foreign disease for destruction by the immune system, where human immunoglobulins cannot (www.nourishinghope.com).

In general camel milk contains the following immune proteins in higher qualities than other milk according to www.nourishinghope.com:

- Peptidoglycan Recognition Protein (PGRP) is very high in camel milk. It stimulates the hosts' immune response and has antimicrobial activity.
- Camel lactoferrin has a higher bioactivity than cows and goats milk (Conesa et al., 2008). Lactoferrin prevents microbial overgrowth and invading pathogens.
- Lysozyme is an enzyme that is part of the innate immune system that targets gram-positive bacteria.
- Lactoperoxidase has bactericidal activity on gram-negative bacteria like *Escherichia coli*, *Salmonella* and *Pseudomonas*
- N-acetyl-beta-D-glucosamidase (NAGase) has antibacterial activity and found in similar quantities in human milk.

Camel milk against cancer

Various scientific studies showed that application of camel milk-camel urine (drinking cure) lead to a reduction in the growth of cancer cells (Magjeed, 2005). So, a group of scientists have developed a formula of the drug for the treatment of cancer. Single doses have already been successfully tested in mice and now want to try to take place in human. The results showed that a high success rate in treating of blood cancer (leukemia). The drug may also be used successfully to treat lung, liver and breast cancer. A study from Korashy et al. (2012) investigated that camel milk (but not bovine milk), significantly inhibited HepG2 (human hepatoma) and MCF7 (human breast) cells proliferation and the induction of death receptors in both cell lines and oxidative stress mediated mechanisms. The scientists believe that camel milk inhibited HepG2 and MCF7 cells survival and proliferation through the activation of both the extrinsic and intrinsic apoptotic pathways.

In addition, the potential of camel milk lactoferrin for its ability to inhibit the proliferation of colon cancer cell line, HCT-116 in vitro and the DNA damage and its antioxidant activity was evaluated for the first time (Habib et al., 2013).

Camel milk against autism

It has been reported that autism is funded by the opioid peptides (Panksepp, 1979). This means that excessive amounts of endogenous or exogenous opioid peptides from food (cow's milk) derived proteins and can be pathophysiology in the autism disease (Dettemer et al., 2007). Casein proteins are metabolized incomplete in the intestines of some people. As a result, short neuroactive peptides, such as β -casomorphins are formed, which are derived from casein. β -casomorphin has long been considered as a risk factor for autism (Woodford, 2011).

In general, autism is an autoimmune disease, which surprisingly reaches the intestine not the brain (Schoenfeld et al., 2000). The reactions in the intestines begin with diarrhea and effect on appetite.

It has been demonstrated that the camel milk has a therapeutic effect in the Autism disease (Al-Ayadhi and Elamin, 2013), because camel milk does not contain the two caseins that lead to the autism symptoms when drinking cow milk. The results of Shabo and Yagil (2005) and the report of Yagil (2013) showed the use of camel milk against autism in the following cases:

- A 4-year-old female, which was autism Disease, after 40 days of drinking camel milk, her autism symptoms disappeared.
- A 15-year-old boy was cured after a 30-day intake of camel milk from his illness (autism).
- In a hostel for autistic youths, 21-year-olds consumed camel milk for two weeks and were observed to be quieter and less self-destructive.

The results indicated that children under 10 years have phenomenal benefits while children over 15 years had wonderful gains.

Regarding to the results seen with autism, camel milk significantly improved clinical measurement of autism severity.

The research Work from Al-Ayadhi and Elamin (2013) on the effect of camel milk consumption on oxidative stress in autistic children showed clearly that the camel milk could play an important role by reducing oxidative stress and the behavior of autistic children has been improved. Similar results were shown by the working group of Wernery et al., (2012) that the autistic children after the use of camel milk have a better social condition and operate a reduction in hyperactivity and increased vigilance and regular bowel movements.

Camel milk for tuberculosis patients

A scientific study from India has led to the conclusion that there is a significant improvement of symptoms observed values through consumption of camel milk by multidrug-resistant tuberculosis ill patients. So it happened that in the test group with camel milk, administered as a dietary supplement with 1 liter/day and patient. There was no cough, sputum, chest pain more. Consequently, an increased appetite and a gain in body weight were recorded in the group, which receiving camel milk as a complement (Mal et al., 2006). The exact course of the improved condition of patients consuming additional camel milk has not been investigated yet (Wernery and Yagil, 2012).

CONCLUSIONS

Camel milk plays very important role in the treatment of many serious diseases in many parts of the world, because it is rich in numerous bioactive substances. Camel milk can be used to treat Diabetes, food allergies, cancer, Hepatitis B and C, Autism, psoriasis, gastrointestinal disorders, high cholesterol in the blood, strengthen the immune system, tuberculosis and others. An increasing number of scientific publications focus on the medicinal potency of camel milk with its special components.

Even the patient can benefit from the biological factors in camel milk, it must be consumed raw, fresh and free of pathogens. This milk could be available also after a good machine milking.

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Conflict of interest

The Author declared that it has no conflict of interest.

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