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Retrospective study on the therapeutic effects and nutritional values of camel's milk

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Abstract

Camel milk Camel milk is an excellent substitute for human milk and does not contain β-lacto globulin. This study intends to review the therapeutic effects of nutritional values of the camel milk in the treatment of different human diseases. MEDLINE from1946 to March 2016, EMBASE from1974 to March 2016, and Google Scholar were searched using the following terms: milk, bodily secretions, camels, camelus, camelides, dromedary, *bactrian camel*, insulin and nano antibodies. The identified articles were reviewed, if the study was investigating the use of camel milk for the potential treatment of diseases that affecting humans. Accordingly, 24 out of 430 studies were included after assessment. The identified studies highlighted the application of camel milk in the treatment of diseases, including diabetes, autism, cancer, various infections, heavy metal toxicity, colitis, and alcohol-induced toxicity. Although most studies using both the human and animal model, a clinical benefit with an intervention of the camel milk, showed variations and sometimes limitations, therefore, the observations of the reviewed studies must be taken into consideration. In conclusion, and based on the evidences of the reviewed studies, the authors recommend to do more future studies on camel milk before consider it to replace the standard therapies for any human diseases.

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Introduction

camel's milk is widely used in various populations for its healing properties and disease prevention mechanisms (Yagil, 2013). Some of the most common indications associated with its applications included diabetes, allergies, immune disorders and

cancer (Clutton-Brock *et al.,* 1999). Although camel milk is used traditionally in the Middle East, Africa and Asia, the initiation of online pharmacies and awareness of natural health products have increased the availability of camel milk for animals that are allergic or intolerant to cow's milk protein (Ehlayel *et al.,* 2011), like in North America and Europe. As a result, clinicians need to be aware of its properties, reported claims, and clinical data when meeting with patients and developing treatment plans. There are two distinct types of camels: *Camels dromedaries* one hump camel) and *Camels Bactrians* (chapman's or two-humped camels). Bactrians are present in the cold desert regions of Central Asia, while dromedaries are native to the hot deserts of North Africa and West Asia (Clutton-Brock *et al.,* 1999). The milk of both types of camels is composed of high minerals and vitamins. High unsaturated fats and the scientific reasons behind the use of camel milk as a natural health product come mainly from its so-called antioxidant **(**Konuspayeva *et al.,* 2009). immunomodulatory, anti-inflammatory, insulin mimetic and anti-apoptotic properties. **(**Konuspayeva *et al.,* 2009; Korashy *et al.,* 2012). These properties have been largely determined by in vitro studies and therefore provide only hypothetical mechanisms of benefit. The clinical efficacy and value of camel's milk as a therapeutic agent is currently unclear. Although there are studies on animal and human populations, most of them are small and evaluate a wide variety of indications and populations. However, patient beliefs may push the use of this agent as a therapeutic alternative or health product that complements modern medical practice (Furnham and Kirkcaldy, 1996). Therefore, a critical review is needed to provide clinicians with a strong history of efficacy data regarding camel's milk as a health product. Consequently, this systematic review was designed to summarize and evaluate the literature regarding the therapeutic efficacy and safety of camel's milk as a therapeutic and natural agent.

2.1. Nutritional value

2.1.1 Protein of milk

The main component of milk, which has a major impact on its nutritional value and technological relevance, is protein. Milk proteins are a heterogeneous group of compounds that have different composition and properties. They are divided into casein complexes and whey protein fractions. Casein is the most important protein in milk, while the proportion of whey protein is relatively low (Guo *et al.,* 2007). Currently, there are four main fractions of casein: αs1-, αs2-, β- and κ. their proportion is diverse and the polymorphism of these proteins has been demonstrated in most animal species (Barłowska, 2007). Human casein does not contain the αs1 fraction which is the predominant factor causing allergies to milk proteins. However; it is rich in β-fraction (Zicarelli, 2004). Milk protein allergy (MPA) is an allergic reaction to proteins commonly found in cow's milk. It is caused by the immune system that reacts to milk proteins because they pose a threat to the body. An activated immune system reacts as if it were a foreign virus or a toxin. Several studies have shown that the majority of children allergic to cow's milk protein (CMPA) synthesize antibodies mainly against α-casein and β-lactoglobulin (Lara *et al.,* 2005). Camel milk is a suitable replace for breast milk because it does not contain β-lactoglobulin, a

characteristic of ruminant milk proteins. Another critical anti-allergenic factor is that the functional components of camel milk include immunoglobulins similar to those of human milk, which are known to reduce children's allergic reactions and enhance their future food response (Shabo *et al.*, 2005). El- Hatmi *et al.*, (2007) reported that camel milk contains higher amounts of antibacterial substances (eg, lysozyme, lactoferrin and immunoglobulins) compared to cow's milk and buffalo milk.

2.1.2 Milk Lipids

Fat is the main substance that defines as the energy value of milk and makes a major contribution to the nutritional properties of milk and its technological adequacy. Milk fat globules have a mean diameter of less than 0.1 μm to about 18 μm (El-Zeini, 2006) and consist of a triglyceride nucleus surrounded by a natural biological membrane. The milk fat globule membrane contains components typical of any biological membrane such as cholesterol, enzymes, glycoproteins and glycolipids (Fauquant *et al.*, 2007). Mansson, (2008) stated that lipids build 30% of the membrane and can be subdivided into the following groups: phospholipids (25%), cerebrosides (3%) and cholesterol (2%). The remaining 70% of the membrane consists of proteins. Fat globules with the largest average diameter are found in buffalo milk (8.7 μm), the smallest in camel milk (2.99 μm) and goat milk (3.19 μm). A high degree of dispersion of the milk fat has a positive influence on the access of lipolytic enzymes to small fat globules (SFG). Therefore, goat or camel milk is more digestible for humans (D'Urso *et al.*, 2008). Cholesterol is present in the milk fat globule membrane (MFGM) and accounts for 95% of the sterols in milk fat. SFGs are characterized by a larger area of MFGM per unit fat. As a result, a greater share of SFG is linked to a relatively higher concentration of cholesterol in milk. Camel milk, which has the highest dispersion state of milk fat, contains the most cholesterol (animal species studied) (31.3 to 37.1 mg / 100 g of milk). Camel's milk is also unique in terms of its fatty acid profile. It contains 6-8 times less short-chain fatty acids than milk from cows, goats, sheep and buffaloes (Ceballos *et al.*, 2009).

2.1.3 Milk Mineral Components

Milk is significant origin of mineral substances, especially calcium, phosphorus, sodium, potassium, chloride, iodine, magnesium and small amounts of iron. The main mineral compounds in milk are calcium and phosphorus, which are important for bone growth and healthy development of newborns. The great bioavailability of these minerals influences the unique nutritional value of milk. Camel milk is the richest in these minerals (Al-Wabel, 2008). Mean values of Na (229.70 mEqL-11), K (550.74 mEqL-11), Ca (994.06 mg%), P (441.68 mg%) and Mg (11.82 mg%) present in the milk of camels at the beginning of lactation. At the end of lactation, the corresponding levels were 35.49 ± 0.89 mEqL-1, 71.86 ± 1.43 mEqL-1, 97.32 ± 0.51 mg%, 47.14 ± 0.52 mg % and 13.58 ± 0.31 mg%, respectively (Mal *et al.*, 2007). Differences in macro-mineral levels reported by various research groups may be due to race differences or environmental conditions such as food and soil. The variation races of camels have different abilities to deposit minerals into their milk (Wangoh *et al.*,

1998). The concentration of Fe, Zn and Cu was 1.00012, 2.00002, 0.44004 mg / dl, respectively. The values of trace elements namely. Fe, Zn and Cu were significantly higher in camel's milk than in cow's milk (Singh *et al.,* 2006).

2.1.4 Milk Vitamins

camel's milk is a kind of exception because of its high concentration of vitamin C. It contains 30 times more vitamin C than cow's milk, and 6 times more than breast milk. This is very important in desert areas, where fruits and vegetables are scarce. As a result, camel milk is often the only source of vitamin C in the diet of people living in these areas (Haddadin *et al.,* 2008). Vitamin A, E and B1 levels were low in camel's milk compared to cow's milk. The concentration of vitamin C in camel's milk at the beginning and end of lactation was 5.26 ± 0.47 and 4.84 ± 0.20 mg%, respectively. Moreover, its Vitamin C content is two to three times higher in than in cow's milk. Levels of vitamin A, E and B1 were higher in camel colostrum than in adult camel's milk. However, the vitamin C content remains higher in mature she camel. The higher vitamin C content can be attributed to the more synthetic activity in breast tissue during the early lactation phase, which decreased as lactation progressed (Stahl *et al.,* 2006). The low pH due to the vitamin C content stabilizes the milk and can be stored relatively longer periods. Camel's milk is of significant nutritional importance because vitamin C has a powerful antioxidant action availability of a relatively higher amount of vitamin C in raw (Mal *et al.,* 2007).

2.2. Medicinal properties of camel milk

2.2.1 Anti-diabetic property

There is a traditional belief in the Middle East, that regular consumption of camel's milk helps in the prevention and control of, diabetes. Recently it has been reported that camel milk may have such properties. The literature review mentions the following advantages: (i) the insulin present in camel milk has particular properties that make absorption into the circulation easier than insulin from other sources; ((ii) camels insulin is envelope in nanoparticles (lipid vesicles) that allow it to enter the stomach and enter the circulation; (iii) some other elements of camel milk make it anti-diabetic (Ajamaluddin *et al.,* 2012). The long-term study was managed up on time to evaluate the efficacy, safety and acceptability of camel milk as an adjunct to insulin therapy in type 1 diabetics. Camel's milk can be said to be safe and effective in improving long-term glucose control, with an important decrease in insulin doses in patients with type 1 diabetes (Amjad *et al.,* 2013). The insulin in milk is proven by the many researches that follow Camel's milk contains high concentrations of insulin at 150 U/ml. Although human, cow and goats milk contains insulin, it degrades in the acid environment of the stomach. This does not happen with camel milk that does not react with acid and no coagulum is formed (Zagorski *et al.,*1998).

2.2.2 Antibacterial activity

Camel's milk includes different protective proteins mainly enzymes that exert antibacterial and immunological property. The presence, of these proteins helps makes clear some of the natural healing properties of the milk (Farah, 1993). According to Conesa *et al.,* 2008; Ueda *et al.,* 1997 and Kiselev, 1998, the camel milk contains protective proteins, and its immune system: Lysozymes; participate in the basic immune system, which is based on targeting common structures for the causes of invasive disease. The immune protects the body against infections is Lactoferrin: Iron-saturated lactoferrin (which begins at the second week of lactation) inhibits the growth of microbes in the gut and participates in the initial immune system, which depends on the targeting of common patterns of causes of invasive disease. It gives to the host's non-immune defense system, extend bactericidal activity (mainly on gram-negative bacteria), and has growth activity, antitumor activity and close relationship (71%) with the human thyroid peroxidase involved in iodization and coupling in the formation of thyroid hormones. The highest concentrations of this enzyme are in camel milk, have been found in camel's milk, have an apparent effect, on breast cancer by controlling metastases, stimulate the immune response of the host (Hoelzer *et al.*,1998).

2.2.3 Treatment for allergies

The fact that camel milk lacks β-lactoglobulin and a "new" β-casein (Makinen-kijunen and Palosne, 1992), the two potent allergens in cow's milk, makes milk good-looking too children with milk allergies. Camel's milk has a positive effect in children with severe food allergies. Children with severe food allergies quickly improved with camel milk. The reactions are fast and lasting. Much research still needs to be done on the curative effects of milk (Restani *et al.*,1999). Another relevant fact is that the constituents of camel milk include immunoglobulins similar to those of breast milk, which reduce children's allergic reactions and reinforce their future response to food (Makinen-kijunen and Palosne, 1992).

In conclusions, this review is focused on the camel's milk properties and its therapeutic effects and the nutritional values in the treatment of various human diseases

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