INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 17, No. 4, p. 83-98, 2020

RESEARCH PAPER OPEN ACCESS

Nutritional Composition and Medicinal Properties of Camel Milk, and Cheese Processing

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Key words: Camel Milk, Nutritional Composition, Medicinal Effect, Immune Boosting, Camel Milk Cheese.

http://dx.doi.org/10.12692/ijb/17.4.83-98 Article published on October 10, 2020

Abstract

This review has been conducted on camel milk and its nutritional parameters and medicinal effect on humans. Basically, milk is a complete diet and it is composed of a wide range of health-beneficial components. Camel milk has salty taste due to rich of minerals. Nutritionally, it is composed of protein in form of casein and whey, short-chain fatty acid, lactose, immunoglobulins, vitamin including A, E, D, and B, and minerals such as sodium, potassium, iron, copper, zinc and magnesium, especially calcium and kalium. Medicinally, camel milk can reduce the risk of cancer and autism. This milk is also suitable for infectious diseases like diarrhea, hepatitis and allergy and plays a vital role in physiological disorders such as diabetes. The immunoglobulins components of camel milk boost human immunity. Camel milk is stored after processing in the form of cheese. The camel milk is beneficial for human health against diseases.

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Introduction

Camel Milk

Out of 19 million camels 15 million were in Africa and 4 million in Asia. It considered multi-purpose animal with gigantic beneficial prospective. Camel milk is principle part of the rural community's fundamental eating routine, which contributed up to 30% of the yearly caloric intake (Al-Salihi, 2016).

Because of the absence of β-lactoglobulin, milk of camel is taken as the best substitute for the milk of humans. Narrow-minded persons of lactose effectively make the drain of camel, was shown by the research exposers. Camel milk has an abundance of minerals plus vitamins particularly iron, vitamin. C and vitamin B. the salubrious properties such as antibacterial, antiviral and antitumor characteristics are due to the presence of lactoferrin in the milk of camel. Short in assessment and antigens filtration permitting plus the abilities of the unaffected immune system is upgrading ailments competing immunoglobulins are present in it.in addition to being the major occupier of insulin, 52 blocks of insulin per liter are carried by it that makes it an important cure for diabetes and gastrointestinal diabetes (Gizachew *et al.*, 2014).

Zinc is present in a big amount in camel milk, fast production of the immune system cells that are sensitive to zinc deficiency. It is well known that in the management of unsusceptible cells of the immune system and their development a crucial role is played by the zinc (Yadav *et al.*, 2015). Antibacterial and antiviral characteristics by the proteins are also examined (El-Agamy, 2009). Camel milk exhibits an assertive check on β cells as well as comprehends insulin in it. Hypoglycemic properties like encouraging cure that maybe the character of insulin alike proteins exhibited obliging influence in the cure of patients suffering from diabetes are shown by the camel milk (Shabo and Yagil, 2005).

Camel Milk Production

In Africa, lactating camels normally produce 1000-2700 liters milk per lactation but it was reported that in South Asia, the production of milk is up to 12000 liters per lactating. Camels, 2nd or 3rd month of lactation produce maximum milk and in between 8-18 months remain to produce milk. Daily milk production in the wet season is doubled than that of the dry season. There is a similarity between the lactation graph of dairy cattle and dairy camel, but camels have more insistent lactation. Usually, Arabian camels are considered as maximum milk producers and are progressively used in demanding dairy operation as compare to Bactrian camels (Raziq *et al.*, 2008).

In 2014 the United States had a 5,000 population of imported camels. The rate of producing cow milk is relatively low than camel milk. In the United States, camels are rare especially female camels, they can be bred safely after the age of four and matures slowly. The female camel stops producing milk if their gestation period which is of thirteen months should conclude a live birth followed by suckling. Not similar to a cow that can give milk up to nine months after being separated from calf when its born but a camel only shares her milk with her calf and also with farmer up to 12-18 months (Dokata, 2014).

Camel milk composition

The changes in camel milk is occur due to the distinction of the geographical origin point and other factors, for example, the physiological stage, feeding conditions, occasional or physiological varieties, hereditary or health status of the camel have additionally a central significance (Mal *et al.*, 2006). Typically it has a sweet and sharp taste, yet some of the time it is salty (Rao, 1970). The synthetic arrangement of camel milk has been examined in different parts of the world (Abu-Lehia, 1987). The general composition of camel's milk differs in different parts of the world with a scope of 3.07-5.5% fat, 3.5-4.5% protein, 3.4-5.6% lactose, 0.7-.95% ash, and 85.87-90% water. Camel milk is opaque white with a normal smell (Mal *et al.*, 2006). An investigation on ten Kazakhstan camels detailed that the main colostrum got during the initial 2 days of lactation, add up to solids was 18.4%, because of the

decrease complete proteins and minerals to 3.6%, and 0.1% respectively; lactose level remained for all intents and unaltered while the fat substance expanded to 5.8% (Sestuzheva, 1958).

The camels are drunk water only one time during winter. From spring until the finish of summer mothers and calves allowed to drink water just once per week for one hour only. Water contents of camel milk are 86 percent, when freely available but at shortage water contents of milk are raised to 91 percent. Along these lactating camel loses water to milk during the dry spell. This could be a characteristic adjustment with a specific end goal to give supplements, as well as important fluid to the dehydrated calf (Merin *et al.*, 2001). Moisture and protein observed high in camel milk compare to cow milk. Similarly, a low quantity of total solids and fat in milk has advantages of drinking camel milk over other dairy animals. Changes in the chemical composition of milk confirmed an increase in fat from 0.10-3.78 percent although protein reduced from 1.62-2.66 percent (Singh *et al.*, 2006).

Protein

The protein of camel milk liked that of dairy animal's milk however camel milk caseins and fractions were observed to be poor in crude protein when contrasted by bovine milk. Casein is a significant protein in camel milk constituting around 52 - 87% of aggregate protein of which β-casein 65%, α-1 casein 22%, α-2 casein 9.5% and k-casein 3.5% (Khaskheli *et al.*, 2005).

Casein fractions isolated in camel milk and observed to be homologous with bovine casein. The balance between the diverse casein fractions is altogether different, be that as it may, and most recognized by the low measure of kappa casein just around 5 percent of total casein, compared with bovine casein which was13.6 percent. This real contrast in kappa casein content has demonstrated troubles in cheese making (Laleye *et al.*, 2008). Camel milk protein contained another sort of protein, a small amount of the beta-casein, and it had a greatly low k-casein which is most likely behind the way that milk does not curdle easily. The major protein in camel milk is casien (1.63– 2.76%). Casien is contributes around 52 to 87 percent of total proteins. The b-CN content is higher than a-CN and constitutes around 65 to 21% of total casein compared with 36 to 38% in bovine milk respectively (Kappeler *et al.*, 2003). The concentration of β-lactalbumin is 3.5mg/ml and 1.2mg/ml in dairy animals. Few properties of camel milk whey protein observed not the same as milk of different animals. It accounted for the heat stability of camel milk influenced by protein contents. Camel milk indicated less dependability at high temperatures of 140^{o}C (Wernery, 2006).

Besides urea or formaldehyde not improved heat stability of camel milk. Camel milk whey seemed more heat-stable (Wernery, 2006). Breakdown of camel milk represented to lower 32-35% whey than dairy animal whey protein 70-75 percent at 80^{o}C for 30 minutes.

The second protein, whey is vital portion of camel milk protein which covers 20 to 25% total protein (Mal *et al.*, 2006). Peptidoglycan recognition protein (PGRP), which is perceived as an enzyme recognized in camel milk, not in bovine milk.

This enzyme contained broad antimicrobial actions and the capacity to control tumor metastasis (Wernery and Yagil, 2012).

The previous study showed that the amino acid arrangement determined in 15 tests of camel milk in Sudan and compared with other dairy animal milk casein, demonstrated more proline and threonine in camel milk casein noted less alanine, arginine, glycine, histidine and serine. Conversely, the information wrote about amino acid composition demonstrated that amino acid contents of camel milk protein like that of dairy animal's milk. Levels of calcium, phosphorus and magnesium found to run between 74.1-200.2 mg, 2.19-2.9 mg and 5.9-11.5 mg correspondingly in Somalian camel milk (Kula and Tegegne, 2016).

Vitamins

Camel's milk significantly contains fewer vitamin A and riboflavin than cow milk while vitamin C by and large three times higher than bovine milk (Farah *et al.*, 1992). Eleven camel milk tests in Saudi Arabia were investigated, and discovered that the vitamin C content was 23.7, thiamin content was 0.33 and the riboflavin content was 0.416 mg/kg. Vitamin C and riboflavin content in camel milk were 24.9 and 0.56 mg/kg. The researcher revealed that the levels of vitamin C and riboflavin in raw camel milk were higher than dairy animal milk. The author detailed decrease in vitamin C of around 27, 41, 53, and 67% for tests of raw camel milk heated at 63, 80, 90, and 100C° for 30 min. However heat treatment caused an unimportant measure of decimation (0-7%) of the riboflavin content (Mehaia, 1994).

As per the USDA report 2009, 250ml camel milk furnish a fully developed person around 15.5 percent cobalamin (B_{12}), 8.25 percent riboflavin (B_2), 5.25 percent vitamin A, 10.5 percent ascorbic acid (C), thiamin (B_1) and pyridoxine (B_6) recommended daily intake (Alhaj *et al.*, 20006). The estimations of trace minerals such as Fe, Zn, and Cu observed to fundamentally high in camel milk when compared by cow milk (Sing *et al.*, 2006).

Fats, lactose and minerals

In dromedary camel milk the fat content is 1.2%-6.4 % (Konuspayeva *et al.*, 2009). Contents of high chain fatty acids are high in camel milk as compare to short-chain fatty acids. An important lipid, linoleic acid and other unsaturated fatty acids are high in camel milk, which is good for nutrition (Yagil, 1982). The amount of total lactose in camel milk has been reported. It is vital source of minerals especially calcium and kalium (Konuspayeva *et al.*, 2009).

The distinction in caloric value might be ascribed by the variety in lactose, fat and protein substances as camel milk has nearly low aggregated milk solids. Water contents in camel milk differ 87- 90percent. An inverse relationship found between total solids of camel milk and water intake by camel (Khaskheli *et al.*, 2005). At the point when camel milk left to stand, acidity quickly enhances and acidity contents increased from 0.03% after 2 hours to 0.14% following 6 hours. In Sudan, the lactic acid level of new camel milk had a range of 0.1% to 0.22% and the pH ranges from 6.0 to 6.5. The normal thickness of camel milk was 1.029 gcm^{-3}. The thickness of milk at 20°C was 1.72 mPa, while the consistency of cow milk in similar dry matter contents under the same conditions was 2.04 mPa (Mal *et al.*, 2006).

The principal information of unsaturated fat arrangement in camel milk was published, who analyzed milk fat of Indian camels utilizing old system of fractional distillation. The camel milk is normally homogenized milk whose milk fat ranged between 2.6 to 3.2% and has a size with a normal measurement of 2.99µm which is not as much as the span of bovine milk fat globules. Camel milk fat had lower contents of carotene compared with bovine milk (Mehaia and Al-Kahnal, 1989).

A general example of camel milk unsaturated fats shows that short-chain unsaturated fats C4 to C12 are available in little amount compared and dairy animals' milk fat, yet the concentrations of C14:0, C16:0 and C18:0 are moderately high. They additionally expressed that there is a high content of polyunsaturated fats in camel colostrums and milk (Hjort and Hussein, 1993).

Medicinal properties of camel milk

The previous decade has seen a sensational increment and developing enthusiasm for the utilization of camel milk for its therapeutic qualities and now bioactive elements of camel milk have increased huge consideration of researchers from everywhere throughout the world to think over their potential medical advantages (Rasheed *et al.*, 2016). Because of the development of worldwide demand for camel milk, camel cultivation has now been broadly expanded in different districts of the world especially in Asia and Africa. Camel milk and its items, for example, frozen yogurt, and chocolates are presently accessible in the neighborhood markets far and wide

throughout the gulf nations and now have nearly begun to supply all globally (Konuspayeva *et al.*, 2009).

In vitro studies, case reports and in some clinical trials some therapeutic effects of camel milk were determined. Camel milk can be used in treating tuberculosis, liver cirrhosis, Rota viral diarrhea, autism, hepatitis, diabetes, rickets, metabolic diseases, autoimmune diseases and Crohn's disease, as reported in the citing of six review articles (Yagil, 2004; Mullaicharam, 2014).

Autism

The intake of camel milk in youngsters affected by autism showed discounts in autism signs and enhanced motor abilities, language, cognition, joint coordination and skin fitness (Panwar *et al.*, 2015). Children consuming camel milk have had tremendous upgrades in their manner and diets. Camel milk is used as medicinal purposes and several researcher showed that camel milk act as antidiabetic, antiallergic and antimicrobial (El-Salam and El-Shibiny, 2013). The unique characteristics of camel milk consisting of its healing ability and lack of LG have made it a focal point region of studies within the fields of fitness technological know-how and nutrition as an antimicrobial, antidiabetic and antihypertensive complement. Camel milk is displaying encouraging effects inside the treatment of autism, cancer, diabetes, and hepatitis and it's far safe for children with bovine milk allergic reaction (Dubey *et al.*, 2016; Gader and Alhaider, 2016).

Alphahydroxyl acid camel milk helps to discard outer layer of useless cells of skin epidermis via helping to interrupt sugars which might be used to protect pores and skin cells collectively. This enables revealing new cells more flexible and spotless. Hydroxyl acid helped to dispose of wrinkles, age spots, relieve dryness as they make the outer layer of the skin thinner and lower layer of dermis thick. In addition liposome presence in camel milk related for potential beauty element to enhance antigrowing older impact (Choi *et al.*, 2013).

Allergy

The absence of beta-lactoglobulin and the one of a kind arrangement of beta-casein in camel milk save from various type allergic. However, camel milk might be a fascinating opportunity for infant milk foodstuffs. Lactose intolerance is a separate entity. It happened in human beings above five years because of the lesser or absence of an enzyme (lactase) in the GIT. Approximately 90-95% of black people and the simplest 20%-25% of white individuals of the world have partial or whole lactose intolerance. So, the camel milk contain low lactose content that is high as in cow milk, camel milk lactose intolerance does no longer occur but reason likewise now not yet acknowledged (Wernery, 2006).

Milk protein allergy is a hypersensitivity of proteins usually determined in cow milk because of the immune mechanism reacting to milk proteins as they might risk to the body. An activated immune mechanism reacted simply to oversee a virus or toxin. Numerous studies have validated most of the kids with cow milk protein hypersensitive reaction synthesized antibodies predominantly against alpha casein and beta-lactoglobulin (Lorenzen & Meisel, 2005). Some babies and youngsters are allergic to bovine milk could have hypersensitivity after eating buffalo, goat, sheep and cow milk proteins because the presence of wonderful immunological is move-response with their opposite numbers (El-Agamy *et al.*, 2009).

Various foods can motive hypersensitive reactions, in particular intake of ruminant milk and milk commodities. A few food allergic reactions are severe and can result in anaphylactic reactions. It's been cited that there are essentially three exclusive sorts of allergies. The first kind is a right away response, i.e., within forty-five minutes of drinking cow milk, and develops urticaria, angioedema and probably a real anaphylactic reaction. The second kind occurs among forty-five minutes to 20 hours and manifests as pallor, vomiting and diarrhea. The third type may also take longer than 20 hours and includes blended reactions involving the skin, breathing tract, and

intestine. Anaphylaxis is an unexpected, intense, doubtlessly deadly, systemic hypersensitivity that could contain various regions of the frame (along with the skin, respiration tract, gastrointestinal tract, cardiovascular gadget). Camel milk is a good alternative to human milk because it has been no longer incorporating beta-lactoglobulin. Another crucial anti-allergic component was that the useful additives of camel milk consist of immunoglobulin just like those in human milk which might be acknowledged to reduce kid's allergic reaction and enhance their future response to food (Shabo and Yagil, 2005).

The rate of occurrence of milk allergy is very high in infants and young children. The incidence of milk allergy in infants and young children is very high. So, the need is to find a milk that is good alternative of mothers or bovine milk for children. Camel milk is preferred as an alternative and safely consumed. In pediatric department, in between April 2007-February 2010, a research performed on 35 children of age about 6-12 months having cows milk allergy(CMA), 80% of them safely consume camel milk and never get any severe allergic reaction (Ehlayel, 2011). In second research, named "To Determine Whether Camel Milk is Safe tan Goat Milk in CMA", for this purpose 38 children having CMA were elected to perform some tests: CBC, total IGE, Cow Milk specific IGE and SPT. Children were allowed to feed on fresh goat and camel milk. The test result showed less allergic reactions in children, though, it was considered that camel milk is a safe alternative to goat milk (Ehlayel, 2011). In a further study, researchers examined the patients, with CMA, using prick-by-prick test with powdered CM and full cream cow's milk, aged 2 years 3 months and 3 years 6 months. Resultantly, patients were negative for CM in prick test and positive for cow's milk. This research absolutely related with the observations of second research, in which 35 patients were tested with fresh camel milk (Rubino, 2011). Similarly, in a sixth study CMA patients of age 13months- 14 years tested by food antigens and prick-by-prick test with powdered camel milk and cow's milk full of fat. Finally, all patients tested positive for full cream cow milk and negative for powdered CM. Researches above concluded that CM is a preferable to infants having CMA. Further research is needed to finalize these findings. The researchers then theorized that because of different protein of CM that does not provoke any immune response, children were able to easily consume CM safely instead of Cow's milk (Ehlayel, 2011).

Camel milk substantiated its possible effect in treatment of food allergies. A study was conducted to explore the outcomes of camel milk on children with hypersensitivity while consuming cow's milk. In a study, eight students who suffered to a different degree of allergies participated. Only camel milk was given to them to drink (Shabo *et al.*, 2005). The children with severe Food allergies shown positive results when treated with Camel milk. Allergic reactions are fast and leave an enduring effect. El-Agamy studies suggested that in western blotting, when camel's milk protein specific antisera applied no immunologic cross reactions take place between cow's and camel's milk. This is a laboratory assessment to analyze the capability of camel's and cow's milk in allergic children. Assessment of milk has done on basis of molecular and immunological similarities. Two different methods of electrophoresis were applied to extract milk proteins of camels, cows, and humans, and then analyzed. The results show that camel milk proteins are utilized as an alternative of food allergies (El-Agamy Elsayed *et al.*, 2009).

Antimicrobial and anti-inflammatory

Camel milk rich in lactoferrin have effective antimicrobial and anti-inflammatory characters which included microbial obstruction, antiviral consequences, herpes simplex virus, human immunodeficiency virus (HIV), antifungal effects (*Candida albicans*), immune-supportive, immune-modulating capabilities, regulated maturation, activation of neutrophils, maturation and utilities of lymphocytes and anticancer actions (Kanwar *et al.*, 2015). Camel milk carries better quantities of antibacterial supplies compared to cow and buffalo

milk (El-Hatmi *et al.*, 2006).

Effect of small size immunoglobulins of camel milk on beta cells (Agrawal *et al.*, 2007b) and deficient in coagulation of camel milk in the human stomach have additionally contributed to the hypoglycaemic effect (Agrawal *et al.*, 2003). Camel milk antibodies are a potent and selective inhibitor of the viral enzyme mechanism. This explains acute resistance to lethal animal viral illnesses like foot and mouth sickness. A huge quantity of viral antibodies in camel milk suggested that they have uncovered to sicknesses now not infected (Konuspayeva *et al.*, 2009).

Cancer

Camel milk has revealed to set off apoptosis of human breast cancer. Most cancerous cells engulfed through epigenetic mechanisms (Wernery and Yagil, 2012). In human breast cancer cells, apoptosis is provoked by oxidative and apoptotic mechanism by using camel milk (Korashy *et al.*, 2012). Camel milk helped to repair after antitumor treatments by antigenotoxic and anticytotoxic resulted in inhibition of micro-nucleated polychromatic erythrocytes to improve the mitotic index of bone marrow cells (Salwa and Lina, 2010).

Colorectal cancer is reduced up to 60% by the use of camel milk because it contains lactoferrin; an iron-binding protein. It interacted with complex carbohydrates on the surface of cell and prompted signaling like iron pathway follow the inhibition of tumor growth through apoptosis (Habib *et al.*, 2013). Lactoferrin of camel milk has capability to treat tumors through blockading the propagation of tumor cells. Literature showed that with the aid of excessive concentrations of 3-5mg/L lactoferrin in camel milk proliferation of colon cancer inhibited with 56% recovery. In contrast, no inhibition of mobile proliferation turned into cited decrease concentrations of less than 1mg per ml (Tsuda and Sekine, 2000). Active antibodies in camel milk can bind tumors in tissue killing tumor cells without the destruction of tissues. But human antibodies are big to try this (Levy *et al.*, 2013). Lactoferrin in camel milk perform function of thrombin, it repressed coagulation and formation of fibrin, in turn, delayed the growth of metastatic cells (Gader and Alhaider, 2016).

HCV

Observations had first suggested camel milk as an antiviral. It is reported that camel's milk is much beneficial in enhancing and regulating medical and biochemical status, and rate of mortality due to chronic hepatitis. The latest researches showed that lactoferrin in camel's milk helps in inhibition of HCV genotype for contamination of human peripheral system. The direct relation between camel milk lactoferrin and HCV controlled the termination of viral access to normal cells. It is concluded that camel lactoferrin is a powerful antiviral agent as compared to bovine lactoferrin (Redwan, 2007).

Even though camel milk has such values, its consumption has constrained to pastoral location and deserted beings. For this reason, schooling at nutritional and medicinal value of camel milk should be incorporated within the cattle extension program. Further studies should have to be carried out on the dietary and medicinal worth of camel milk (Gizachew *et al.*, 2014).

Intolerant to lactose

Cow milk has higher lactose content than camel milk (OA and HA, 2010). Camel milk can be consumed by lactose-intolerant individuals, which is due to the consumption of cow's milk as studied on 25 patients indicated only in one study so camel milk can be an option for people who can (Cardoso *et al.*, 2010).

Diarrhea

Diarrhea causing Rota virus can be cured by camel milk. The effects of camel milk on diarrhea are under research. In 2010, an animal review suggested that in a model rat, diarrhea is cured by fermented camel milk because of high sodium, potassium contents in it. Fermented camel milk can be determined as good food because of high nutrition value and use in medicinal applications (Mona *et al.*, 2010).

Enhancement in Crohn's and autism diseases like diarrhea; bowel movements considered normal as reported in a review study. Further, on etiology of some diarrheal diseases, authors gave new strategies (Yagil, 2013).

Camel milk boost immune system

Combination of camel milk with few local date merchandise; will increase the antioxidant potential for camel milk, and considerably increases phenolic components in camel milk, and also reduces the high activity of serum enzymes and the attention of urea, and increases the interest of an enzyme (glutathione-S-transferase) proved in a poisoned rat have a look at. And this blended beneficial effect of blending camel's milk with dates requires its use as an excessive nutritional and health price sweetener (Al-Humaid *et al.*, 2010). There become high-quality advantages of camel milk supplementation in TB sufferers. Camel milk includes defensive proteins that may have a probable position boosting immune defenses system. Antibacterial characteristics of camel milk proteins damage mycobacterium tuberculosis (Mal *et al.*, 2006). In Indian camel milk used therapeutically towards dropsy, Jaundice, troubles of spleen, tuberculosis, bronchial asthma and anemia (Rao *et al.*, 1970).

Camel immune mechanism is more potent than human and small immunoglobulin skip from camel milk to human blood. As immunoglobulins found in camel milk throughout lactation, offer a mechanism combating autoimmune illnesses. Autoimmune illnesses caused B-cells incorrectly make antibodies adjacent to the tissue of the body called self-antigen rather than foreign antigen by rehabilitating the immune systems in preference to despair (El-Agamy, 2000).

Camels have a tremendous immune structure, different from all mammalians. There were five groups of human antibodies IgG, IgM, IgA, IgD and IgE. Simplest antibodies included IgG, IgD and IgE, are "Y" shaped macromolecules referred to monomers. While IgM is pentamer and IgA is a dimer. A monomer consisted of four glycoprotein chains, two heavy chains and two light chains. Immunoglobulins are macromolecules having difficulties in achieving and penetrating antigens. But camel immunoglobulins do not have any short-chain and small so lively against the antigen (Riechmann and Muyldermans, 1999). The main blunder in the development of human immunotherapy is the level of antibodies. Larger antibodies cannot reach targets. Camel antibodies are 1/10th of the scale of humans.

Relative simplicity over resemblance and specificity of camel IgG potential to attain and interact with active sites allowed penetration of dense tissues to arrive at antigen. The maximum pertinent factor is the traditional treatment of autoimmune diseases based totally on immune containment whilst camel milk Igs improve the immune system by stimulating reliability (Muyldermans *et al.*, 2001).

Camel milk processing

Camel Milk Fermentation

Conventionally, camel milk consumed either fresh or fermented milk by nomadic tribes. However, there is a growing fashion for the intake of fermented milk products as a medicinal drug which includes diabetes treatment (Agrawal *et al.*, 2005). The fermented milk incorporates lactic bacteria that fortify antimicrobial activities towards pathogenic dealers including *Bacillus, Pseudomonas, Mycobacterium, Staphylococcus, Salmonella* and *Escherichia* (Puzyrevskaya *et al.*, 2000). Camel milk isn't easily fermented by typically using dairy starter cultures. It's been assumed that antimicrobial additives of the camel milk were inflicting this resilience to acidification. It has now been shown that the charge of proteolysis is limiting the lactic acid microorganism of bovine foundation in camel milk whereas antimicrobials don't have any contribution to the put off of the lactic acid bacteria. Complete camel milk and its products are treasured. For fermentation of camel milk, we created two consortia of lactic acid bacteria and bifidobacteria *Lactobacillus acidophilus, Lactococcus lacti, Lactobacillus acidophilus* and *Bifidobacterium bifidum*. It established that those

traces of lactic acid bacteria and bifidobacteria produced exopolysaccharides and synthesized biologically low molecular peptides. The era of receiving dry fermented products from camel milk with an introduction to their composition of oligosaccharides-inulin developed (Farag *et al.*, 2019).

Milk proteins are considered as the most imperative source of the wide scope of organically dynamic mixes (El-Agamy, 2009). Bioactive peptides of different actions can be produced during milk aging with LAB (Mills *et al.*, 2011). Cancer prevention properties showed in mature bovine and camel milk recommend adjacent to their nourishing worth they are additionally potential for utilitarian and novel sustenance to health through nourishment (Korhonen, 2009). Wide scopes of regular bioactive peptides have been found in fermented dairy items (Fitzgerald and Murray, 2006).

Valuable source impacts these peptides incorporate immunomodulatory actions, antioxidative actions (Solieri *et al.*, 2015), antimicrobial (Hernandez *et al.*, 2005), opioids, mineral official (Lorenzen and Meisel, 2005), and ACE inhibitor actions (Gobbetti *et al.*, 2004).

The ability of camel skimmed milk to form a curd in course of fermentation with the aid of starter culture determined that the dromedary milk coagulum (pH 4.4.) did no longer monitor curd formation but indicated a fragile and heterogeneous structure, the coagulum appears to be made up of dispersed casein flakes (Attia *et al.*, 2001).

Biochemical alterations in amino acid, water-soluble vitamins and natural acids take place at some point of fermentation at temperature 43°C of camel milk inoculated with *S.thermophilus, L.bulgaricus, L. lactis, L.acidophilus* and combined yogurt culture have been studied (Magdi *et al.*, 2001). The first-class of acidophilus milk made from cow milk was advanced and had curd while that made from camel milk become watery and brought on inside the form of flocks without a curd formation and the acceptability of the acidophilus milk made from cow milk scored higher than that of camel milk (Abu-Tarboush, 1994).

Amino acids analysis camel milk fermented foodstuffs revealed an insignificant increase in alanine, arginine, lysine, histidine and arginine other side valine, methionine and tyrosine decreased. Fermentation significantly decreased vitamin C contents and has no significant effect on riboflavin and thiamine contents. Single, as well as mixed fermentation culture, resulted in a decrease in lactose concentration with a parallel increase in glucose and galactose (Magdi *et al.*, 2010).

A relative observation at the fermentability of camel and cow milk using lactic acid cultures (yogurt subculture, cheese way of life and *Lactobacillus acidophilus*) indicated that the three cultures were less energetic in camel milk than in cow milk, as decided using the quantity and charge of acid production in the 2 milk samples. *Lactobacilli acidophilus* found to be the least active of the three cultures. Colonies of subculture organisms taken from camel milk discovered to be smaller than those from cow milk in all likelihood indicating the presence of growth-inhibiting factors. Camel milk did not attain a gel-like structure after 18-hour incubation (Gnan *et al.*, 1991).

Camel Milk Cheese Processing

Cheese making innovation means to save milk so that utilization could be put off periods from days to months. Manufacturing of cheese in the same way as other food protection permits the wholesome and economic estimation of food materials. It utilized numerous spots to control the ruining of milk where surplus measures of milk changed over to items or ruined. The first point of cheese formulation was expanding the timeframe of realistic usability and preserves the nutritious segments of milk. Making hard cheese from camel milk was fruitful when whey culture was incorporated (Gader and Alhaider, 2016).

To enhanced the hardness of curd and lessened the coagulating time. The attributes of the hard cheese

(e.g. surface and hardness) are like those of Grana cheese produced using cow milk. Researchers found that over half of the milk fat was held in the whey, which color is white. Assembling cheese from camel milk can be enhanced by utilizing the ultrafiltration method (Mehaia, 1993). It is extremely hard to get camels milk to turn sour, additionally pasteurizing the milk at simply the accurate temperature is essential as though it is somewhat too low, the microorganisms remains and if too high, the milk won't coagulate. Additionally little or a lot of salt has precisely a similar impact. The camel was sifted and heated to 72°C for 15 seconds. Calcium chloride (0.02 %) or CaSO4 (0.015 %) added with constant shake to run the cheese-making process. Afterward, milk was permitted to cool up to 40°C and then 0.15 % starter culture incorporated. The temperature kept at 35-40°C. Calf rennet was utilized for coagulation of milk with a ratio of 2ml for each liter of milk adequate for coagulation. When coagulation time found to go between 3-4 hours required for rennet to coagulate camel milk then assumed it suitable. Additionally, coagulated milk keeps for 2 hours at room temperature in clean cheesecloth to exclude the water contents and a short time later cutting was performed. After cutting cheese curd cooking performed till more whey isolated. Moisture, fat and yield of cheese analyzed at the end (Rao *et al*., 1970).

The chemical arrangement of dormiati type cheese produced using camel milk utilizing the ultrafiltration process had higher moisture contents and lower fat and protein content than cheese delivered by the ordinary process (Mehaia, 1993). The range of total solids, SNF, fat, proteins, casein, ash and chlorides was: 28.38 - 30.69%, 27.45 - 29.33%, 0.50 - 1.6%, 22.32 - 24.79%, 16.24 - 19.64%, 1.64 - 2.49% and 0.60 - 0.90%, relatively (Inayat *et al*., 2003). The average estimations of fat substance for camel cheese utilizing Camifloc (CF cheese) and CaCl2 were 11.5 % and 11.75 % (El-Zubeir and El-Jabreel, 2008). Cheese could be effectively produced from camel milk, simply after blending with the milk of goat, sheep, or cow (Rao *et al*., 1970). The previous study showed that soft delicate white cheese with great adequacy can be produced using low-fat camel milk with lactic cultures. In many cases, the yield of cheese was low contrasted with the cheese produced using other dairy animals. The processing of milk in the research center in Saudi Arabia. The outcome shows that camel milk isn't promptly prepared into cheese and milk from other dairy animals. These outcomes are constructing concerning its low total solids content. He reasoned that its reasonableness for cheese making reduces in a hot season since camel milk animals is affected by water and feed accessibility (Ramet, 2001).

Another examination concluded that invigorating sheep's milk with camel's milk enhanced the processing properties of camel milk for cheese making. The blending procedure made significant differences in the kinds of mixed milk in all properties (enhances coagulating time, curd solidness and lessen curd making with equivalent yield and timeframe of realistic usability (Derar and Zubeir, 2016).

The research evaluated that the normal coagulation time (minutes) of cheese produced using camel's milk was 260.51 minutes. The addition of various levels of sheep's milk to camel milk decreased the coagulation time. In addition the cheese produced using unadulterated sheep milk took the briefest time (74.25 minutes) to coagulate (Derar and Zubeir, 2016). The methods for add up to solids content for the cheeses produced using camels milk, camel milk ratio sheep milk (75% : 25%), camel milk ratio sheep milk (50 : 50), camel milk ratio sheep milk (25% : 75%) and sheep milk toward the start of capacity were 43.71%, 44.86 %, 47.57 %, 46.79% and 48.63%, separately. The camel's milk with respect to sheep's milk (50%:50%) cheese recorded most noteworthy extent of total solids (Derar and Zubeir, 2016).

The strains segregated from camel milk are best for the acid formation and coagulated the milk in less time. It inferred that cheese could be arranged effectively and better outcomes can be acquired by coagulating milk with a starter culture. Initially, the starter culture was a blend of undefined microorganisms however broaden in businesses has

encouraged the departure of various strains in the biological system and led to uniqueness in cheese. Interests expanded to separate strain from traditional cheese (Leroy & De Vuyst, 2004). Probably most commonly recognized lactic acid bacteria utilized as a part of cheese formation or often utilized as a part of a mixture with others for its capacity to create folic and formic acids which utilized for purine synthesize (Gobbetti *et al.*, 2015). The researcher revealed that an acceptable Dormiati cheese with a palatable gross composition yield, great flavor and in general overall acceptability can be acquired in cheese produced by using a mixture of camel milk and dairy animals milk as takes after 50%camel milk and half bovine milk or 25% camel milk and 75% cow milk. Raw camel milk indicated poor rentability and the curd framed was looser and weaker than curd from cow and goat milk (Bayoumi, 1990). Few authors have revealed that camel milk cannot be coagulated with rennet except if it mixed with different kinds of milk (Rao *et al.*, 1970).

Numerous specialists around the globe explored the chemical composition of fermented milk. The normal composition of conventional cheese was 10.7 and 37.5% total solids, 2.22 and 16.47% fat, 3.1 and 15.8% protein, 4.2 and 4.1% lactose, 0.17 and 0.5% chloride and 0.54 and 1.265 ashes, separately. While the pH and lactic corrosive substances were 4.2 and 4.1, 0.67 and 1.04%, respectively. Chemical composition of Leben (Iraqi matured milk) was 3% fat, pH 3.9, 1.31% titratable acidity, 0.07% ethanol and 339 mg acetoin diacetyl/kg (Abo-Elnaga *et al.*, 2012). To modify milk into cheese, the gel got after coagulation assume vital role. For cow milk, calcium ions help to go to this gel stable in all types of milk. Typically calcium phosphate or calcium chloride is utilized, for the most part on milk after heat treatment. It is expressed that to get firmness curd of camel milk, 10-15 g of calcium chloride per 100 kg of milk must be included when rennet is utilized (Benkerroum *et al.*, 2011).

Conclusion

It is concluded that camel milk has kept medicinal components that can cure diarrhea and allergy, improve hepatitis and cancer diseases and prevent diabetes and autism. Wide nutritional components of camel milk aid to regulate and develop the human body, its vitamins like A and E and immunoglobulins boosting immunity. Camel milk is store after processing in the form of cheese. Further research is required to investigate other factors for the improvement of camel milk and its products.

Acknowledgments

The authors thank the Library Department, Government College University, Faisalabad (GCUF), and IT Department, Higher Education Commission (HEC), for the access to journals, books, and valuable database.

References

Abo-Elnaga TR, Gouda AS, Kamel YM, Mahmoud MA, Osman WA. 2012. Application of the polymerase chain reaction for identification of Mycoplasma isolated from aborted She Camel. Global Veterinaria **8(4),** 386-392.

Abu-Lehia I. 1987. Composition of camel milk. Milchwissenschaft. Milk Science International **42,** 368.

Abu-Tarboush HM. 1994. Growth behavior of Lactobacillus acidophilus and biochemical characteristics and acceptability of acidophilus milk made from camel milk. Milchwissenschaft **49(7),** 379-382.

Agrawal R, Beniwal R, Kochar D, Tuteja F, Ghorui S, Sahani M, Sharma S. 2005. Camel milk as an adjunct to insulin therapy improves long-term glycemic control and reduction in doses of insulin in patients with type-1 diabetes: a 1 year randomized controlled trial. Diabetes research and clinical practice **68(2),** 176-177.

Agrawal R, Budania S, Sharma P, Gupta R, Kochar D, Panwar R, Sahani M. 2007. Zero prevalence of diabetes in camel milk consuming Raica community of north-west Rajasthan, India. Diabetes

research and clinical practice **76(2)**, 290-296.

Agrawal RP, Swami SC, Beniwal R, Kochar DK, Sahani MS, Tuteja FC, Ghorui SK. 2003. Effect of camel milk on glycemic control, lipid profile and diabetes quality of life in type 1 diabetes: a randomised prospective controlled cross over study. Indian Journal of Animal Sciences **73(10),** 1105-1110.

Alhaj O, Kanekanian A, Peters A. 2006. The effect of Bifidbacterium lactic and trypsin on cholesterol. Paper presented at the International Food and Health Innovation Conference, Malmö, Skane Food Innovation Network, Sweden.

Al-Humaid A, Mousa H, El-Mergawi R, Abdel-Salam A. 2010. Chemical composition and antioxidant activity of dates and dates-camel-milk mixtures as a protective meal against lipid peroxidation in rats. American Journal of Food Technology **5(1),** 22-30.

Al-Salihi K. 2016. Observations on dromedary (Arabian camel) and its diseases. MRVSA **5(1),** 1-10.

Attia H, Kherouatou N, Dhouib A. 2001. Dromedary milk lactic acid fermentation: microbiological and rheological characteristics. Journal of industrial Microbiology and biotechnology **26(5),** 263-270.

Bayoumi S. 1990. Studies on composition and rennet coagulation of camel milk. Kieler Milchwirtschaftliche Forschungsberichte **42(1),** 3-8.

Benkerroum N, Dehhaoui M, El Fayq A, Tlaiha R. 2011. The effect of concentration of chymosin on the yield and sensory properties of camel cheese and on its microbiological quality. International journal of dairy technology **64(2),** 232-239.

Cardoso RR, Santos RMDB, Cardoso CRA, Carvalho MO. 2010. Consumption of camel's milk by patients intolerant to lactose. A preliminary study. Revista Alergia de Mexico **57(1).**

Choi SK, Park KD, Kim D, Lee DW, Kim YJ. 2014. Preparation of camel milk liposome and its anti-aging effects. Journal of the Society of Cosmetic Scientists of Korea **40(2),** 155-162.

Derar AMA, El Zubeir IE. 2016. Effect of fortifying camel milk with sheep milk on the processing properties, chemical composition and acceptability of cheeses. Journal of Food Science and Engineering **6,** 215-226.

Dokata MD. 2014. Factors influencing camel milk production in central division of Isiolo District: A case of three camel milk women selfhelp groups in Isiolo County, Kenya (Doctoral dissertation, University of Nairobi).

Dubey US, Lal M, Mittal A, Kapur S. 2016. Therapeutic potential of camel milk. Emirates Journal of Food and Agriculture 164-176.

Ehlayel M, Bener A, Abu Hazeima K, Al-Mesaifri F. 2011. Camel milk is a safer choice than goat milk for feeding children with cow milk allergy. International Scholarly Research Notices, 2011.

Ehlayel MS, Hazeima KA, Al-Mesaifri F, Bener A. 2011. Camel milk: an alternative for cow's milk allergy in children. In Allergy and asthma proceedings **32(3),** p 255). OceanSide Publications.

El Zubeir IE, Jabreel SO. 2008. Fresh cheese from camel milk coagulated with Camifloc. International Journal of Dairy Technology **61(1),** 90-95.

El-Agamy E. 2000. Specific immunoglobulins to human rota virus in camel colostrum and milk. Paper presented at the Proc. 2nd Intl. Camelid Conf. Agro-economics of Camelid Farming. Almaty, September (p 98).

El-Agamy EI, Nawar M, Shamsia SM, Awad S,

Haenlein GF. 2009. Are camel milk proteins convenient to the nutrition of cow milk allergic children? Small Ruminant Research **82(1),** 1-6.

El-Agamy EI. 2009. Bioactive components in camel milk. Bioactive components in milk and dairy products **107,** 159-192.

El-Agamy Elsayed I, Nawar M, Sherif MS, Awad S, Haenlein GFW. 2009. Are camel milk proteins convenient to the nutrition of cow milk allergic children? Small Ruminant Research **82(1),** 1–6.

El-Hatmi H, Levieux A, Levieux D. 2006. Camel (Camelus dromedarius) immunoglobulin G, α-lactalbumin, serum albumin and lactoferrin in colostrum and milk during the early post partum period. Journal of Dairy Research **73(3),** 288-293.

El-Salam MA, El-Shibiny S. 2013. Bioactive peptides of buffalo, camel, goat, sheep, mare, and yak milks and milk products. Food Reviews International **29(1),** 1-23.

Farag MA, El Hawary EA, Elmassry MM. 2019. Rediscovering acidophilus milk, its quality characteristics, manufacturing methods, flavor chemistry and nutritional value. Critical Reviews in Food Science and Nutrition 1-18.

Farah Z. 1993. Composition and characteristics of camel milk. Journal of Dairy Research **60(4),** 603-626.

Fitzgerald RJ, Murray BA. 2006. Bioactive peptides and lactic fermentations. International Journal of Dairy Technology **59(2),** 118-125.

Gader AGMA, Alhaider AA. 2016. The unique medicinal properties of camel products: A review of the scientific evidence. Journal of taibah university medical sciences **11(2),** 98-103.

Gizachew A, Teha J, Birhanu T, Nekemte E. 2014. Review on medicinal and nutritional values of camel milk. Nature and Science **12(12),** 35-41.

Gnan S, Mohammed M, Igwegbe A, Shareha A. 1991. A comparative study on the fermentability of camel and cow milk by lactic acid culture. Paper presented at the International Conference on Camel Production and Improvement, Tobruk (Libyan Arab Jamahiriya), 10-13 Dec 1990.

Gobbetti M, De Angelis M, Di Cagno R, Mancini L, Fox PF. 2015. Pros and cons for using non-starter lactic acid bacteria (NSLAB) as secondary/adjunct starters for cheese ripening. Trends in Food Science & Technology **45(2),** 167-178.

Gobbetti M, Minervini F, Rizzello CG. 2004. Angiotensin I-converting-enzyme-inhibitory and antimicrobial bioactive peptides. International Journal of Dairy Technology **57(2-3),** 173-188.

Habib HM, Ibrahim WH, Schneider-Stock R, Hassan HM. 2013. Camel milk lactoferrin reduces the proliferation of colorectal cancer cells and exerts antioxidant and DNA damage inhibitory activities. Food Chemistry **141(1),** 148-152.

Hernandez D, Cardell E, Zarate V. 2005. Antimicrobial activity of lactic acid bacteria isolated from Tenerife cheese: initial characterization of plantaricin TF711, a bacteriocin-like substance produced by Lactobacillus plantarum TF711. Journal of applied microbiology **99(1),** 77-84.

Hjort AO, Hussein MA. 1993. Camel herd dynamics in southern Somalia: long-term development and milk production implications. EPOS, Environmental Policy and Society. pp. 31-41.

Inayat S, Arain MA, Khaskheli M, Malik AH. 2003. Study of the effect of processing on the chemical quality of soft unripened cheese made from camel milk. Pakistan Journal of nutrition **2(2)**, 102-105.

Kanwar JR, Roy K, Patel Y, Zhou SF, Singh MR, Singh D, Singh RS. 2015. Multifunctional iron bound lactoferrin and nanomedicinal approaches to enhance its bioactive functions. Molecules **20(6),** 9703-9731.

Kappeler S. 1998. Compositional and structural analysis of camel milk proteins with emphasis on protective proteins (Doctoral dissertation, ETH Zurich).

Khaskheli M, Arain MA, Chaudhry S, Soomro AH, Qureshi TA. 2005. Physico-chemical quality of camel milk. Journal of Agriculture and Social Sciences **2,** 164-166.

Konuspayeva G, Faye B, Loiseau G. 2009. The composition of camel milk: a meta-analysis of the literature data. Journal of food composition and analysis **22(2),** 95-101.

Korashy HM, Maayah ZH, Abd-Allah AR, El-Kadi AO, Alhaider AA. 2012. Camel milk triggers apoptotic signaling pathways in human hepatoma HepG2 and breast cancer MCF7 cell lines through transcriptional mechanism. BioMed Research International 2012.

Korhonen H, Pihlanto A. 2006. Bioactive peptides: production and functionality. International dairy journal **16(9),** 945-960.

Kula JT, Tegegne D. 2016. Chemical composition and medicinal values of camel milk. Int J Res Stud Biosci **4(4),** 13-25.

Laleye L, Jobe B, Wasesa A. 2008. Comparative study on heat stability and functionality of camel and bovine milk whey proteins. Journal of Dairy Science **91(12),** 4527-4534.

Leroy F, De Vuyst L. 2004. Lactic acid bacteria as functional starter cultures for the food fermentation industry. Trends in Food Science & Technology **15(2),** 67-78.

Levy A, Steiner L, Yagil R. 2013. Camel milk: disease control and dietary laws. Journal of Health Science **1(1),** 48-53.

Lorenzen PC, Meisel H. 2005. Influence of trypsin action in yoghurt milk on the release of caseinophosphopeptide-rich fractions and physical properties of the fermented products. International Journal of Dairy Technology **58(2),** 119-124.

Magdi OA, Ibrahim RAE, Hamid DA. 2010. Biochemical changes occurring during fermentation of camel milk by selected bacterial starter cultures. African Journal of Biotechnology **9(43),** 7331-7336.

Mal G, Sena DS, Jain V, Sahani M. 2006. Therapeutic value of camel milk as a nutritional supplement for multiple drug resistant (MDR) tuberculosis patients. Israel Journal of Veterinary Medicine **61(3/4),** 88.

Mehaia M. 1993. Composition, yield and organoleptic evaluation of fresh Domiati cheese made from a mixture of camel and cow milk. Australian Journal of Dairy Technology (Australia).

Mehaia MA, Al Kahnal MA. 1989. Studies on camel and goat milk proteins: nitrogen distribution and amino acid composition. Nutrition reports international.

Mehaia MA. 1993. Fresh soft white cheese (Domiati-Type) from camel milk: composition, yield, and sensory evaluation. Journal of Dairy Science **76(10),** 2845-2855.

Merin U, Bernstein S, Creveld CV, Yagil R, Gollop N. 2001. ORIGINAL PAPERS-Camel (Camelus dromedarius) colostrum and milk composition during the lactation. Milchwissenschaft **56(2),** 70-73.

Mills S, Ross R, Hill C, Fitzgerald G, Stanton C. 2011. Milk intelligence: Mining milk for bioactive substances associated with human health.

International dairy journal **21(6),** 377-401.

Mona EY, Ragia OM, Abeer AKH, Mosa TE. 2010. Biochemical effects of fermented camel milk on diarrhea in rats. New York Science Journal **3(5)**, 106-111.

Mullaicharam AR. 2014. A review on medicinal properties of camel milk. World Journal Pharmaceutical Science **2(3),** 237-42.

Muyldermans S, Cambillau C, Wyns L. 2001. Recognition of antigens by single-domain antibody fragments: the superfluous luxury of paired domains. Trends in biochemical sciences **26(4),** 230-235.

OA AH, Ha AK. 2010. Compositional, technological and nutritional aspects of dromedary camel milk-Review. International Dairy Journal **20(12),** 811-821.

Panwar R, Grover CR, Kumar V, Ranga S, Kumar N. 2015. Camel milk: Natural medicine-Boon to dairy industry. Karnal: ICAR National Dairy Research Institute 10.

Puzyrevskaya O, Saubenova M, Baizhomartova M, Baimenov E. 2000. Microbiological and biochemical characterization of Shubat. Paper presented at the 2nd International Camelid Conference: Agroeconomics of Camelid Farming, Almaty, Kazakhstan.

Ramet JP. 2001. The technology of making cheese from camel milk (Camelus dromedarius) (No. 113). Food & Agriculture Org.

Rao DR, Chawan C, Pulusani S. 1981. Influence of milk and thermophilus milk on plasma cholesterol levels and hepatic cholesterogenesis in rats. Journal of Food Science **46(5),** 1339-1341.

Rasheed N, Alghasham A, Rasheed Z. 2016. Lactoferrin from camelus dromedarius inhibits nuclear transcription factor-kappa B activation, cyclooxygenase-2 expression and prostaglandin E2 production in stimulated human chondrocytes. Pharmacognosy research **8(2),** 135.

Raziq A, Younas M, Kakar MA. 2008. Camel~ A potential dairy animal in difficult environments. Pakistan Journal of Agricultural Sciences **45(2),** 263-267.

Redwan ERM, Tabll A. 2007. Camel lactoferrin markedly inhibits hepatitis C virus genotype 4 infection of human peripheral blood leukocytes. Journal of immunoassay & immunochemistry **28(3),** 267-277.

Riechmann L, Muyldermans S. 1999. Single domain antibodies: comparison of camel VH and camelised human VH domains. Journal of immunological methods **231(1-2),** 25-38.

Rubino M, Mazza GA, Rubino S, Mahdi AM, Zurlo F, Dolceamore RT, Miniero R. 2014. Camel milk: A possible alternative to infant formulas for patients with allergy to cow milk proteins. Digestive and Liver Disease **46,** e116.

Salwa MQ, Lina AK. 2010. Antigenotoxic and anticytotoxic effect of camel milk in mice treated with cisplatin. Saudi journal of biological sciences **17(2),** 159-166.

Sestuzheva E. 1958. Effect of stage of lactation on camel's milk. Mol. Prom **19,** 33-39.

Shabo Y, Barzel R, Margoulis M, Yagil R. 2005. Camel milk for food allergies in children. Israel Medical Association Journal **7(12),** 796–8.

Shabo Y, Yagil R. 2005. Etiology of autism and camel milk as therapy. International Journal on Disability and Human Development **4(2),** 67-70.

Singh R, Ghorui SK, Sahani MS. 2006. Camel milk: Properties and processing potential. Sahani, MS the Indian camel. NRCC, Bikaner 59-73.

Solieri L, Rutella GS, Tagliazucchi D. 2015. Impact of non-starter lactobacilli on release of peptides with angiotensin-converting enzyme inhibitory and antioxidant activities during bovine milk fermentation. Food microbiology **51,** 108-116.

Tsuda H, Sekine K. 2000. Milk components as cancer chemopreventive agents. Asian Pac J Cancer Prev **1(4),** 277-282.

Wernery R, Yagil R. 2012. Medicinal properties in camel milk for treatment of Epidemic Diseases. Paper presented at the Proceedings of the 3rd ISOCARD International Conference, 29th January-1st February.

Wernery U. 2006. Camel milk, the white gold of the desert. Journal of Camel Practice and Research **13(1),** 15.

Yadav AK, Kumar R, Priyadarshini L, Singh J. 2015. Composition and medicinal properties of camel milk: A Review. Asian Journal of Dairy and Food Research **34(2),** 83-91.

Yagil R. 2013. Camel milk and its unique anti-diarrheal properties. Israel Medical Association Journal **15,** 35-36.

Yagil R. 1982. Camels and camel milk book. Food and Agriculture Organization of the United Nations; p 17–18. Available.