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Composition and medicinal properties of camel milk: A Review

Alok Kumar Yadav*, Rakesh Kumar, Lakshmi Priyadarshini[1]and Jitendra Singh[2]

Dairy Cattle Breeding Division,
ICAR-National Dairy Research Inst., Karnal-132 001, Haryana.
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ABSTRACT

Many research findings proved that camel milk is closer to human milk than any other milk. Camel milk is different from other ruminant milk, having low cholesterol, low sugar, high minerals (sodium, potassium, iron, copper, zinc and magnesium), high vitamin C. Camel milk is unique from other ruminant's milk in terms of composition as well as claimed health effects. Camel milk has potential therapeutic characteristics, such as anti-hypertensive, anti-diabetic and anti-carcinogenic. It is often easily digested by lactose-intolerant individuals. On the other hand, camel milk also has ability to reduce the elevated level of bilirubin, globulin and granulocytes. Camel milk failed to show any effect towards improving the level of hemoglobin and leukocytes, and decreasing the erythrocyte sedimentation rate. Camel milk proteins contained satisfactory balance of essential amino acids. It contains disease-fighting immunoglobulin's which are small in size, allowing penetration of antigens and boosting the effectiveness of the immune system. This review focused on the medicinal properties of camel milk which will be more useful to generate value added product.

Key words: Camel milk, Composition, Nutrition, Medicinal properties.

INTRODUCTION

The camel is among the animals mentioned in the Quran as a miracle of the God (Deurasech, 2005). Yagil (1986) has reported that the dromedary camel is an important component of the dry land and desert ecosystem. It is not only an important economic means of short distance transport to the rural and urban societies inhabiting in arid and semi arid zones, but also serves as a source of milk in some of areas of camel rearing societies namely "raikas" and "rabaris" since centuries.

Tezera (1998) reported the importance of camel milk for treating malaria, jaundice, gastro intestinal disorder and strong cough (pneumonia). Research by Indian scientists supports the therapeutic value of camel milk in the treatment of several diseases including tuberculosis (Ilse, 2004).

There are 23.9 million camels in the world. India has 0.45 million camel which is 1.9% of the total world camel population (BAHS, 2012). Sahani *et al.* (1998) reported that the different Indian camel like Bikaneri, Jaisalmeri, and Kachchhi possess the milk production potential 3.22 ± 0.15, 2.17±0.16 and 3.94± 0.13 liter/day respectively with the lactation length of 14-16 months and he also pointed out the Indian camel owners consume the fresh milk daily.

Consumer appreciates camel milk for its medicinal properties. It is reputed to be an anti infectious, anti cancerous and anti diabetic. It is regarded as an energy given product for convalescent. Camel milk helps to treat infectious diseases such as tuberculosis in humans. Camel milk is also used in Kazakhstan as an adjunct to chemotherapy for some form of cancers, those of the digestive tract. The insulin demand decreased in diabetic patients and glyceamia is better balanced (Guakhar and Bernard, 2004). Kurtu (2004) reported that camel milk is claimed by the Somali people to have a remedial effect for at least 13 different kinds of diseases, including hyperacidity, hypertension, pneumonia and respiratory diseases and also to be an aphrodisiac.

Composition of camel milk

Gross composition of camel milk: Camel milk is opaque white with normal odour and salty taste. Opaque white colors because of the fats are finely homogenized throughout the milk. The composition reported by the different research worker is depicted in Table 1.

The milk fat consists mainly of long chained poly unsaturated fatty acid (PUFA) (Abu–Lehiya, 1987). The proteins percentage varies from 2.30% to 3.95% but lacks the allergic β lacto globulin and have different "new" β casein.

*Corresponding author's e-mail: alokvet3842@gmail.com. [1]DCP, Division ICAR-NDRI, Karnal.
[2]Veterinary officer, Department of Animal Husbandry, Lucknow, U.P.

TABLE 1: Composition of camel milk

Water (%)	DM (%)	Fat (%)	Total protein (%)	Lactose (%)	SNF (%)	Ash (%)	References
86.43	13.57	3.78	3.95	4.88	9.59	0.95	Ohri and Joshi (1961)
87.02	12.98	3.08	3.80	5.40	9.92	0.70	Khan and Appana (1965)
87.60	13.00	2.90	3.90	5.40	10.10	0.80	Harbans (1966)
90.50	9.50	2.30	2.30	4.05	-	-	Raghvendar *et al.* (2004)
88.55-90.15	-	2.60-3.20	3.73-3.89	-	7.25-8.25	0.82-0.85	Mal *et al*. (2006) and (2007)

Camel milk has powerful antioxidant property because of vitamin C. Higher vitamin C content may be attributed to more synthetic activity in the mammary tissue during early phase of lactation that declines as lactation advanced. It has a relatively low pH probably caused by the high concentration of ascorbic acid (vitamin C). The low pH due to vitamin C content stabilizes the milk and can be kept for relatively longer period. (Beg *et al.*, 1986; Yagil, 1985 and Farah, 1996).

Mineral profile: Camel milk has high concentration of calcium and iron, the low pH of the milk (which by the vitamin C) allows enhanced absorption from the duodenum. It also contains higher amount of zinc. The rapidly dividing cells of the immune system are sensitive to zinc deficiency. The role of zinc in the development and maintenance of normally functioning immune system has been well established (Hansen *et al*., 1982).

The average value of Na, K, Ca, P, and Mg, Fe, Zn and Cu, are depicted in table -2.

Protective proteins: Camel milk contains various proteins mainly enzymes which exert antibacterial and immunological properties. The presence of these proteins has explained some of the natural healing properties of the milk (Kappeler, 1998). The known protective proteins and their immunological action in camel milk are:

Lysozymes: According to Singh *et al*. (2006) Lysozymes activity is 0.03-0.65 mg/dl. Lysozymes participate in many primary immune systems, which is based on targeting of structures common to invading pathogen. Camel milk lysozymes showed a higher lyses value towards *Salmonella typhinurium* compared to egg white and bovine milk lysozymes.

Immunoglobulin's: Immunoglobulins give the immune protection to body against infection such as tuberculosis and some other bacterial and viral infection (Mal *et al*., 2006).

Lactoferrin: According to Morin *et al.* (1995) Lactoferrin activity varies from 95 to 250 mg/dl. Iron saturated lactoferrin (from second week of lactation) prevents microbial growth in the gut and participate in primary immune system, which is based on targeting of structures common to invading pathogen. Camel milk apparently contains much more lactoferrin than in ruminants (cows, sheep, and goats) milk.

Lactoperoxidase: According to Ueda *et al*. (1997) lactoperoxidase activity is 2.23 ± 0.01 U/ml of milk. Lactoperoxidase is found in milk, tears and saliva. It contributes the non immune host defense system and exerting bactericidal activity, mainly on gram negative bacteria. It has growth promotion activity and anti tumour activity. It has close relation (71%) to human thyroid peroxisdase, which is involved in iodination and coupling in the formation of the thyroid hormones.

Peptydoglycon recognition protein (PGRP): The PGRP was first discovered in camel milk and milk has highest concentration of this protein (Kiselev, 1998). It has apparent effect on breast cancer by controlling metastasis. It stimulates hosts immune response and it has broad antimicrobial activity (Kustikova, 1996).

N-acetyl-β glucosaminidase (NA Gase): Morin *et al.* (1995) reported that the milk enzymes NA Gase are an accepted test

TABLE 2: mineral profile of camel milk

Mineral	Early lactation	Late lactation	References
Na	29.70±0.53mEq/L	35.49±0.89 mEq/L	Mal *et al* (2007)
K	50.74±0.51 mEq/L	71.86±1.43 mEq/L	
Ca	94.06±0.75 mg%	97.32±0.51 mg%	
P	41.68±0.55 mg%	47.14±0.52 mg%	
Mg	11.82±0.22 mg%	13.58±0.31 mg%	
Fe	1.00±0.12 mg/dl	-	Singh *et al.* (2006)
Zn	2.00±0.02 mg/dl	-	
Cu	0.44±0.04 mg/dl	-	

for mastitis in cow. When it was first documented then camel milk was rich in NA Gase, it was assumed that those camels suffered from subclinical mastitis. However, after checking milk of hundreds of camels and llamas all with high NA Gase levels another conclusion was reached. It was concluded that NA Gase has an antibacterial activity and so strengthens the antibacterial antiviral activity of milk. It is noteworthy that the NA Gase activity is similar to that in woman's milk conforming the nutritional advantage of camel milk over cow milk.

Fatty acids: According to Narmuratova *et al.* (2006) in camel milk there are higher content of long chain fatty acid (C-14 to C-18) and lower content of short chain fatty acid (C-4 to C-14). These polyunsaturated fatty acids are very essential to human nutrition. The milk fatty acid presents in camel milk are as follows (table-3).

TABLE 3: Fatty acids in camel milk

Fatty acid	Value % by weight
Butyric acid	0.31-0.75
Caproic acid	0.2-0.6
Caprylic acid	0.2-0.3
Capric acid	0.2-0.4
Lauric acid	1-1.8
Myristic acid	15.9-25.2
Myristoleic acid	1.7-4.5
Palmitic acid	25-29.5
Palmitoleic acid	6.1-19.1
Stearic acid	1.9-11.7
Oleic acid	6.8-24.9
Linoleic acid	0.9-0.2
Arachidic acid	0.6-3.4

(Singh *et al.,* 2006)

Camel milk enzymes: Main milk enzymes and their activity are depicted in table-4.

Milk enzyme Gamma glutamil transeferase (GGT) plays an important role in the keeping quality of camel milk and can be used as indicator for the proper heat inactivation of camel milk because it is destroyed between 10-20 minute at 72 ^{0}C (Wernery, 2007).

Water: The water content of camel milk fluctuates from 84% to 90% (Ohri and Joshi, 1961). The camels were allowed adlib. drinking water during winter, from spring until the end of summer the mother and calf were allowed to drink only once a week for an hour. When water is freely accessible the water content of the milk was 86%, when water was restricted the water content of the milk rose to 91%. Thus it appears that the lactating camel loses water to the milk at the time of drought which is considered as natural adaptation in order to provide not only nutrients, but necessary fluid to dehydrated calf (Yagil and Etzion, 1980).

TABLE 4: Milk enzyme and their activity in camel milk

Enzymes	Activity(IU/L)
Aspartate amino transeferase(AST)	7.98-9.21
Alanine transeferase(ALT)	9.49-11
Gamma glutamyl transferase (ã-GT)	254-296
Acid phosphatase(ACP)	2.74-3.08
Alkaline phosphatase(ALP)	16.04-24.93
Lactate dehydrogenase(LDH)	132-168
Catalase	0.083-0.193 moles/ min/g of protein

NRCC (2006-07)

Comparison with cow milk: Yagil (2000) reported that camel milk composition is vastly different from that of ruminant as is their physiology. Fat consist of polyunsaturated fatty acid that are completely homogenized and gives the milk a smooth white appearance. Lactose is present in concentration of 4.8% but this milk sugar is easily metabolized by person suffering from lactose intolerance (Hanna, 2001). The specific gravity of camel milk is less than that of cow, sheep or buffalo milk (Shalash, 1979). The composition of human, cow and camel milk is given in table 5.

Camel milk is different from other ruminants milk, having low cholesterol, low sugar, high minerals, (sodium, potassium, iron, zinc, and magnesium), high vitamin C, low protein and large concentration of insulin. The values of trace minerals were significantly higher in camel milk as compare to bovine milk (Agarwal *et al*., 2004; Arrowal, 2005). The detail compositional difference of cow and camel milk is given in table-6.

The levels of vitamin A, E, and B1 were reported to be low in camel milk compared to the cow milk (Stahl *et al*., 2006). Cow milk contains â carotene but lack in camel milk. The Vitamin C content in camel milk is two to three folds higher as compared to cow milk (Table-7).

Medicinal properties of camel milk: El-Agamy *et al*. (1992) reported that camel milk possesses antibacterial and antiviral activities and they suggested that this milk contains protective

TABLE 5: Composition of human, cow and camel milk

Animal	Water (%)	Fat (%)	Protein (%)	Lactose (%)	Sodium mEq/l	Calcium mg (%)
Human	87	3.80	1.20	7.00	7.00	34
Cow	87.30	3.50	3.40	4.80	22	130
Camels	86-91	1.90-2.20	2.80-3.60	2.80-4.20	11.40	80

(Yagil, 2000)

TABLE 6: Compositional differences of camel and cow milk

Parameters	Camel milk	Cow milk
Water (%)	90	87
Total solids (%)	10.00	13.00
Fat (%)	2.00	4.00
Insulin (µu/ml)	40.50	16.30
Iron (Mg/100g)	0.05	0.27
Calcium (Mg/100g)	132	120
Potassium (Mg/100g)	152	140
Zinc (Mg/100g)	0.50	0.40
Vitamin C (Mg/ml)	35	10
Niacin (Mg/ml)	4.60	0.60
Pantothenic acid (Mg/ml)	0.90	3.80
β-lacto-globulin (Mg/ml)	0	3500
Whey acidic protein (Mg/ml)	157	0
Peptydoglycon recognition protein (Mg/ml)	107	0
β- lacto albumin (Mg/ml)	3500	1200
Kappa casein (%)	5.00	14.00
Casein micelles (µm)	320	160
Whey protein (%)	1.00	0.80
Omega-6 (%)	3.50	5.20
Omega-7 (%)	11.60	2.30

(Singh *et al*, 2006)

TABLE 7: Vitamin content in camel and cow milk

Vitamin	Camel	Cow
β carotene (µg%)	Absent	99.60 ± 62.00
A (µg %)	20.10 ± 10.00	60.90 ± 25.60
E (µg %)	32.70 ± 12.80 µg%	171.00 ± 114.40 µg%
B1 (mg %)	19.60 ± 6.40 mg%	34.70 ± 8.10 mg%
Niacin (mg/ml)	4.60 mg/ml	0.60 mg/ml
Vitamin C (mg/ml)	35.00	10.00

(Stahl *et al*., 2006)

proteins which may have possible role for enhancing immune defense mechanism.

Camel milk is used for treating dropsy, jaundice, spleen ailments, asthma, anemia and piles (Rao *et al*., 1970). The patients suffering from chronic hepatitis had improved liver function after drinking of camel milk (Sharmanov *et al*., 1978). Among the disease successfully treated with camel milk are cirrhosis of the liver, constipation, tuberculosis, autoimmune diseases, IDDM (insulin dependent diabetes mellitus), crohns disease, and autism (Wernery, 2006).

Autoimmune disease: In autoimmune diseases, B cells mistakenly make antibodies against tissue of the body (self antigen) instead of foreign antigen. Occasionally, these auto antibodies either interfere with the normal function of the tissue or initiate destruction of the tissues. Autoimmune diseases can affect the body in different way. For instance, the autoimmune reaction is directed against the brain in multiple sclerosis and the gut in crohns diseases. In other diseases, such as systemic lupus erythmetosus (SLE), various tissues and organ may be affected in different individual with the same diseases. Autoimmune diseases are often chronic, requiring lifelong care and monitoring, even when the person may look or feel well. Currently, few autoimmune diseases can be cured or made to "disappear" with treatment. Many people with these diseases can live normal lives when they receive appropriate medical care.

The conventional treatments of an autoimmune diseases use the immunosuppressive medication these are Nonsteroidal anti- inflammatory drugs (NSAIDs), corticosteroids or steroids, methotrexate, azathioprine, and cyclophosphamide. Unfortunately, these medications also suppress the ability of the immune systems to fight against infection and have potentially serious side effect. In some diseases medication can occasionally slow or stop the immune systems destructive actions.

Camel milk as a therapy for autoimmune disease: Many observations over the past years suggest that autoimmune diseases are controlled or even healed by drinking camel milk. Following properties of camel milk is the basis for the effective control of autoimmune diseases by camel milk.

(a) Hoelzer *et al.* (1998) and El-Agamy (2000) reported that Camel's immune system is stronger than that of human and the small immunoglobulin's pass from the camel milk in to the human blood. As immunoglobulins are found in camel milk throughout lactation, drinking milk will provide a tool for combating autoimmune diseases by rehabilitating the immune systems rather than depression.

(b) Hamers (1998) described that because of the small size of the camel's immunoglobulins they pass in to the milk and so are available for combating autoimmune diseases.

(c) Riechmann and Muyldermans (1999) described the amazing camel immune system, different from all other mammalians. There are 5 classes of human antibodies: IgG, IgM, IgA, IgD, and IgE. The simplest antibodies, such as IgG, IgD, and IgE, are "Y" – shaped macromolecules called monomers. While IgM is a pentamer and IgA is a dimer. A monomer is composed of four glycoprotein chains: two identical heavy chains and two identical light chains. The immunoglobulins are macromolecules, having difficulties reaching and penetrating antigens. But the camel immunoglobulins have no short chains and small so are active against antigen.

(d) Muyldermans *et al.* (2001) reported that, a major flaw in the development of human- immunotherapy is the size of the antibodies. Larger antibodies cannot reach their target. Camel antibodies are one tenth of the size of human ones (natural

nanobodies). The comparative simplicity, high affinity and specificity of camel Igs, and the potential to reach and interact with active sites allow for penetration of dense tissues to reach the antigen.

(e) The most pertinent factor is that conventional treatments of autoimmune diseases are based on immune suppression, while camel milk Igs enhance the immune systems, revitalizing immune integrity.

Viral diseases: Martin *et al.* (1997) reported that camel milk antibodies are potent and selective inhibitor of the viral enzyme system. This explains the extreme resistance to many deadly animal viral diseases like foot and mouth disease, Rift Valley fever and Rinderpest.

According to Koerhler- Rollefsen *et al.* (2001) the large number of viral antibodies in camel serum and milk suggests that they have been exposed to diseases but not infected.

Autism: It is a primary autoimmune disease affects an intestinal enzyme responsible for the formation of the amino acid from the milk protein casein. Normally casein breaks down in to the amino acid in intestine. But autism causes breakdown of casein (primarily β casein and β lactoglobulin) in to the casomorphine not in amino acids. These casomorphine is a powerful opioid, more potent than morphine. Which leads to typical cognitive and behavioral symptoms so eventually this casomorphine causes brain damage. Animal experimentation has shown that casomorphine causes autistic like symptoms.

For treating this it is therefore advisable to restrict milk and milk product that can leads to the formation of casomorphine.

Treatment of autism by camel milk: Shabo and Yagil (2005) have shown in his study autistic childrean drinking camel milk have had amazing improvement in their behavior and diets because of the following properties

(a) Camel milk does not contain β casein and β lactoglobulin so camel milk does not lead to autism symptom.

(b) In addition camel milk contains protective proteins, including immunoglobulins necessary for maintaining immune system.

Tuberculosis and MDR tuberculosis: Tuberculosis is an infectious disease caused by various strains of mycobacterium, usually *mycobacterium tuberculosis*. Tuberculosis remains a chronic emaciating diseases affecting socio- economically deprived population. The tuberculosis bacillus lowers the immune defense mechanism of the body thus exposing the infected person to an increase risk of developing other diseases. According to WHO there are about 16-20 million tuberculosis cases in the world and nearly 8 million cases are added each year.

When TB patient do not takes their medicine as prescribed, the TB bacteria may become resistant to a certain drug. This means that the drug can no longer kill the bacteria. Some time the bacteria become resistant to more than one drug this is called multi drug resistant TB or MDR TB. MDR TB is increasing in developing and industrial countries, seen

TABLE 8: Effect of camel milk on MDR TB patients

Parameter	T_0 patient (dairy milk)	T_1 patient (camel milk)
1-clinical symptoms		
(a) Expectoration	Found	Not found
(b) Breathlessness	Found	Not found
(c) Chest pain	Found	Not found
2-Bacteriological finding		
(b) AFB status (acid fast bacillus status)	Positive	Negative
3-Mantoux test	Positive	Negative
4-Radiological reflection (as seen by x ray)	Less pronounced	More pronounced
5-Haematobiochemical finding		
(a) Hemoglobin (Hb)	Lower	Significant higher
(b) erythrocytes sedimentation rates (ESR)	Less Reduction	More reduction
(c) Total leucocytes count (TLC)	Less Reduction	More reduction
(d) Activity of lactate dehydrogenase (LDH)	Not reduced	Significantly reduced
(e) Activity of creatine phosphokinase (CPK)	Not reduced	Significantly reduced
6-micro mineral content		
(a) Zn	Not increase	Increase
(b) Fe	Not increase	Increase
7-Immunoglobulin's		
(a)percent decrease in Ig A	34.98%	45.18%
(b) percent decrease in Ig G	41.55%	65.25%

(Mal *et al.*, 2000)

as case of endemic infection. Tuberculosis has become an increasingly important public health problem, and new innovative approaches for the identification and treatment of these patients are urgently needed.

Camel milk as a therapy for MDR: According to Gorakh *et al*. (2000) and Alwan and Farhuni (2000) camel milk has beneficial effect on treating TB especially those suffering from MDR.

Mal *et al. (*2000) conducted the study of therapeutic value of camel milk for MDR. A cohort of 14 male in patient who suffered from tuberculosis for the past 7-8 years and who did not receive regular treatment were divided in to two groups, T_1 and T_0 of 8 and 6 patients, respectively. The T_1 patients were given a diet supplement with raw camel milk @ 1 kg/ day, while T_0 patients were given dairy milk through 10 week. Both groups received an almost similar treatment with regular meals from the TB hospital. The clinical symptoms, bacteriological, radiological, haematobiochemical, Immunoglobulin's, mantoux test, and body weight were recorded before and at the completion of the experiment. At the end of the experiment following observations were recorded (table-8).

These results suggested that there was a positive benefit of camel milk supplementation in TB patient. Mal *et al.* (2006) suggested that camel milk contains protective proteins which may have a possible role for enhancing the immune defenses mechanism. Antibacterial properties of these camel milk proteins destroy mycobacterium tuberculosis.

Insulin dependent diabetes mellitus (IDDM): Diabetes mellitus type 1 (also known as type 1 diabetes, or T1DM; formerly insulin dependent diabetes or juvenile diabetes) is a form of diabetes mellitus that results from autoimmune destruction of insulin-producing beta cells of the pancreas. The subsequent lack of insulin leads to increased blood and urine glucose.

Eventually, type 1 diabetes is fatal unless treated with insulin. Injection is the most common method of administering insulin, although another method is insulin pumps. Other alternatives are pancreatic transplants that have been used, as well as pancreatic islet cell transplantation. Transplantation is in the stage of experiment.

Camel milk as a therapy for IDDM: According to Agarwal *et al.* (2002) in India a comparison between conventionally treated juveniles diabetes with those also drinking camel milk showed that the group drinking the camel milk had significantly reduced blood sugar and reduced HbA_1C levels. The amounts of injected insulin were also significantly reduced. Because Camel milk has following properties

(a) Camel milk has insulin like activity, regulatory and Immunomodulatory function on β cells (Breitling, 2002).
(b) Camel milk contains large concentration of insulin- 150 U/ml (Zagorski *et al.*, 1998).
(c) Although human, cow and goat milk contain insulin, but it is degraded in the acids environment of the stomach. This does not occur with camel milk which does not react to acid and no coagulum is formed (Abu-Lehiya, 1987).

Milk allergies: Shabo *et al*. (2005) reported that Food allergies in children are often very serious and can lead to anaphylactic reactions. Various foods can cause allergies, especially consumption of ruminant milk and milk products. Some food allergies are severe and can result in anaphylactic reactions. It has been noted that there are basically three different types of allergic reactions. The first type is an immediate reaction, i.e., within 45 minutes of drinking cow milk, and develops urticaria, angio edema and possibly a true anaphylactic reaction. The second type occurs between 45 minutes to 20 hours and manifests as pallor, vomiting and diarrhea. The third type may take longer than 20 hours and consists of mixed reactions involving the skin, respiratory tract, and gut. Anaphylaxis is a sudden, severe, potentially fatal, systemic allergic reaction that can involve various areas of the body (such as the skin, respiratory tract, gastrointestinal tract, cardiovascular system).

Makinen-Kijunen and Palosvo (1992) reported that cow milk possesses β –lacto globulin and β- casein (two powerful allergens) which is responsible for milk allergies in childrean.

Camel milk as a therapy for Milk allergies: Shabo *et al*. (2005) reported that children with severe food allergies improved rapidly with camel milk. The proteins of camel milk are the decisive components for preventing and curing food allergies because camel milk possesses following properties
(a) Camel milk does not contain beta-lactoglobulin.
(b) Camel milk contain different beta-casein
(c)Another pertinent fact is that the components of camel milk include immunoglobulins similar to those in mothers' milk, which reduce children's allergic reactions and strengthen their future response to foods.

Crohns diseases: Crohn's disease, also known as Crohn syndrome and regional enteritis, is a type of inflammatory bowel disease that may affect any part of the gastrointestinal tract from mouth to anus, showing a wide variety of symptoms. It primarily causes abdominal pain, diarrhoea, vomiting, or weight loss, but may also cause complications outside the gastrointestinal tract such as skin rashes, arthritis, inflammation of the eye, tiredness, and lack of concentration.

Crohn's disease is caused by interactions between environmental, immunological and bacterial factors in genetically susceptible individuals. This result in a chronic inflammatory disorder, in which the body's immune system attacks the gastrointestinal tract possibly directed at microbial antigens.

The bacterial infection by *mycobacterium avium* – subspecies; paratuberculosis (MAP) spread via cow milk as it is unaffected by pasteurization. Apparently, MAP enters the mucosa as saprophytes and only become active when the person is in severe stress, leading to an autoimmune response. There is no cure for Crohn's disease and remission may not be possible or prolonged if achieved. In cases where remission is possible, relapse can be prevented and symptoms controlled with medication, lifestyle and dietary changes, changes to eating habits (eating smaller amounts more often), reduction of stress, moderate activity and exercise.

Camel milk as a therapy for crohns disease: Shabo *et al*. (2008) reported that camel milk drinking has shown good effect for treating Crohn's diseases. As the bacteria belongs to the family of tuberculosis and as camel milk has been used to treat tuberculosis it becomes apparent that the powerful bactericide properties of camel milk combined with Peptydoglycon recognition protein (PGRP) have a quick and positive effect on the healing process. In addition, immunoglobulin's restore the immune system.

Availability of camel milk: In the United Arab Emirates (UAE) pasteurized camel milk which is produced at the Emirates industry for Camel Milk and Products (EICMP) is now regularly sold in the UAE supermarket. This commercially available camel milk is pasteurized at 74^0C for 15 seconds. Dubai Municipality regulations do not permit keeping pasteurized camel milk longer than 5 days on supermarket shelves. However, laboratory investigation has shown that pasteurized milk can easily be kept for at least 15 days under refrigeration. The camel milk and their product also available in Indian market as milk (by Natural Product Company), milk powder (by Sara international company).

Wernery *et al*. (2007) demonstrated that many camel milk components were more heat resistant than those in cow milk. Especially vitamin C, the most heat sensitive vitamin, and insulin were only affected by 5 to 8 % reduction of the value found in raw milk when heated at 72^0C for 5 minutes.

Gamma glutamyl transeferase (GGT) is a potential indicator for the question of whether camel milk has been properly pasteurized or not. In cow milk the indicator enzyme for pasteurization is alkaline phosphatase (ALP) which is destroyed at 72^0C but not in camel milk. Wernery *et al.*, 2007 reported that Gamma-glutamyl transeferase (GGT) seems to be a good component for the proper heat inactivation of camel milk because it is destroyed between 10 and 20 minutes at 72^0C.

CONCLUSION

The milk compositions of dairy animals have been widely studied throughout the world and thousands of references are available especially with regard to milk consumed by humans. The cow milk, which represents 85% of the milk consumed in the world and to a lesser extent, goat and sheep milk. Studies on other dairy animals (buffalo, yak, mare, and camel) are rather scarce, in spite of their nutritional interest.

Yet camel milk is an important source of protein for people living in the arid lands of the world. Also, camel is known for its meditional properties, which are widely exploited for human health.

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