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Camel Milk as Superfood and Nutritious for Pastoral Community in Mountain and Arid Areas

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A unique creature! The camel

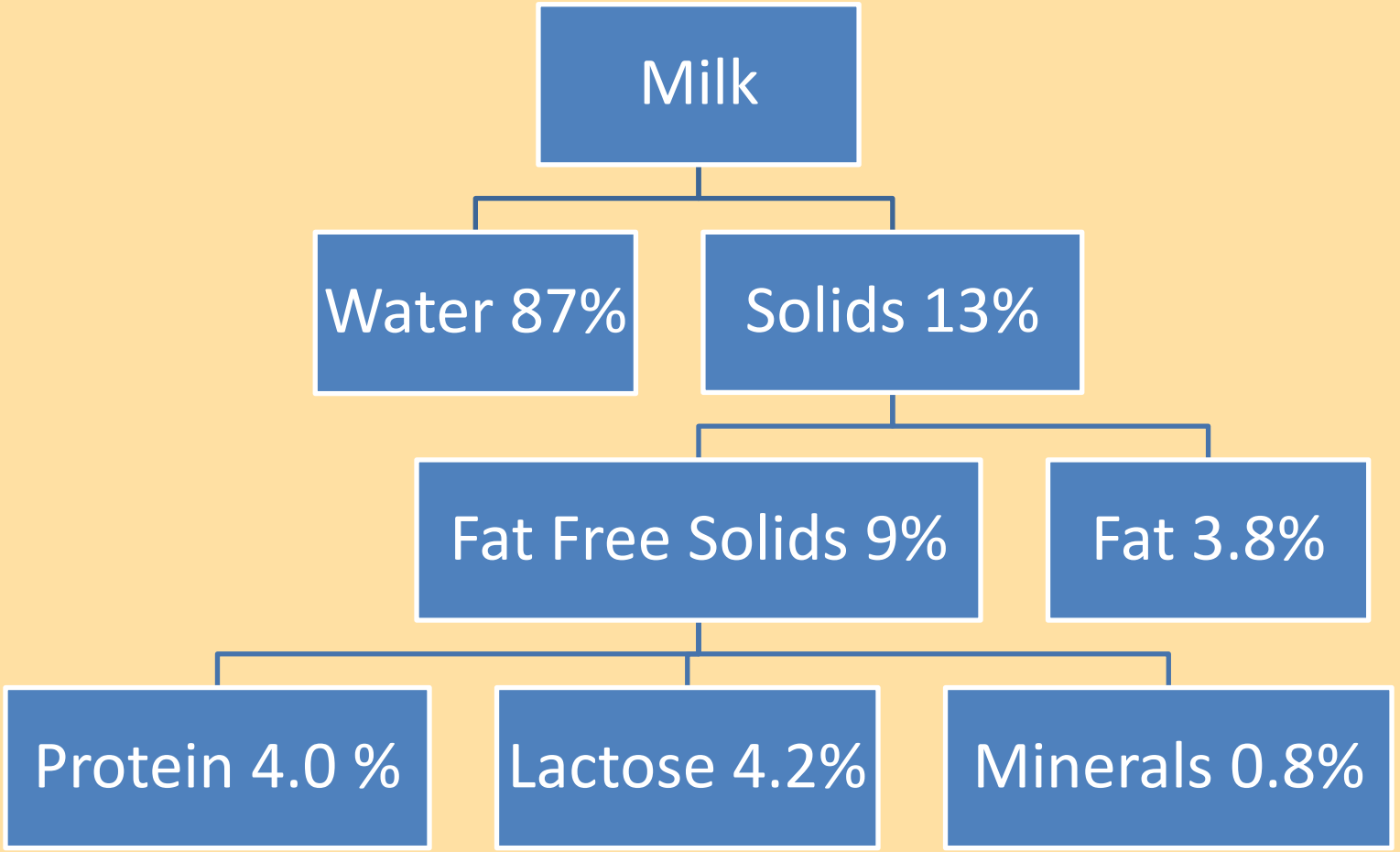
Scientific Miracles in the Creation of Camel

أينما وجدت الصحراء ... وجدت الابل؟؟؟
(Camel distribution in response to climate change)-FAO

Introduction

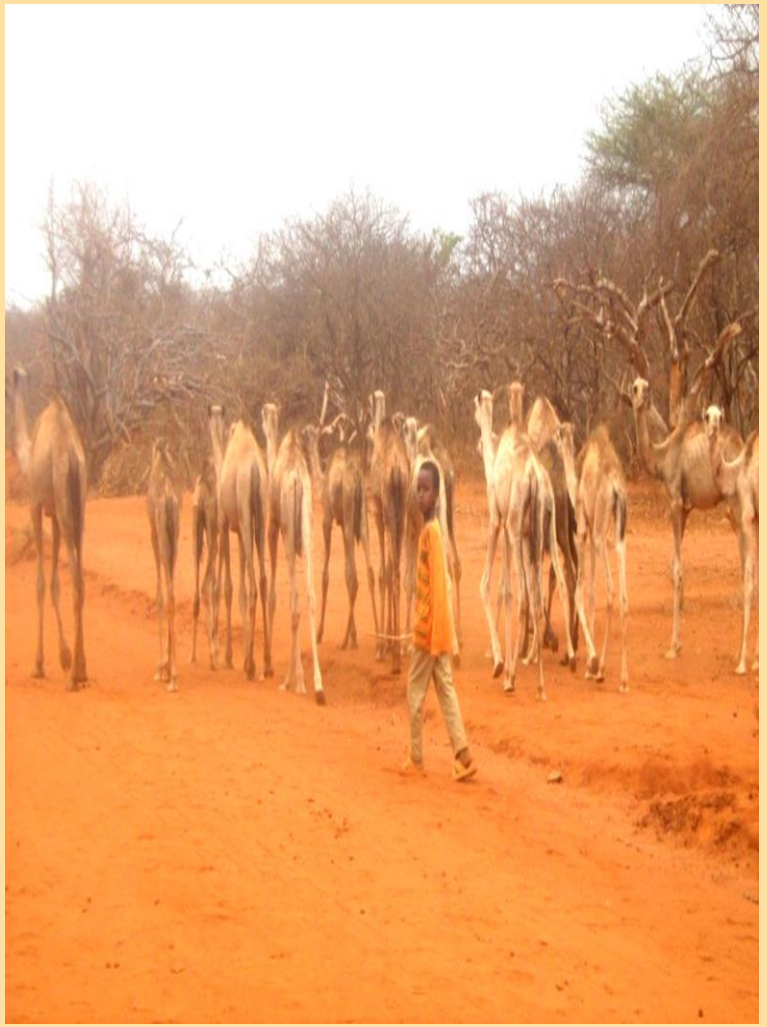
- FAO statistic, the total population of camel in the world is believed to be 26 million, of which 89% are one-humped dromedary camels (*Camelus dromedarius)* while more than 60% of the dromedary camel population is concentrated in the arid mountain areas of North East African countries like Somalia, Sudan, Ethiopia and Kenya [1].
- Camel milk (CaM) has an important role in human nutrition in the hot regions and arid countries as the milk contains all the essential nutrients [2].

General overview of CaM constituents[2]

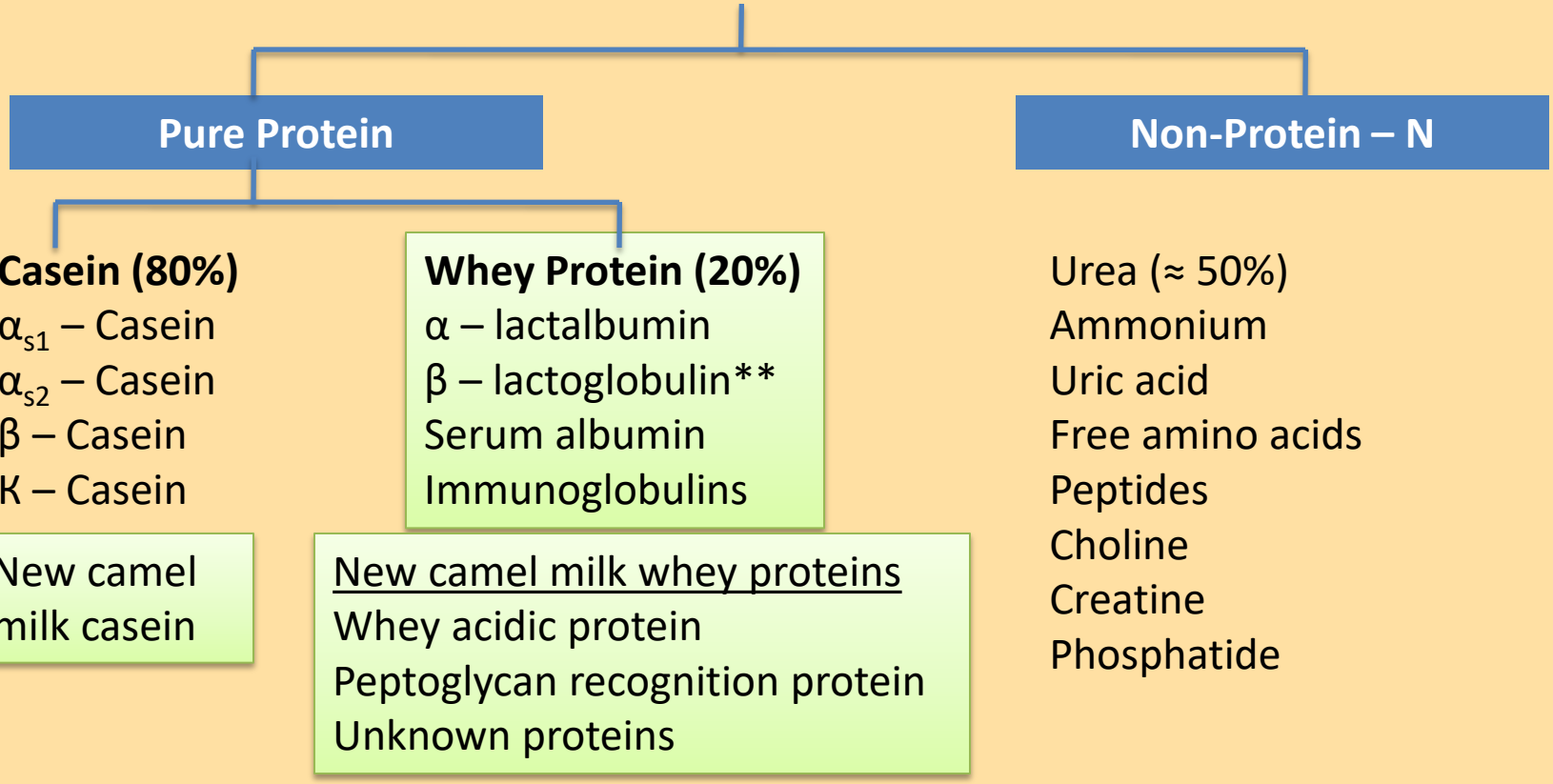


CaM as superfood for desert people

- Camels are essential for daily survival as they provide food for desert people in Africa.
- More milk can be produced by camels than by any other domestic livestock species for extended periods of time in difficult environments and desert zones.
- During a lactation period of 12 to 18 months, the daily supply of camel milk varies from 3 to 10 kg with average 6 kg of milk per head even desert range [11].



Total milk proteins



*Camel milk, like mother milk, does not contain lactoglobin [4,5,9].

Camel milk properties

- Camel milk is provide different nutritional components such as vitamins, minerals and essential amino-acids. which constitutes an important nutritional contribution for people living in the arid and desert areas, where fruits and vegetables are not available [3].
- Several studies have shown that camel milk contains various hydro-soluble and fat-soluble vitamins, such as vitamins A, C, D, E and B group with an overall vitamin content around 3.7g/L [3, 9].
- It is kept at a room temperature of 37 c° and remains for a period of 9 days without spoiling, and at a temperature of 8 c° it remains for a period of 17 days without spoiling.

Nutritional values of CaM

- Camel milk so called white gold of the desert is more similar to human milk than any other milk and differs from other ruminant milk because it contains low cholesterol, high minerals, protective proteins like as lactoferrin, lactoperoxidase, immunoglobulins, lysozyme [2, 12].
- CaM contains high amount vitamin C about 24-52mg/L (5 times) and vitamins B3 compared to cow milk [4,9].
- Camel milk has higher levels of potassium, magnesium, iron, copper, manganese, sodium and zinc than cow milk [4].

Fat content of CaM

- The lipid content of CaM is about 3.5% [5,6, 10]. The fat of camel milk contains a higher amount of fatty acids with long chain (C14-C22) and lower quantity of short chain fatty acids when compared to bovine milk [10].
- Furthermore, it contains more unsaturated fatty acids than bovine milk, especially the essential fatty acids [7].
- However, the average cholesterol content in camel milk fat fraction (~34.5mg/100g) is higher than cholesterol content of cow milk (~25.6mg/100g) [8].

CM Protein for Kids

- Casein is reported to be digested easily in intestine and it is a known source of amino-acids for development and growth of kids.
- Camel caseins are characterized by different proteins proportions when compared to bovine milk and milk from other mammalian species. For instance, Camel milk has higher β-casein amounts representing 44% and 37.4% of total camel and bovine milk proteins, respectively.
- The high percentage of β-casein reflects the higher digestibility rate of camel milk and lower incidence of allergy to infants; indeed, β-casein is more sensitive to peptic hydrolysis than α-casein [13].

Health Aspects of Camel Milk

- Camel milk has higher levels of lactoferrin which play a central role in the determination of these properties[2].
- It contains 25-30 times as much lactoferrin as cow milk.
- Lactoferrin is recently discovered iron containing protein that has been shown to have antiviral, antifungal, anti-inflammatory and anti-carcinogenic effects [2].

Cont.

- The lack of β-lacto-globulin are linked to the hypo-allergic effects of camel milk.
- Camel milk can be the best replacement of infant food after the mother's breast.
- Camel milk is use as aphrodisiac, especially in the stressful conditions of the dry hot weather[2].

DIETARY REQUIREMENT OF CAM

Contribution of some components of CaM according to (DRI) dietary requirements for young children.

Nutrient	Amount	DRI recommendation
Cholesterol	350 mg/lit	300 mg/d
Protein (g/lit)	16 gm/lit	13 – 19 mg/d
vitamin C	36 mg/lit	25 – 45 mg/d
vitamin A	200 µg/lit	300-400 µg/d
Vitamin B6	0.52 mg/lit	0.5 – 0.6 mg/d
Niacin	4.6 mg/lit	6-8 mg/d
Vitamin E	0.33 mg/lit	6-7 mg/d
Vitamin B2	0.6 µg/lit	6-7 mg/d
Vitamin B1	450 mcg/lit	500 – 600 mg/d
Vitamin B12	2 µg/lit	0.9 – 1.2 µg/d
Folic acid	4 µg/lit	150-200 µg/d

Contribution of electrolyte of CaM according to (DRI) dietary requirements for young children.

Nutrient	Amount	DRI
Sodium (Na)	500 mg/lit	800 - 1000 mg/d
Calcium	850 mg/lit	700 – 900 mg/d
Phosphorus	410 mg/lit	460 – 500 mg/d
Magnesium	118 mg/lit	80 – 130 mg/d
Potassium	1400 mg/lit	2000 – 2300 mg/d
Iron (Fe)	12 mg/lit	7 – 10 mg/d
Zinc (Zn)	4.4 mg/lit	3- 5 mg/d
Copper (Cu)	1.5mg/lit	340-440 µg/d

Therapeutic properties of CM for IDDM

- Studies in India have given strong indication, that Insulin Dependent Diabetes Mellitus (IDDM) patients profited from daily intake of 500 ml camel milk considerably, by having their blood sugar reduced significantly [2].

Camel for secretion more insulin

- it has been observed, that camel milk constituents have a stimulating effect on the pancreatic β-cells, which seem to increase insulin secretion.

Anti-diabetic action of camel milk

Diabetes mellitus (DM) is characterized by abnormally high blood glucose levels, resulting from low insulin secretion and/or increased insulin resistance.[16] DM and its complications have become a main focus of interest for researchers worldwide due to their close association with the risk of cerebrovascular and cardiovascular disorders, which were noted in 68% of diabetes-related deaths among patients aged 65 years or older.[17,18] Today, the management of DM remains a great challenge for treating physicians.

In addition to the conventional diabetic management strategies of diet, insulin, oral hypoglycaemic drugs, and exercise, diabetes has also received attention because of the current wide interest in alternative therapies for chronic incurable diseases. In this respect, there is mounting evidence that camel milk (CM) consumption is effective in the control of DM in both humans[9,19–21] and experimental animals.[22,23] Strong support for this notion comes from camel breeders in India who consume CM regularly and who have zero incidence of DM compared to 5.5 percent in other communities in which CM is not consumed.[20] Additional support comes from the more recent finding that the consumption of CM by type I diabetic patients resulted in a 30—35% reduction in the daily insulin requirements, with significant decreases in both blood glucose levels and micro-albuminuria.[9]

These benefits can be related in part to the unique composition of CM, which is rich in insulin, insulin-like proteins,[24] minerals, immunoglobulins[25] and trace elements with anti-inflammatory properties. Additionally, CM possesses antioxidants and free radical scavengers.[26–28] Further,

Here are some interesting medical facts about camel milk:

- The lactoferrin in camel's milk has antibacterial and anti-tumor properties.
- Camel milk has an apparent positive effect on breast cancer.
- Camel milk has been used to treat liver disease, and studies have been performed for hepatitis and liver cancer with promising results.

Milk allergies and lactose intolerance

Milk allergy is an autoimmune disease and occurs globally in 1-7% of all infants. The fact, that camel milk lacks ß-lactoglobulin, a powerful allergen in cow milk, makes camel milk a potent alternative for children suffering from milk allergies.

Lactose intolerance occurs mainly in people older than 5 years and is a completely different entity than milk allergy. It is caused by the decrease or absence of the enzyme lactase in the gastrointestinal tract, which metabolizes the milk sugar lactose. Approximately 90% of black and 25% of Caucasian individuals throughout the world have partial or complete lactose intolerance, associated with nausea, vomiting, cramps and diarrhea. Lactose intolerance as a result of drinking camel milk is unknown, even though the concentration of lactose in camel and cow milk is similar.

Treatment of human tuberculosis and liver diseases

In Kazaksthan treated tuberculosis with camel milk. Patients, who were given standard therapies along with raw camel milk of 1 liter per day as supplement, gained body weight due to increased appetite. Furthermore, radiological improvement in terms of lung expansion with no pus formation was also observed. The treatment was especially beneficial for those patients with multiple drug resistances.

Latest research on the successful treatment of various human diseases with camel milk can be explained by the discovery of components and their medicinal activities.

According to studies conducted in Libya, Camel milk given significant effect on reduce the clinical features of NASH in Rats.

Crohn's Disease

A connection between Crohn's disease and *Mycobacterium avium paratuberculosis* (MAP) seems to exist, and therefore the effect of camel milk may influence positively the severity of occurring symptoms of the disease. MAP could enter the human mucosa as a saprophyte, since it is not completely destroyed by pasteurization.

Severe stress can lead to a secondary autoimmune response, paving the way for Crohn's disease. 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 PGRP (Peptidoglocan recognition protein) have a quick and positive effect on the healing process.

The presence of these proteins help explain some of the natural healing properties of camel milk.

Multiple Sclerosis (MS)

Camel milk fat does not only contain mainly long-chain fatty acids (85%), compared to short-chained fatty acids (15%), but also the fat contains sphingomyolin with high proportions of nervonic acids. Both parameters play an important role in synthesis of nerve cell myolin, which may prevent or even cure MS.

Psoriasis vulgaris

Tissue repair proteins in camel milk, which are not yet clearly defined, triggered a healing process in patients with psoriasis, and were described by Wernery (2006). A clinical study, conducted in a German hospital with 20 patients suffering from a serious resistant state of psoriasis, further substantiated this achievement by topical application of a cream, containing 40% camel milk.

Autism

Recent scientific findings related to autism revealed a connection to cow milk casein. When cow milk casein is digested properly, it breaks down into large peptides like casomorphine, and should than be broken down further into smaller amino acids. It was described, that urine samples of people with autism contain high amounts of casomorphin peptides in their urine, because of a malfunction of their immune system. These casomorphin peptides are called neuropeptides, because they have been shown to react with areas of the brain such as the temporal lobes, which are involved in speech and auditory integration. Neuropeptides also decrease the ability to feel pain and affect cognitive function. Neuropeptides can react with opiate receptors in the brain and in this way mimicking the effects of opiate drugs like heroin and morphine.

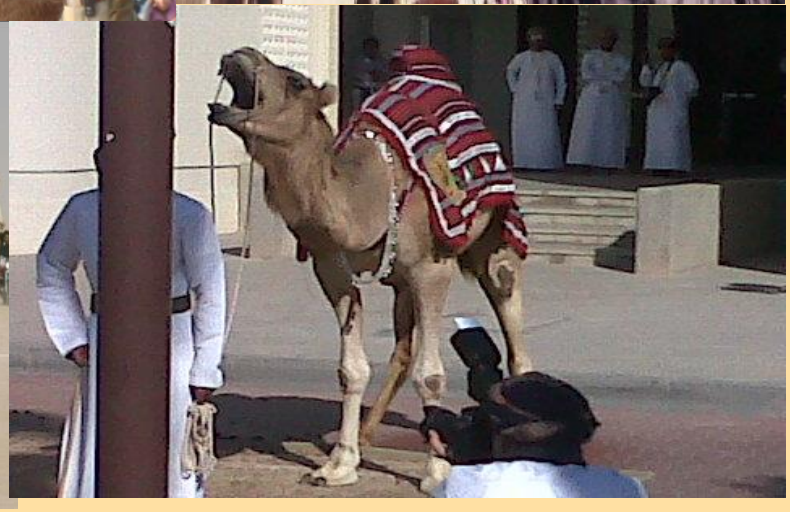
Even though that there is only anecdotal evidence of symptom remission after exclusion of all dairy products deriving from cow, autistic children drinking camel milk have had amazing improvements in their behavior and diets.

Conclusion

It is obvious that camel milk possesses besides its nutritional values important medicinal properties for pastoral community in arid lands and mountains. In the future these properties should be seriously investigated.

Hence, participants of this conference hopefully take this presentation as a stimulant by forming working groups to intensify research on ‘Medicinal properties in camel milk for the treatment of human diseases’.

International Camel Festival



Reference

1. FAO (2013).Statistical year book.Food and Agriculture Organization of the United Nations, Rome, Italy, 2013.
2. Mustafa A.B., Faraz A., Bashari M. (2023). Challenges of Camel Milk as Superfood and Health Booster: A Review, In: Emerging Challenges in Agriculture and Food Science Vol. 8. page B. P. Publisher, UK.
3. Haddadin MSY, Gammoh SI, Robinson RK (2008) Seasonal variations in the chemical composition of camel milk in Jordan. J Dairy Res 75(1): 8-12.
4. Stahl T, Sallmann HP, Duehlmeier R, Wernery U (2006) Selected vitamins and fatty acid patterns in dromedary milk and colostrum. J camel Pract Res 13(1): 53-57.
5. Pereira PC (2014) Milk nutritional composition and its role in human health. Nutrition 30(6): 619-627.
6. Konuspayeva G, Faye B, Loiseau G (2009) The composition of camel milk: A meta-analysis of the literature data. J Food Compos Anal 22(2): 95-101.
7. Attia H, Kherouatou N, Fakhfakh N, Khorchani T, Trigui N (2000) Dromedary milk fat: Biochemical, microscopic, and rheological characteristics. J Food Lipids 7(2): 95-112.
8. Konuspayeva G, Lemarie É, Faye B, Loiseau G, Montet D (2008) Fatty acid and cholesterol composition of camel's (Camelus bactrianus, Camelus dromedarius and hybrids) milk in Kazakhstan. Dairy Sci Technol 88(3): 327-340.
9. Abbas, S, Hifsa A, Aalia N, Lubna S. Physico-chemical analysis and composition of camel milk. International Research. 2013; 2(2):85-98.
10. Elagba M, Mustafa AB. Fatty Acids Content in Milk of Dromedary Camel (Camelus dromedarius) from Farming and Pastoral Systems in Sudan. Int. J. of Sci. and Res. 2016; 5(6):570-573. http://dx.doi.org/10.21275/v5i6.NOV164095.
11. Gizachew, Ayele, Jabir Teha, TadesseBirhanu,(2015), Ethiopia Nekemte. "Review on Medicinal and Nutritional Values of Camel Milk."
12. Yadav, Alok Kumar, et al. "Composition and medicinal properties of camel milk: A Review." *Asian Journal of Dairy and Food Research* 34.2 (2015): 83-91.
13. El Agamy EI, Nawar M, Shamsia SM, Awad S, Haenlein GFW (2009) Are camel milk proteins convenient to the nutrition of cow milk allergic children? Small Rumin Res 82(1): 1-6.

Thank you for attention