

Health aspects of camel products with a focus on present knowledge and future prospects of camel milk for diabetes and cow's milk allergy.

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SUMMARY

Introduction. Halfway round the globe people consider camel milk en camel urine to be a powerful tonic against many diseases. To be able to use these health claims in the marketing of camel milk, European authorities require that these health claims are proven scientifically in clinical randomized controlled studies.

Methods. The present scientific knowledge of the health aspects of camel milk products **were** assessed by reviewing the literature, using PubMed. Furthermore European researchers of camel products were interviewed.

Results. Several clinical studies support the claim that camel milk helps the treatment and possibly also the prevention of diabetes. A few clinical studies strongly suggest that camel milk can be tolerated by patients with cow's milk protein allergy. However more randomized placebo-controlled studies for getting an approved health claim **are needed**.

We did not find clinical scientific studies who support the widespread clinical experiences that camel milk will help the treatment of chronic gastro-intestinal disorders, psoriasis, hepatitis and autism. Nor did we find enough clinical support that camel urine will help to treat cancer. Therefore future clinical studies are needed to support these health claims.

Conclusion. It is to be expected that ongoing and other studies will establish that camel milk helps the treatment of diabetes and cow's milk protein allergy. Consequently the demand for camel milk will increase enormously, the more as prevalence of diabetes and cow's milk allergy are increasing worldwide.

In anticipation of this, countries where camels are kept, are recommended to develop supply chains for safe camel milk supply, to meet the future huge demand for camel milk. Furthermore camel milk products, including camel milk powder, chocolates, bread, soap, crème salad dressings, liquor, ice and cheese will be developed, giving a boost to further economic growth.

INTRODUCTION

Halfway round the globe people consider camel milk en camel urine to be a powerful tonic against many diseases[1;2]. The United Nations Food and Agriculture Organization (FAO) sees bright prospects for camel products and stimulates the increase of its production, especially camel milk (1,2). Therefore recently a camel dairy was started in Europe.

Increase of knowledge about the health of camel products will increase the sale of these products. Consequently health and wellbeing of not only humans will increase but also of the camels themselves, if they are kept appropriately. The European Camel Research Society stimulates these principles by stimulating European camel farmers to learn from each other as well as from camel farmers elsewhere in the world. Furthermore it stimulates scientific research of camel and camel products. To be marked because of its health, the health claims of the camel products should be proven scientifically to get approval of the European Food and Safety Authority (EFSA)[3]. For this approval ideally both working mechanism should be understood and randomized, placebo-controlled trials should have demonstrated the efficacy in patients.

[INSERT IMAGE]

Fig. 1 Camel to be milked with a milking machine at the Dutch camel dairy.

As far as now there is only one camel dairy which is certified to milk camels in Europe. This is because in Europe animals are only permitted to be used for production purposes if they are on the list of production animals. Camels are not on that list. Camel dairy Smits (www.camelmilk.nl) is, as far as now, the only European camel farm permitted to milk camels. In 2013 the farm had about 80 camels. They are milked with a milking machine, 4 camels at the same time. The calf suckles during 1-2 minutes. Immediately after that the milking machine is attached (fig1). Milk is sold fresh from the farm. Frozen untreated fresh camel milk is sold all over Europe and camel milk powder, is available all over the world (see web shop at www.camelmilk.nl). The camel dairy induced the development of several products with camel milk (powder) including camel milk capsules, camel milk chocolates and camel milk bread (fig 2) . Together with the HAS University Applied Sciences in of 's Hertogenbosch, The Netherlands, new products are being developed including camel ice, camel pancake mix and camel bread mix (fig 3).

[INSERT IMAGE]

Fig. 2 Products made from Dutch camel milk

[INSERT IMAGE]

Fig. 3 Products of camel milk in development

The camel dairy also strongly stimulates scientific studies on camels and their products So the ammonia emission of camels was established ([4]. Without this knowledge it is not possible to get permission to build stables for camels in Europe. Furthermore the camel dairy strongly stimulates scientific studies on the health aspects of camel product, e.g. camel milk[5]. Within this scope this articles summarizes the present knowledge of health aspects of camel products and the future prospects, with a special focus on the significance of camel milk for diabetes and cow's milk allergy.

METHODS

To assess the present scientific knowledge of the health aspects of camel milk products the literature was reviewed, using PubMed. Furthermore European researchers of camel products were interviewed.

RESULTS

Camel products

The literature on the health aspects of camel products is divided into camel hair, camel urine, camel blood and camel milk.

Camel hair

Camel hair is used to make clothes, tents and blankets. We are not aware of scientific studies with camel hair.

Camel urine

Camel urine is widely used in the Arabian peninsula to treat various diseases including cancer. Two in vitro studies showed that camel urine indeed has specific and efficient

anti cancer and immune-modulating properties[6;7]. Another in vitro study[8] showed that camel urine also has antiplatelet activity. When this is confirmed in appropriate human studies, camel urine might be used in the prevention of cardiovascular diseases and stroke.

Blood

Camel blood contains very specific antibodies devoid of light chains[9]. The active part of these small antibodies are called nanobodies. These nanobodies, when labeled, can detect cancer cells[10;11] and destroy them[12]. Furthermore antibodies can detect viruses[13] and possibly help to destroy them. Recently antibodies are found to be able to detect atherosclerosis [14].

Camel milk

In countries where camels live camel milk has been used for long times to treat diseases. Nevertheless only a few studies on the health aspects of camel milk have been published.

Diabetes

Agrawal et al were the first who studied the significance of camel milk for patients with diabetes. They demonstrated in animal studies that camel milk improved glucose metabolism[15;16]. Studies in dogs showed that a certain amount of camel milk is minimally needed (at least 250 ml in the diabetic dogs) and that the effect continued after stopping drinking camel milk [17]. Furthermore they found that Diabetes hardly occurs in a community where camel **milk** is drunken, while diabetes occurred as frequently as worldwide (prevalence 5 %) in a community with the same way of life, where camel milk was not drunken [18].

Several controlled studies have been performed in diabetes patients. They showed in patients with Diabetes Type I that camel milk improved glucose concentrations and HbA1c while also less insulin was needed [16;19-24]. This finding was confirmed in an Egyptian study[25]. Agrawal et al. demonstrated that camel milk not only may help diabetes type I patients, but also Diabetes Type II patients [26].

In a not yet published study with Dutch camel milk performed at the department of Nutrition **of Wageningen** University and Research (WUR), in The Netherlands we found that 500 cc of fresh camel milk once lowered blood glucose **in** diabetic type I patients **more** than cow's milk. In another not yet published study also performed at WUR we found that the glycaemic index of camel milk was lower than that of cow's milk and that the glycaemic index of fresh camel milk did not differ from that of frozen camel milk and camel milk powder.

The positive influence of camel milk at the glucose metabolism of diabetes patients is described to insulin-like properties of camel milk proteins. Proteins are destroyed by acid in the stomach especially as milk forms a coagulum in the stomach, allowing acid and pepsin to break down proteins over a period of time. But camel milk lacks coagulum formation and passes rapidly through the stomach, together with insulin like protein/insulin[27]. Camel milk contains about 52 units insulin/litre[28] Furthermore immunomodulating properties of camel milk proteins may be involved in the prevention and treatment of diabetes[29-31]].

Cow's milk protein allergy

Camel milk does not contain beta-lactoglobulin. This protein, which is in cow's milk, goats milk and horse's milk, is the main cause of cow's milk allergy. Human milk and camel milk do not contain beta-globulin[32]. Because of its lack of beta-globulin and because of its immunomodulating properties[33], camel milk can help patients with cow's milk allergy according to the world allergy Organisation[34].

We found two studies camel milk for humans with cow's milk allergy. They suggested that camel milk showed that camel milk can be tolerated by children with severe cow's milk protein allergy[35;36]. One study suggested that camel milk can also be tolerated by people with lactose intolerance[37].

Autism

At internet many enthusiastic stories are published on the positive influence of camel milk on autism. Shabo and Yagil published a few successful case reports[38] According to these scientists autism could be considered as an auto-immunological disorder [38] associated with a leaky gut [31;39-41]. Change of the compounding of the gastro-intestinal bacteria flora is supposed to induces leakage of substances from the gastro-intestinal tract to blood which can reach the brain. They may cause inflammation reactions in the brain, inducing autism. According to this theory camel milk helps the treatment of autism because of its immunological and probiotic properties[36;38;42].

Chronic gastro-intestinal disorders

Camel milk is used in several countries to treat gastro-intestinal disorders[43]. The efficacy has been attributed to the high concentration of immunoglobulin, lactoperoxidase and peptidoglycan recognition of it [44]. However studies with camel milk in humans with gastro-intestinal disorders have not yet been published.

There is increasing evidence that the basic cause of Crohn's disease is caused by a microbial infection. There is a striking resemblance between Crohn's disease in humans, assumed to be an autoimmune disease, and Johne's disease in cattle, the latter caused by an infection of Mycobacterium avium subspecies paratuberculosis (MAP). MAP is absorbable by humans because it is not destroyed by pasteurization[45]. It is hypothesized that after MAP enters the intestinal tissues it remains there as a saprophyte, becoming active only in the presence of severe emotional stress[46;47]. Camel milk has powerful bactericidal properties and can rehabilitate the immune system. It was observed that drinking non-pasteurised camel milk is beneficial to people with all the variety of symptoms associated with an infection of the alimentary canal [46]. However clinical studies have not yet been published.

Hepatitis C Virus infection

Hepatitis C Virus infection is a serious worldwide health risk. It is one of the most important causes of cirrhosis worldwide, and particularly in some countries of Asia (notably Japan) where it is now more prevalent than chronic hepatitis B virus infection. Hepatitis C virus infection can also lead to hepatocellular carcinoma. It is estimated that there are more than 170 million people chronically infected and that 3-4 million persons are newly infected each year. About 1-15 % of them are estimated to develop cirrhosis within 20 years after the initial infection[48]. The potential treatment of the recognized effective drugs (interferon plus ribavirin and/or pegylated interferon) for hepatitis C virus lead to an impressive sustained virological respond that did not exceed 56%[49]. In vitro studies showed that camel milk lactoferrin inhibits hepatitis C virus Genotype 4 infection of human peripheral leukocytes[50], starting from 0.25 mg/ml[51;52].

There are **some indications from** in vitro studies **showing** that camel milk also might help treatment of chronic hepatitis B patients[53]. However clinical studies in patients with hepatitis C and B have not yet been published.

FUTURE DEVELOPMENTS

Several research institutes in the world are performing studies to elucidate as exactly as possible the health aspects of camel milk, mostly using in vitro studies.

Recently the WUR started a study using NMR and de LC-MS-SPE techniques to identify and quantify camel milk proteins and to compare the results with cow's milk. This study will also reveal if the compounding of camel milk proteins will change by freezing, pasteurisation or making camel milk powder.

Depending of the results fresh camel milk, frozen camel milk or camel milk powder will be used in placebo/controlled studies in diabetes type I and Type II patients.

According to Dutch medical ethics randomized studies with camel milk are not permitted in children with cow's milk allergy before safety and tolerance of camel milk has been proven in adults with cow's milk allergy. Presently such a study ongoing in the Netherlands, performed at the Jeroen Bosch Hospital in 's Hertogenbosch . When the results confirm the worldwide clinical positive experiences, the way is free for randomized clinical studies on the tolerance of camel milk in children with cow's milk allergy.

DISCUSSION

The present review of the literature **shows** that recent scientific **studies support** the experiences of many centuries, gained in countries where camels are kept, showing that camel milk and urine can be used well to treat diseases. Furthermore there are strong indications that nanobodies from camel blood, and possibly also from camel milk will play a major role in diagnosis and treatment of cancer, infections and vascular disease. Most studies are in vitro studies, performed in a lab or studies performed in animals. There have not been performed enough human studies for getting a health claim, which is good enough for the marketing of camel products in Europe.

The health claim which is the best supported by clinical studies is the claim that camel milk might help diabetes patients. When randomized controlled studies in diabetes patients, to be started in Europe soon, support the earlier published **findings**, diabetes patients **can** be helped **using camel milk**. Diabetes patients in countries where camel milk is available can profit as the first. However in many of these countries the infrastructure for producing camel milk appropriate for human use is pretty poor. The more this infrastructure will be improved, the more diabetics in these countries can be helped. The importance of this issue is increasing as diabetes is one of the most increasing diseases in countries of Africa and the middle east. When governments of these countries are not able to improve the infrastructure for a well-functioning safe milk supply chains their selves, other, rich, countries and development aid organisations should help them.

When the demand for camel milk increases, e.g. for the prevention and treatment of diabetes, the well-being of camel holders and their families will also increase, as will that of other people who work **in camel milk supply chains**.

If the **recently** initiated Dutch camel milk study reveals what camel milk proteins exactly are involved in the prevention and treatment of **diseases**, these proteins could

be extracted from the camel milk and be added to other food. **This** will induce a further growth of camel milk production.

When more (epidemiological) studies support the earlier findings that camel milk may contribute substantially to the prevention of **diabetes**, this will strongly stimulate the development of other measures to prevent diabetes.

Another health claim that could be proven pretty easily is that camel milk may be tolerated by patients with cow's milk allergy. When this claim is supported by the findings of the present Dutch study in adults with cow's milk allergy, the study can be repeated in children with cow's milk allergy. Next to a proven health claim of camel milk for diabetes patients also a proven health claim of camel milk for cow's milk allergy will stimulate the production of camel milk **further**.

When the evidence increases that camel milk indeed has health improving proteins, it will become easier to get financial support for other clinical studies with camel milk, i.e. in patients with chronic gastro-intestinal disorders, psoriasis and autism.

Next to camel milk also camel urine seems to contain substances which may improve health (especially of patients with cancer) as has been known for many years already in the Middle East. Problem however is how to collect the urine cost efficiently.

Confirmation of the health claims of camel milk and urine will increase the worldwide demand for camels. This is probably not the case when the health claims of camel blood are confirmed. To get a special nanobody a camel is **vaccinated**, **then** the blood is collected and the nanobodies are removed from the heavy chain antibodies of the blood. These nanobodies are then incorporated into bacteria, which multiply the nanobodies. Consequently only one camel is needed for millions of nanobodies. What is more, the vaccinated camel cannot be used further. To prevent that this vaccinated camel comes into the food chain he/she will have to be sacrificed.

To summarize, camel milk for diabetes and cow's milk allergy are the most promising health claims. If further clinical studies establish these claims a firm base is made for fast growing camel milk industry in countries where camels can be kept. **When** these camels are kept appropriately, health of both humans and camels increase.

References:

1. FAO: The next thing: camel milk. FAO newsroom.
2. Yagil R: Camels and camel milk; in FAO, (ed): Rome, 1982.
3. Asp NG, Bryngelsson S: Health claims in Europe: new legislation and PASSCLAIM for substantiation. *J Nutr* 2008;138:1210S-1215S.
4. Smits MG, Monteny GJ: Ammonia emission from camel dairy in The Netherlands. *Journal of Camel Practice and Research* 2009;16:139-142.
5. Smits MG, Huppertz T, Alting AC, Kiers JL: Composition, constituents and properties of Dutch camel milk; 2011, pp 1-6.
6. Al-Yousef N, Gaafar A, Al-Otaibi B, Al-Jammaz I, Al-Hussein K, Aboussekhra A: Camel urine components display anti-cancer properties in vitro. *J Ethnopharmacol* 2012;143:819-825.
7. Alhaider AA, Bayoumy N, Argo E, Gader AG, Stead DA: Survey of the camel urinary proteome by shotgun proteomics using a multiple database search strategy. *Proteomics* 2012;12:3403-3406.
8. Alhaidar A, Abdel Gader AG, Mousa SA: The antiplatelet activity of camel urine. *J Altern Complement Med* 2011;17:803-808.

9. Hamers-Casterman C, Atarhouch T, Muyldermans S, Robinson G, Hamers C, Songa EB, Bendahman N, Hamers R: Naturally occurring antibodies devoid of light chains. *Nature* 1993;363:446-448.
10. Vaneycken I, Devoogdt N, Van GN, Vincke C, Xavier C, Wernery U, Muyldermans S, Lahoutte T, Caveliers V: Preclinical screening of anti-HER2 nanobodies for molecular imaging of breast cancer. *FASEB J* 2011;25:2433-2446.
11. Revets H, De BP, Muyldermans S: Nanobodies as novel agents for cancer therapy. *Expert Opin Biol Ther* 2005;5:111-124.
12. D'Huyvetter M, Aerts A, Xavier C, Vaneycken I, Devoogdt N, Gijs M, Impens N, Baatout S, Ponsard B, Muyldermans S, Caveliers V, Lahoutte T: Development of ¹⁷⁷Lu-nanobodies for radioimmunotherapy of HER2-positive breast cancer: evaluation of different bifunctional chelators. *Contrast Media Mol Imaging* 2012;7:254-264.
13. Vanlandschoot P, Stortelers C, Beirnaert E, Ibanez LI, Schepens B, Depla E, Saelens X: Nanobodies(R): new ammunition to battle viruses. *Antiviral Res* 2011;92:389-407.
14. Broisat A, Hernot S, Toczek J, De VJ, Riou LM, Martin S, Ahmadi M, Thielens N, Wernery U, Caveliers V, Muyldermans S, Lahoutte T, Fagret D, Ghezzi C, Devoogdt N: Nanobodies Targeting Mouse/Human VCAM1 for the Nuclear Imaging of Atherosclerotic Lesions. *Circ Res* 2012;110:927-937.
15. Agrawal RP, Sahani MS, Tuteja FC, Ghouri SK, Sena DS, Gupta R, Kochar DK: Hypoglycemic activity of camel milk in chemically pancreatectomized rats - an experimental study. *Int J Diab Dev Countries* 2005;25:75-79.
16. Agrawal RP, Kochar DK, Sahani MS, Tuteja FC, Ghouri SK: Hypoglycemic activity of camel milk streptozotocin induced diabetic rats. *Int J Diab Dev Ctries* 2004;24:47-49.
17. Sboui A, Khorchani T, Djegham M, Agrebi A, Elhatmi H, Belhadj O: Anti-diabetic effect of camel milk in alloxan-induced diabetic dogs: a dose-response experiment. *J Anim Physiol Anim Nutr (Berl)* 2009.
18. Agrawal RP, Budania S, Sharma P, Gupta R, Kochar DK, Panwar RB, Sahani MS: Zero prevalence of diabetes in camel milk consuming Raica community of north-west Rajasthan, India. *Diabetes Res Clin Pract* 2007;76:290-296.
19. Agrawal RP, . SSC, Beniwal R, Kochar DK, Kothari RP: Effect of camel milk on glycemic control, risk factors and diabetes quality of life in type-1 diabetes: A randomised prospective controlled study. *Int J Diab Dev Countries* 2002;22:70-74.
20. Agrawal RP, Swami SC, Beniwal R, et al.: 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* 2003;73:1105-1110.
21. Agrawal RP, Beniwal R, Kochar DK, Tuteja FC, Ghouri SK, Sahani MS, Sharma S: 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 Res Clin Pract* 2005;68:176-177.
22. Agrawal RP, Beniwal R, Sharma S., et al.: Effect of raw camel milk in type 1 diabetic patients: 1 year randomised study. *Journal of Camel Practice and Research* 2005;12:27-31.
23. Agrawal RP, Saran S, Sharma P, Gupta RP, Kochar DK, Sahani MS: Effect of camel milk on residual beta-cell function in recent onset type 1 diabetes. *Diabetes Res Clin Pract* 2007;77:494-495.
24. Agrawal RP, Jain S, Shah S, Chopra A, Agarwal V: Effect of camel milk on glycemic control and insulin requirement in patients with type 1 diabetes: 2-years randomized controlled trial. *Eur J Clin Nutr* 2011.
25. Mohamad RH, Zekry ZK, Al Mehdar HA, Salama O, El Shaieb SE, El Basmy AA, Al said MG, Sharawy SM: Camel milk as an adjuvant therapy for the treatment of type 1 diabetes: verification of a traditional ethnomedical practice. *J Med Food* 2009;12:461-465.
26. Agrawal RP, Sharma P, Gafoorunissa SJ, Ibrahim SA, Shah B, Shukla DK, Kaur T: Effect of camel milk on glucose metabolism in adults with normal glucose tolerance and type 2 diabetes in Raica community: a crossover study. *Acta Biomed* 2011;82:181-186.

27. Wernery U, Nagy P, Bhai I, et al.: The effect of heat treatment, pasteurization and different storage temperatures on insulin concentrations in camel milk. *Milchwissenschaft-Milk Science International* 2006;61:25-28.
28. Zagorski O, Maman A, Yafee A, Meisles A, Creveld v, Yagil R: Insulin in milk. a comparative study. *Int J Anim Sci* 1998;13:241-244.
29. Dahlquist GG: Primary and secondary prevention strategies of pre-type 1 diabetes. Potentials and pitfalls. *Diabetes Care* 1999;22 Suppl 2:B4-B6.
30. El Agamy EI, Nawar MA: Nutritive and immunological values of camel milk: a comparative study with milk of other species; Second international Camelid Conference: Agroeconomics of Camelid Farming. Almaty, Kazakhstan. 2000, pp 33-45.
31. de KS, Keszthelyi D, Masclee AA: Leaky gut and diabetes mellitus: what is the link? *Obes Rev* 2011;12:449-458.
32. Nodake Y, Fukumoto S, Fukasawa M, Sakakibara R, Yamasaki N: Reduction of the immunogenicity of beta-lactoglobulin from cow's milk by conjugation with a dextran derivative. *Biosci Biotechnol Biochem* 2010;74:721-726.
33. El Agamy EI: The challenge of cow milk protein allergy. *Small Ruminant Research* 2007;68:64-72.
34. Fiocchi A: World Allergy Organization (WAO) Diagnosis and rationale for Action against Cow's Milk Allergy (DRACMA) Guidelines. *Pediatr Allergy Immunol* 2010;21:1-125.
35. Ehlayel MS, Hazeima KA, Al-Mesaifri F, Bener A: Camel milk: an alternative for cow's milk allergy in children. *Allergy Asthma Proc* 2011;32:255-258.
36. Shabo Y, Barzel R, Margoulis M, Yagil R: Camel milk for food allergies in children. *Isr Med Assoc J* 2005;7:796-798.
37. Cardoso RA, Santos RMDA, Cardos CRA, Carvalho MO: Consumption of camel's milk by patients intolerant to lactose. A preliminary study. *Revista Alergica Mexico* 2010;57:26-32.
38. Shabo, Yagil R: Aetiology of autism and camel milk as therapy. *International Journal of Disability and Human Development* 2005;4:67-70.
39. Terjung B, Spengler U: Atypical p-ANCA in PSC and AIH: a hint toward a "leaky gut"? *Clin Rev Allergy Immunol* 2009;36:40-51.
40. de ML, Familiari V, Pascotto A, Sapone A, Frolli A, Iardino P, Carteni M, De RM, Francavilla R, Riegler G, Militerni R, Bravaccio C: Alterations of the intestinal barrier in patients with autism spectrum disorders and in their first-degree relatives. *J Pediatr Gastroenterol Nutr* 2010;51:418-424.
41. White JF: Intestinal pathophysiology in autism. *Exp Biol Med (Maywood)* 2003;228:639-649.
42. Jassim SA, Naji MA: The Desert Ship heritage and science. *Biologist (London)* 2001;48:268-272.
43. Cardoso RR, Ponte M, Leite V: Protective action of camel milk in mice inoculated with *Salmonella enterica*. *Isr Med Assoc J* 2013;15:5-8.
44. Kapeller SR: Compositional and Structural Analysis of the Camel Milk Proteins with Emphasis on Protective Proteins; ETH,Zurich, Switzerland, 1998.
45. Corti S, Stephan R: Detection of *Mycobacterium avium* subspecies paratuberculosis specific IS900 insertion sequences in bulk-tank milk samples obtained from different regions throughout Switzerland. *BMC Microbiol* 2002;2:15.
46. Shabo Y, Barzel R, Yagil R: Etiology of Crohn's disease and camel milk treatment. *Journal of Camel Practice and Research* 2008;15:55-59.
47. Yagil R: Camel milk and its unique anti-diarrheal properties. *Isr Med Assoc J* 2013;15:35-36.
48. Yu ML, Chuang WL: Treatment of chronic hepatitis C in Asia: when East meets West. *J Gastroenterol Hepatol* 2009;24:336-345.
49. Blight KJ, Kolykhalov AA, Rice CM: Efficient initiation of HCV RNA replication in cell culture. *Science* 2000;290:1972-1974.

50. Yunus MB, Aldag JC: Restless legs syndrome and leg cramps in fibromyalgia syndrome: a controlled study. *BMJ* 1996;312:1339.
51. El-Fakharany EM, Abdelbaky N, Haroun BM, Sanchez L, Redwan NA, Redwan EM: Anti-infectivity of camel polyclonal antibodies against hepatitis C virus in Huh7.5 hepatoma. *Virology* 2012;9:201.
52. Liao Y, El-Fakkarany E, Lonnerdal B, Redwan EM: Inhibitory effects of native and recombinant full-length camel lactoferrin and its N and C lobes on hepatitis C virus infection of Huh7.5 cells. *J Med Microbiol* 2012;61:375-383.
53. Saltanat H, Li H, Xu Y, Wang J, Liu F, Geng XH: [The influences of camel milk on the immune response of chronic hepatitis B patients.]. *Xi Bao Yu Fen Zi Mian Yi Xue Za Zhi* 2009;25:431-433.
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This article represents the presentation given at the School for Oriental and African Studies (SOAS, University of London) camel conference on 29-30 April 2013 (<http://www.soas.ac.uk/camelconference/>)