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Camel Urine and Milk in the Arab Heritage (Folk Medicine): A Review

The strong mutually beneficial relations between the Arabian or one-humped camel (*Camelus dromedarius*) and its Arab owners have been documented since ancient times. The dromedary is valued as a source of power, fortune and delight, reported the Arabic historian Al-Jāhiz, who described it as a "complete animal" for human beings (Baesmel 2004, Al-Ani 2004). It is exceptionally well-adapted to long periods of drought and heat and can survive and reproduce in conditions intolerable to other domestic animals (Abdalla et al. 1988). The camel as the king of the desert has thus played a crucial role in the life of desert dwellers, not only for transportation, meat and wool, but also as a source of milk and urine. These fluids were of special significance in the folk medicine of people living in the deserts, since they were traditionally used to maintain good health and to treat diverse diseases (Redwan/Tabll 2007, Conesa et al. 2008, Agrawal et al. 2009). This review aims to discuss the most important aspects of camel urine and camel milk as medical remedies past and present.

THE HISTORICAL USE OF CAMEL URINE AND CAMEL MILK

In the Holy Qur'an (How the camels are created, Q 88, 17) the camel is mentioned as particularly important animal of the Arabian Peninsula under various terms: *al-ibil* is the plural, *al-nāqah* refers to a she-camel, *al-jamal* is the male camel, and *al-ba'īr* indicates a camel regardless of its sex. A further name, *al-'ishār*, occurs in Q 81, 4, meaning a she-camel that is ten months pregnant, and *al-hīm* (Q 56, 55) are camels that have been affected by disease.

The folk-medicine use of camel milk and urine is reported in the pre-Islamic era and it appears in various written Islamic sources. The curative effects of camel milk and urine were already mentioned by the Islamic scholar Al-Bukhārī. In his *hadīth*-collection[1] called *as-Sahīh*, it stated that some people arrived in the Madinah area and fell sick because of the climate. The Prophet (peace and blessings of Allah be upon him) told them to drink the milk and urine of camels, after which they recovered and were as healthy as before (Al-Bukhārī, no. 2855[2], Al-Abdalall 2010).

Another source for the medicinal use of camel urine dates back to the time of the famous Persian scholar Avicenna (980–1037), author of the book Al-Qānūn, where he reports "for the Bedouin people, camel urine remains an important natural remedy for different health problems" (Al-Abdalall 2010).

The old name of urine in Arab history is *wazr*, and in pure Arabic is *bawl*. It was used as a treatment for women's hair, for stomach pain (mixed with milk), for gums and toothache, eye infections, skin injuries and infections, snake bites, camel mange, for pregnant women, liver tumour, to assuage thirst and hunger and to wake up a drunk man (Baesmel 2004). The camel owners in the desert gave patients suffering from internal ailments a mixture of camel urine and

[1] The Hadiths are collections of sayings and acts of the Prophet Muhammad gathered and written down during the 8th and 9th centuries.

[2] Cf. http://hadith.al-islam.com.

milk as a morning drink. For all these uses the urine had to be fresh from a young she-camel. Milk was added to overcome its strong odor. The duration of this kind of folk medical treatment lasted a few weeks, after which the patients were declared as healthy again.

A current *in-vivo* series of experiments in which a mixture of camel urine and milk was given to albino mice showed no effects on the normal liver (Khalifa 1999), kidney (El-Elyani 1999) or stomach (El-Elyani/Khalifa 2006), indicating its biological safety.

THE IMPORTANCE OF CAMEL MILK AND URINE

Many components of the camel milk can also be found in the milk of other animals, but the she-camel produces the highest percentage of vitamin C (Mehaia 1994), ranging from 23 to 100 mg/kg. The concentration of vitamin C in urine was found more in female camels than in male. Early tests on camel milk, known in Arabic as *khalafāt*, showed that the whey lysozyme in it inhibited pathogenic bacteria such as *Clostridium perfringens, Staphylococcus aureus, Shigella dysenteriae and Salmonella typhimurium*, but not *Bacillus cereus or Eschericia coli* (Barbour et al. 1984). Another advantage of camel milk is its insulin characteristics (Zagorski et al. 1998). Recent experimental studies have also shown clear antigenotoxic and anticytotoxic effects of camel milk in mice treated with the drug cisplatin (Quita/Kurdi 2010), due to its generally high level of immunoglobulins. The camel's immune system also has special features, camel antibodies being mainly composed of heavy chains, which is an important feature in the development of diagnostic and therapeutic features (Hamers-Casterman et al. 1993) as an indication of the role of blood in various vital secretions.

FACTORS SUPPORTING THE POSITIVE CHARACTERISTICS OF CAMEL MILK AND URINE

The morphometric speciality of camel kidneys is considered to be the first natural factor in its positive characteristics (Abdalla/Abdalla 1979) as an anatomical requisite for the production of hypertonic urine. The second factor is the high salinity of urine due to various biochemical contents, with plants being the most effective factor responsible for its therapeutic action. It has been found that these desert plants as well as those growing naturally in different areas have antimicrobial characteristics (Kaul/Nigam/Dhar 1976, McCallion et al. 1982, Zaki et al. 1984). Analysis of various types of desert plant has found a strong effect against bacteria, yeast and fungi, and Zaki et al. (1984) have proved a similar effect in wormwood.

The camel's selective grazing habits probably play a direct role in searching for such plants during its long journeys in the desert (Wilson 1984). Laboratory analysis of these plants found active ingredients which are reflected in the urine used for therapeutic purposes, including *Suaeda monoica* and *Schrad citrullus colocynhis.* Thirdly, a pure bacterial isolate from camel urine, patent registered by (Al-Awadi 1998), was found to have potent antipathogenic characteristics and survived in the high alkalinity of urine. The fourth factor attributed to the miracle action is the urea present in camel urine; this was described by Read (1925) and may play a role as invasive action on the keratin layer.

Camel kidneys are physiologically adaptive organs that can regulate their excretion of urine (1–7 L per day) depending on the environmental conditions such as temperature and water availability. It has also been found that unusual member-bond bodies in the basal lamina of the uriniferous tubules of the kidneys are directly related to its adaptive function (Safer/Katchburian 1991). The glomerular filtration rate and urine concentration also has a direct relation to the high salinity of camel urine (Yagil/Berlyne 1978). The concentration of urine and its chemical components vary in accordance with the challenges camels face in their varied habitat. The renal functions can also withstand severe dehydration, with changes in the urea metabolism (Etzion/Yagil 1986). During dehydration potassium is excreted while sodium tends to be retained in the extra fluid and is used later to restore the camel's fluid volume (Siebert/Macfarlane 1971).

The first analysis of camel urine was carried out simultaneously by two different researchers (Read 1925, Smith/Silvette 1928) in dromedaries for not more than 10 substances, which included total nitrogen, ammonia, total creatinine, creatine, hippuric acid, purine bases and chlorides. Although it was initially found that the composition of camel urine was little different to that of other herbivorous animals (Kalra/Arya 1959), more detailed work determined additional compounds (Amer/Al-Hendi 1996, Faye et al. 1999, Salwa et al. 2004). In more detailed analysis of pregnant camel urine, more than 30 components were identified with molecular weights ranging between 220 and 490. These included sulphur, oxygen, nitrogen, heterocyclic aromatic compounds belonging to thiophen, furan, pyridine and quinolone (El-Nadi/Al-Torki 2007).

In analysing the effects of age and sex on the pH of racing camels' urine, no significant effect was found in the same age groups of the same sex, whereas different age groups of the same sex showed a significant difference (Wasfi/Boni/Hadi 1998), showing that the urine pH increases with age.

The trace-element excretion pattern seems to differ partly between camel and cow urine in cases of mineral supplementation. The retention ability of these elements is either clearly better in the camel (i.e. manganese) or slightly less than in the cow (i.e. copper, zinc, iron). These findings suggest that the camel anticipates the transitory mineral under-nutrition period (Faye et al. 1999). Etzion/Yagil (1986) showed that desert animals are characterized by their physiologically thrifty characteristics.

Amer/Al-Hendi (1996) described microscopic features and showed the presence of phosphorus, calcium oxalate, ammonium urate and epithelial and granular cells. Using neutron activation analysis, Al-Attas (2008) tested some essential elements in milk and urine of camels, and discovered that it contained large amounts of sodium and potassium, substituting the loss of such elements in the case of diarrhea. It also contained high levels of zinc, which assists in the cure of the infection due to diarrhea. Mycotoxins are a diverse range of molecules that are harmful to animals and humans. They are secondary metabolites secreted by molds, mostly *Penicillium* and *Fusarium*, and they are produced in cereal grains as well as in forage before, during and after harvest in various environmental conditions. Due to the diversity of their toxic effects and their synergetic properties, mycotoxins are a danger to consumers of contaminated foods and feeds (Yiannikouris/Jonany 2002). Al-Awadi and Al-Jedabi (2000) proved an inhibitory and antibiotic activity of camel urine against the growth of *Candida albicans* (yeast), *Aspergillus niger, Fusarium oxysporum* even after boiling at 100°C. The effect of urine and milk on efficiency of aflatoxins as inhibitors to *Bacillus subtilus* growth is seen as a primary step to find a way to destroy fungal toxins.

Recently, Al-Abdalall (2010) found that camel urine and milk have successfully inhibited aflatoxins and mycelium growth. The author added that camel urine at low concentrations has no significant inhibitory effect on fungal growth, while inhibition can be clearly recorded at high concentrations. Studies of the chemical composition and nutritional quality of camel milk show 11.7% total solids, 3.0% protein, 3.6% fat, 0.8% ash, 4.4% lactose, 0.13% acidity and a pH of 6.5. It is low in cholesterol and sugar and rich in sodium, potassium, zinc, iron, copper, manganese, niacin and vitamin C (Knoess 1979). In addition, camel milk has a low level of protein and high concentration of insulin, which means it can safely be taken by people with a high sensitivity to lactose and immune deficiency (Gast 1969).

Camel milk is pure white and slightly sweet. Yet camels who feed on certain diets, such as some wild desert plants, may produce salty milk. Physiological and genetic factors also affect milk production. The percentage of water in camel milk varies according to the amount of water the camel drinks; it may reach 89% in the milk if it drinks water every day, or 91% if it drinks for one hour a week. It seems that camels can not only endure harsh conditions – they even release more water into their milk during in these conditions; an effect that can be to the benefit of babies or human beings in general (Farah 1993, Abu-Lehia 1989).

In Kazakhstan camel milk is also used as an adjunct to chemotherapy for some cancer treatments, especially those of the digestive tract. Good results were reported in autoimmune diseases such as Crohn's disease and multiple sclerosis (Yagil/Van Creveld 2000). The positive effect of camel milk on diabetic patients has been studied in India (Agrawal et al. 2003), where the consumption of 0.5 L of camel milk per day decreased the insulin demand in diabetic patients and glycaemia was better balanced. Consumers appreciate camel milk for its medicinal properties; it is reputed to be anti-infectious, anti-carcinogenic and anti-diabetic. More generally, it is regarded as an energy-giving product for convalescents.

Camel milk is commonly used to help treat infectious diseases such as tuberculosis in humans. Shubat, a sparkling beverage of fermented camel milk with a sour flavor is commonly used as a cure in sanatoriums (Urazakov/Bainazarov 1974) and works as a laxative on people unaccustomed to drinking it (Rao 1970). A series of metabolic and autoimmune diseases are successfully treated with camel milk. In India, it is used therapeutically against oedema, jaundice, problems of the spleen, tuberculosis, asthma, anemia, piles and diabetes (Rao 1970).

The early effect as a possible anti-carcinogenic agent was described experimentally by Kabarity et al, 1988, who showed that treatment by colchicines inhibited formation of c-tumour in *Allium cepa* root tips. The anti-oxidant and anti-mutagenic activity of camel urine was also demonstrated after bone-marrow cells in mice showed toxicity induced by the drug cylophosphamide (Al-Harbi et al. 1996). These studies hint at a definite effect of camel urine in the pathophysiology of various cells. In other experiments, the fungi *Aspergillus niger, Fusarium oxysporum* and *Rhizoctonia solani* and the yeast *Candida albicans* were exposed to camel urine and were inhibited at different concentrations (Al-Awadi/Al-Gudaibi 1999). The growth of various pathogenic bacteria, *Acinitobacter sp 1&2, Ent. Faecalis, P. aeroginosa, H. influenzae, Klebsiella sp., E. coli, M. morganii, Providencia sp., Strep. pneumoniae, Citrobacter sp., Entero. cloacae, S. aureus (MSSA) and S. aureus (MRSA)* was inhibited when exposed to fresh camel urine (Shoeib/Ba-Hatheq 2009) .

It was reported that camel urine produced a significant improvement in the histochemical content of infected liver tissue with *Escherichia coli* in rabbits (Khalifa et al. 2005). Furthermore, it has been proved in *in-vivo* and *in-vitro* experiments that early pregnancy camel urine has hepatoprotective and anti-parasitic (*Fasciola gigantica*) effects (Khogali 2005).

INDUSTRIAL PROCESSING OF CAMEL URINE

Experiments on the value of camel urine as a therapeutic agent in a series of *in-vitro* and *in-vivo* laboratory experiments were mostly conducted in Saudi Arabia. They resulted in the discovery registered by Faten Khorshid (US Patent Application 20090297622 2008) under the title "Separation and formulation of bioactive fraction and subfraction from camel urine work as anticancer agent" and designated as PM701 and PMFK.[3] The urine's physical characteristics described in this patent was: a yellowish color, a solid crystalline form, a sharp (offensive) odor, a pH of 8.03, water insoluble and a specific gravity of 1.045.

In the studies published in the literature regarding the medicinal properties of camel urine, it has been found to have anti-oxidant and anti-mutagenic compounds following the treatment mice with toxicity induced cyclophosphamide (Al-Harbi et al. 1996). Khorshid and Moshref (2006) have also reported the anti-carcinogenic effect of camel urine in different cancer types in rats. However, these studies did not investigate the mechanisms by which camel urine exhibits such anti-carcinogenic effects. Noor (2008) showed that it had inhibited mild steel corrosion, and suggested chemisorptions of organic matter in the urine (i.e. urea, uric acid and/or creatinine).

[3] http://www.patentstorm.us/applications/20090297622.html (accessed 29 Sept. 2011).

Abdulqader et al. (2011) provided the first evidence that camel urine has the potential to block dioxin-like compounds. It inhibits the TCDD-mediated effect, at least in part by inhibiting the expression of Cyplal, a cancer-activating gene, at both the transcriptional and the post-transcriptional levels through an AhR-dependent mechanism. These results are of potential clinical significance to humans in that they reveal the molecular mechanism involved and could explain the anecdotal evidence for the successful use of camel urine in the treatment of various medical conditions.

REFERENCES

Abdalla, MA/Abdalla, O (1979): "Morphometric Observations on the Kidney of the Camel, *Camelus Dromedaries*", in: *Journal of Anatomy* 129/1, pp. 45–50

Abdalla, OM/Wasfi, I.A/Gadir, FA (1988): "The Arabian Race Camel Normal Parameters: Haemogram, Enzymes and Minerals", in: *Comparative Biochemistry and Physiology A: Comparative Physiology* 90, pp. 237–239

Abdulqader, A/Alhaidera, Mohamed AM/El Gendyb, Hesham M/Korashyc, Ayman OS/El-Kadib A (2011): "Camel Urine Inhibits the Cytochrome P450 1a1 Gene Expression through an AhR-dependent Mechanism in Hepa 1c1c7 Cell Line", in: *Journal of Ethnopharmacology* 133, pp. 184–190

Abu-Lehia, I (1989): "Medical and Chemical Characteristics of Camel Milk – Fat and its Fractions", in: *Food Chemistry* 34, pp. 261–268

Agrawal, RP/Swami SC/Beniwal R/Kochar DK/Sahani MS/Tuteja FC/Ghouri SK (2003): "Effect of Camel Milk on Glycemic Control, Risk Factors and Diabetes Quality of Life in Type-1 Diabetes: A Randomised Prospective Controlled Study", in: *Journal of Camel Practice and Research* 10/1, pp. 45–50

---/Dogra, R/Mohta, N/Tiwari, R/Singhal, S/Sultania, S (2009): "Beneficial Effect of Camel Milk in Diabetic Nephropathy", in: *Acta Bio-medica: Atenei Parmensis* 80, pp. 131–134

Al-Abdalall, A (2010): "The Inhibitor Effect of Camel's Urine on Mycotoxins and Fungal Growth", in: *African Journal of Agricultural Research* 5/11, pp. 1331–1337

Al-Ani, FK (2004): *The Camel:Management and Diseases*, Al-Sharq Printing Press, Jordan

Al-Attas AS (2008): "Determination of Essential Elements in Milk and Urine of Camel and in *Nigella sativa* Seeds", in: *Arabian Journal of Chemistry* 1/2, pp. 123–129

Al-Awadi, A (1998): *Patent Discovery Registration, at King Abdul-Aziz city for Science and Technology*, Riyadh, Kingdom of Saudi Arabia.

---/AL-Jedabi A (2000): "Antimicrobial Agents in Camel's Urine", in: *Journal of Union Arab Biologists, Microbiology and Viruses s* 8/11, pp. 265–281

---/Al-Gudabi, A (1999): "Effect of Camel Urine Inhibiting Growth of Some Pathogenic Fungi and Yeast", in: *Journal of Union Arab Biologists, Microbiology and Viruses* 8/B, pp. 335–363

Al-Harbi, M/Qureshi, S/Ahed, M/Raza, M/Baig, A/Shah, H (1996): "Effect of Camel Urine on the Cytological and Biochemical Changes Induced by Cyclophosphamide in Mice", in: *Journal of Ethno pharmacology* 52/3, pp. 129–137

Amer, A/Al-Hendi, A (1996): "Physical, Biochemical and Microscopical Analysis of Camel Urine", in: *Journal of Camel Practice and Rsearch* 3/1, pp. 17–21

Baesmel, S (2004): "The Milk and Urine of the Camel between the Heritage and Science", in: *Journal of Science and Technology* 18/70, pp. 17–23

Barbour, E/Nabbut, N/Frerichs, W/Al-Nakhli, H (1984): "Inhibition of Pathogenic Bacteria by Camel's Milk: Relation to Why Lysozyme and Stage of Lactation", in: *Journal of Food Protection* 47/11, pp. 838–840

Conesa, C/Sanchez, L/Rota, C/Perez, MD/Calvo, M/Farnaud, S/Evans, RW (2008): "Isolation of Lactoferrin from Milk of Different Species: Calorimetric and Antimicrobial Studies", in: *Comparative Biochemistry and Physiology B: Biochemistry & Molecular Biology* 150, pp. 131–139

El-Elyani, A (1999): "Some Directories on the Scientific Miracles in Prophetic Medicine Effect of Camels Urine and Milk on the Histological Structure of Kidney", in: *Journal of Union Arab Biologists. Zoology* 11A, pp. 223–238

El-Elyani, R/Khalifa, S (2006): "Histological Studies on the Effect of Camel Urine and Milk on Stomach of Albino Mice", in: *Saudi Journal of Biological Sciences*, p. 13

El-Nadi, AH/Al-Torki, AI (2007): "Chemical and Biochemical Composition of Pregnant Camel Urine (*Camelus dromedarius*)", in: *International Journal of Biology and Biotechnology* 4/4, pp. 433–434

Etzion, Z/Yagil, R 1986: "Renal Function in Camels (*Camelus Dromedaries*)", in: *Physiological Zoology* 59/5, pp. 558–562

Farah, Z (1993): "Composition and Characteristics of Camel Milk: A Review", in: *Journal of Dairy Reasearch* 60, pp. 603–626

Faye, B/Bengoumi, M/Tressol, C (1999): "Comparative Trace-Element Excretion in the Camel and Cow", in: *Journal of Camel Practice and Research* 6/1, pp. 19–25

Gast, M/Mauboisj, JL/Adda, J (1969): *Le lait et les produits laitiersen Ahaggar*, Centre Rech. Anthr. Prehist. Ethn.

Hamers-Casterman, C/Atarhouch, T/Muyldermans, S/Robinson, G/Hamers, C/Songa, EB/Bendahman, N/Hamers, R (1993): "Naturally Occurring Antibodies Devoid of Light Chains", in: *Nature* 363, pp. 446–448

Kabarity, A/Mazrooei, S/Elgindi, A (1988): "Camel Urine as a Possible Anticarcinogenic Agent", in: *Arab Gulf Journal of Scientific Research. Agricultural and Biological Sciences* 6/1, pp. 55–63

Kalra, DB/Arya, PL (1959): "A Preliminary Study of the Camel Urine", in: *Indian Veterinary Journal* 36, pp. 24–26

Kaul, VK/Nigam, SS/Dhar, KL (1976): "Antimicrobial Activities of the Essential Oils of Artemisia Absinthium Linn, A Vestita Wall and A Vulgaris Linn", in: *The Indian Journal of Pharmacy* 38, pp. 21–22

Khalifa, A (1999): "Some Directories on the Scientific Miracles in Prophetic Medicine Effect of Camel's Urine and Milk on the Histological Structure of Liver", in: *Journal of Union Arab Biologists. Zoology* 11A, pp. 207–222

Khalifa, S/Al-Elyani, A/Al-Alwani, D (2005): "Histological, Cytological and Histochemical Studies on the Effect of Camel's Urine on the Liver of Rabbits Infected by *Escherichia Coli*", in: *Saudi Journal of Biological Science* 2, pp. 66–80

Khogali, S (2005): *"Hepatoprotective and Anti-Parasitic Effect of Dromedary Female Camel Urine",* PhD thesis, University of Khartoum, http://etd.uofk.edu/uofkketdallview.php?=2562, consulted 2 Feb., 2011

Khorshid, F/Moshref, S (2006): "In-Vitro Anticancer Agent, I-Tissue Culture Study of Human Lung Cancer Cells A549, II-Tissue Culture Study of Mice Leukemia Cells L1210", in: *International Journal of Cancer Research* 2/4, pp. 330–344

Knoess, KH (1979): "Milk Production of the Dromedary", in: *Camels: IFS Symposium*, Sudan, pp. 201–214

McCallion, RF/Cole, AL/Waltker, RL/Blunt, JW/Munro, HG (1982): "Antibiotic Substances from New Zealand Plants", in *Planta Medica* 44, pp. 134–138

Mehaia, MA (1994): "Vitamin C and Riboflavin Content in Camel Milk: Effect of Heat Treatments", in: *Food Chemistry* 50, pp. 153–155

Noor, E (2008): "Electrochemical Study for the Corrosion Inhibition of Mild Steel in Hydrochloric Acid by Untreated and Treated Camel's Urine", in: *European Journal of Scientific Research* 20/3, pp. 496–507

Quita, S/Kurdi, L (2010): "Antigenotoxic and Anticytotoxic Effect of Camel Milk in Mice Treated with Cisplatin", in: *Saudi Journal of Biological Sciences* 17, pp.159–166

Rao MB/Gupta RC/Dastur NN (1970): "Camel's Milk and Milk Products", in: *Indian Journal of Dairy Sciences* 23, pp. 71–78

Read, BE (1925): "Chemical Constituents of Camel's Urine", in: *Journal of Biological Chemistry* 64, pp. 615–617

Redwan, RM/Tabll, A (2007): "Camel Lactoferrin Markedly Inhibits Hepatitis C Virus Genotype 4 Infection of Human Peripheral Blood Leukocytes", in: *Journal of Immunoassay & Immunochemistry* 28, pp. 267–277

Safer, AM/Katchburian, E (1991): "Unusual Membrane-Bound Bodies in the Basal Lamina of the Uriniferous Tubules of the Camel *Camelus Dromedarius*", in: *Acta Anatomy* 140, pp. 156–162

Salwa, K/Ali, S/Samia, A/Majid, A (2004): "Physical and Biochemical Contents of Camel, Goat and Human Urine", in: *Journal of Animal and Veterinary Advances* 3/9, pp. 586–589

Shoeib, A/Ba-Hatheq, M (2009): "Preparation of Camel Urine to Appear its Antagonistic Effect to Overcome on the Human Pathogenic Bacteria, in Comparison with Antibiotics", in: *Saudi Journal of Biological Sciences* 163, pp. 151–160

Siebert, BD/Macfarlane, WV (1971): "Water Turnover and Renal Function of Dromedaries in the Desert", in: *Physiology Zoology* 44/4, pp. 225–240

Smith, HW/Silvette, H (1928): "Note on Nitrogen Excretion of Camels", in: *Journal of Biological Chemistry* 78, pp. 409–411

Urazakov, NU/Bainazarov SH (1974): *Problemy Tuberkuleza* 2, pp 89–90.

Varley H, Gowenlock AH, Bell M (1980): *Practical Clinical Biochemistry*. 5th ed. Vol. 1, Heinemann Medical Books, London

Wasfi, LA/Boni, NS/Hadi, AA (1998): "The Effects of Age and Sex on The PH of Camel Urine", in: *Third Annual Meeting for Animal Production Under Arid Conditions*, *UAE University, Al Ain, UAE, May 2–3 1998*, *Abstracts Book*, p. 42

Wilson, RT (1984): *The Camel.* London and New York: Longman http://www.patentstorm.us/applications/20090297622.html, consulted 29 Sept., 2011

Yagil, R/Berlyne, M (1978): "Glomeruler Filtration Rate and Urine Concentration in the Dromedary Camel in Dehydration", in: *Renal Physiology* 1, pp. 104–112

---/Van Creveld, C (2000): "Medicinal Use of Camel Milk – Fact or fancy?" *Proceedings International Camelid Conference*, Almaty, Kazakhstan, p. 100

Yiannikouris A/Jonany J (2002): "Mycotoxins in Feeds and their Fate in Animals: A Review", in: *Animal Research* 51, pp. 81–99

Zagorski, O/Maman, A/Yafee, A/Mesies, A/Creveld, C/Yagi, R (1998): "Insulin in Milk – A Comparative Study", in: *International Journal of Animal Science* 13, pp. 241–244

Zaki, D/Abdel-EL-Aziz, M/EL-Gengeihy, S/Morsi, N (1984): "Antimicrobial Potentialties of Some Egyptian Desert plants", in: *Herba Hungarica* 23, pp. 73–78