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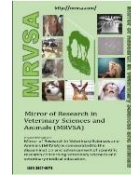
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Observations on dromedary (Arabian camel) and its diseases

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This article describes some facts regarding the dromedary, its classification, distribution and population in the world. In addition, the diseases of camels and its classification according to OIE is also described. Since, little is known about the health problem of Iraqi camels, this article plays a magnificent role in filling the knowledge gap and drawing attention towards the improvement of camel health care and its management practices. Much emphasis is given to the occurrences of abortion in the herd of camels in Iraq. Subsequently, the authors would like to give more attention to the Iraqi camels herd and enhancement its future and production performances as camels consider as the animals of the future.

Abstract

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Introduction

Camel is the common name for large, humped, long-necked, even-toed ungulates comprising the mammalian genus *Camelus* of the Camelidae family. There were over 19 million camels worldwide according to FAO statistics 2008, of which: 15 million are found in Africa and 4 million in Asia. Camel is considered as one of the highly mulch animals, although they are living in the harsh desert environmental conditions (Knoess, 1984; Abbas and Tilley, 1990; Schwartz, 1992).

According to taxonomy, physiology or behaviour, the camelids are not ruminants. They are a polygastric animal, but not a true ruminant (Fowler, 1996). True ruminants have four compartment stomach, whereas there are three compartments in the camel stomach. Since after feeding, the camel also ruminates, therefore, it is called a special ruminant or sometimes as a pseudo-ruminant. Camelids differ from ruminant in susceptibility to infectious and parasitic diseases according to Fowler, (2010). The differences between

Karima Al-Salihi, (2016); 5 (Special issue), 1-10.
1st Iraqi colloquium on camel diseases and management.
Mirror of Research in Veterinary Sciences and Animals

camelids and ruminants should exclude camelids from being classified as ruminants. Despite that, camelids have been located in various categories, such as “exotic animals,” “wild animals,” “other livestock species,” Two genera are comprised in the family Camelidae (Figure 1), these are:

- The genus *Camelus* (Linnaeus, 1758), includes two species. The first species is *C. dromedarius*, the dromedary or one-humped camel, the world population of which is estimated to be 15,368,000, with approximately 80% in Africa and 20% in Asia. The second species is *C. bactrianus* (Linnaeus), the bactrian or two-humped camel, of which there are some 1.7 million in their natural habitat in Asia.

- The genus *Lama* comprises *Lama glama* (the llama), *Lama pacos* (the alpaca), *Lama guanicoe* (the guanaco), and *Vicugna vicugna* (the vicugna). Only the first two have been domesticated. They are raised in herds in the Andes at altitudes above 2,500 m. Their population is estimated to be 7,165,000 (Bisby *et al.*, 2011).

Kingdom Animalia (animals)
Eumetazoa (metazoans)
Bilateria (bilaterally symmetrical animals)
Deuterostomia (deuterostomes)
Phylum Chordata (chordates)
Craniata (craniates)
Subphylum Vertebrata (vertebrates)
Superclass Gnathostomata (jawed vertebrates)
Euteleostomi (bony vertebrates)
Class Sarcopterygii (lobe-finned fishes and terrestrial vertebrates)
Tetrapoda (tetrapods)
Amniota (amniotes)
Synapsida (synapsids)
Class Mammalia (mammals)
Subclass Theria (Therian mammals)
Infraclass Eutheria (placental mammals)
Superorder Cetartiodactyla (cetaceans and artiodactyls)
Order Artiodactyla (even-toed ungulates)
Family Camelidae (camels, llamas, and relatives)
Genus *Camelus* (camels)
Species *Camelus bactrianus* (Bactrian camel)
Species *Camelus dromedarius* (dromedary)

Figure 1. Shows the Complete Classification of the Camels including the higher taxa (Source: Simpson G.G 1954; Classification of mammals .Bull. Amer. Mus. Nat. Hist.85, 1-350)

Usually, camels raise in the dry desert conditions. The severity of the desert conditions particularly during the long dry season put the camels under severe stress conditions and make them susceptible to many diseases and illness (Abbas *et al.*, 1993; Agab, 1993). Scarce of the studies on the camel disease in the past led some scientists to consider

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1st Iraqi colloquium on camel diseases and management.
Mirror of Research in Veterinary Sciences and Animals

camels, as resistant to many disease causing factors (Zaki, 1948; Dalling *et al.*, 1988). However, the camels have proved as other livestock, being susceptible, to the common disease causing pathogens affecting other animal species (Wilson 1984; Abbas and Tilley, 1990; Abbas and Agab, 2002). Little is known about the camels and its health problems in Iraq compared to other livestock. The depth of information on Iraqi camels and camel production and disease has not been adequate to solve its multifaceted problems. Consequently, this review article intends to describe some facts regarding the dromedary, its classification, distribution and population. In addition, to describe the diseases of camels and its classification according to OIE and to give attention towards the improvement of health care and management practices of camels in Iraq.

History of Origin and domestication of camels

About 50-60 million years ago, camel-like animals are thought to have originated from North America. Before their extinction in their native land, camels spread across the Bering land bridge, moving the opposite direction from the Asian immigration to America, to survive in the Old World and eventually be domesticated and spread globally by humans. Throughout the years, they develop into two main types: The Bactrian camel, which has two humps and mainly lives in the cold deserts of China and Mongolia, and the dromedary, which is one humped and is found in the hot deserts of Africa and the Middle East. It is thought that the dromedary was first domesticated in southern Arabia about 5,000 years ago. It is used for transport, as a beast of burden, and for meat, milk and hides and, in some communities, for its blood too. In addition, cylinder seals from Middle Bronze Age Mesopotamia showed riders seated upon camels, these are approved the domestication of camels in Mesopotamia.

Facts on Dromedary

The camel, unlike other domestic animals, has no less than 20 specific adaptations of its body that help it survive extreme heat and go without water for long periods. Camels can travel to remote pastures over a tremendous area camels can walk up to 60 kilometres in a day – and go on giving milk during drought when other animals stop lactating or even die. Camels will also eat everything, fresh plants, dried plants, very salty plants, bones, fish and meat, even leather. The ‘anatomical adaptations’ of camel’s body that help its surviving in the desert are include:

1. Long legs that lift it well above the hot ground, and sternal pads – very hard skin pads at the back of its front leg joints, and the front of its back leg joints – that keep its body clear of the ground when seated, allowing air to circulate around it and keep it cool .
2. Camel’s nostrils can close against dust; large padded feet to support its weight in sand; protruding frontal orbit and long eyelashes that shadow the eye against the sun; a membrane also found in other animals, that moves like a very thin third eyelid across the eye and brushes away sand from the eye; the ears are small and covered in hair, including the inside of the ear, which helps keep out sand and dust.

Karima Al-Salihi, (2016); 5 (Special issue), 1-10.
1st Iraqi colloquium on camel diseases and management.
Mirror of Research in Veterinary Sciences and Animals

3. Camels can live for 40 years, but the productive lifespan is between 20 and 30 years.
4. Camels have been used for long distance travel, for trade, exploration.
5. A unique fore-stomach (rumen) which has only three chambers (rumen of other ruminants has four chambers) and contains so-called glandular sacs that produce a saliva-like liquid; such glandular sacs are not found in the rumen of any other ruminant.
6. Body Length about 300 cm / 10 ft ; Shoulder Height about 180-210 cm / 6-7 ft; Weight range from 600 to 1000 kg / 1320-2200 lb ; males are larger than females and camels can drink 26 to 40 gallons (100 to 150 liters) of water at one time.
7. Gestation period are 12-13 months and usually give to one calf/ per birth and the weaning occur at 1-2 years. In addition, sexual maturity for females occur at 3-4 years and males at 5-6 years.

Diseases of Camels and OIE Updated classification on diseases of camelids

Camels were previously considered resistant to most of the diseases commonly affecting livestock, but as more research was conducted, camels were found to be susceptible to a large number of pathogenic agents. Indeed camels are more susceptible for some diseases such as pox, mange, and enterotoxaemia, and manifested more severe signs than other ruminants in the same localities (Abbas and Omer, 2005). The clinical reaction of camels to diseases is usually not very pronounced nor is it predictable. Illness may pass unnoticed. There are many workers believed that: the low density of camel populations, the environments in which they are bred, the long intervals between drinking , all these factors keep camels from frequent contact with other animals, thus diminishing the chance of acquiring infectious diseases. The diseases of camels are classified according to the report released by the second meeting of the OIE ad hoc group on diseases of camelid paris, 3–5 may 2010. Diseases are presented in a list divided into three categories: Viral diseases, Bacterial diseases and Parasitic and Fungal diseases. For each category, the diseases were listed by family of camelids (dromedary camels, Bactrian camels and New World camelids) and classified into three groups for each of these families with Group I: Known to produce significant diseases, Group II: diseases for which camelids are potential pathogen carriers, and Group III: Minor diseases (Figure 2). Some changes are made for each category. Foot and mouth disease (FMD) was removed from the “Viral diseases”, dromedary camels and New World camelids as they were not susceptible, while Bactrian camels were susceptible to FMD (Figure 3). However this finding would need to be further investigated with regard to the serotypes involved and the role of camelids as potential carriers. The OIE ad hoc group were suggested a further research would therefore be necessary, especially on diagnostic techniques and for the identification of virus receptors. Influenza A infections were added to Group I of viral diseases for Bactrian camels based on a scientific publication (Yamnikova *et al.*, 1993).

Within the category “Bacterial diseases”, the Group agreed that Brucellosis appeared to be one of the most important bacterial diseases of camelids (caused mainly by *Brucella abortus* for Bactrian camels contrary to dromedary camels and New World camelids

where *B. melitensis* is predominant). Dermatophilosis was added to Group I of bacterial diseases for dromedary camels (Figure 4).

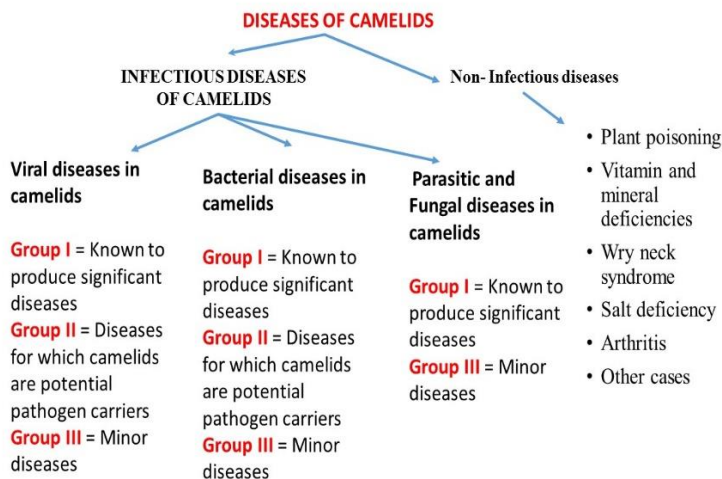


Figure 2. shows the classification of diseases of camels according to the report released by the second meeting of the OIE ad hoc group on diseases of camelid paris, 3–5 may 2010.

Viral diseases in camelids

- | | | |
|--|--|--|
| <ul style="list-style-type: none"> • Group I ➤ Camelpox ➤ Contagious ecthyma ➤ Papillomatosis ➤ Rabies ➤ RVF | <ul style="list-style-type: none"> • Group II ➤ AHS ➤ BT ➤ BVD ➤ PPR | <ul style="list-style-type: none"> • Group III ➤ CCHF ➤ Herpesvirus Infections ➤ West Nile Fever |
|--|--|--|
- RVF: Rift Valley fever
 AHS: African horse sickness
 BT: Bluetongue
 BVD: Bovine viral diarrhoea
 PPR: Peste des petits ruminants
 CCHF: Crimean–Congo haemorrhagic fever

Figure.3: shows the classification of viral diseases in camelids according to the report released by the second meeting of the OIE ad hoc group on diseases of camelid paris, 3–5 may 2010.

Bacterial diseases in camelids

- | | | |
|---|--|--|
| <ul style="list-style-type: none"> • Group I ➤ Anthrax ➤ Bruceellosis(<i>B. melitensis</i>) ➤ Clostridia Infections ➤ Colibacillosis ➤ Dermatophilosis(<i>Dermatophilus congolensis</i>) ➤ Haemorrhagic septicaemia (<i>Pasteurella multocida</i> or <i>Mannheimia hemolytica</i>) ➤ Johne's disease Pyogenic diseases (<i>Caseous lymphadenitis</i>) ➤ Salmonellosis | <ul style="list-style-type: none"> • Group II ➤ Leptospirosis ➤ Q fever ➤ Tuberculosis | <ul style="list-style-type: none"> • Group III ➤ Chlamydiosis ➤ Glanders ➤ Plague (<i>Yersiniosis</i>) |
|---|--|--|

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1st Iraqi colloquium on camel diseases and management.
Mirror of Research in Veterinary Sciences and Animals

Figure.4: shows the classification of bacterial diseases in camelids according to the report released by the second meeting of the OIE ad hoc group on diseases of camelid paris, 3–5 may 2010.

In the category “Parasitic and Fungal diseases”, gastrointestinal parasitoses were added to Group I for dromedary and bactrian camels as these diseases, caused by several different parasites (*Trichostrongylus*, *Haemonchus*, *Taenia* etc.) have a significant economic impact. For the same reason, ring worm was added to Group I of parasitic and fungal diseases for the dromedary and bactrian camels and to Group III for the New World camelids. Coccidioidomycosis (emerging fungal disease) was added to Group III for New World camelids (Figure 5).

Parasitic and Fungal diseases in camelids

• **Group I**

- Cephalopina infestation
- Coccidiosis
- Gastro intestinal parasitosis
- Hydatidosis Echinococcosis
- Mange (*Sarcoptes scabiei*)
- Ring Worm (Dermatophytosis)
- Tick infestations
- Trypanosomosis

• **Group III**

- Myiasis other than Cephalopina
- Neosporosis
- Toxoplasmosis

Figure.5: Shows the classification of parasitic and fungal diseases in camelids according to the report released by the second meeting of the OIE ad hoc group on diseases of camelid paris, 3–5 may 2010.

Camels in Iraq

According to FAO statistic 2011, Iraq owned a total of 58,000 camels (Tara, 2011). All are one-humped camels and are commonly found in certain parts .The greatest proportion of this population is present in the middle and south and west parts of country (Figure.6).

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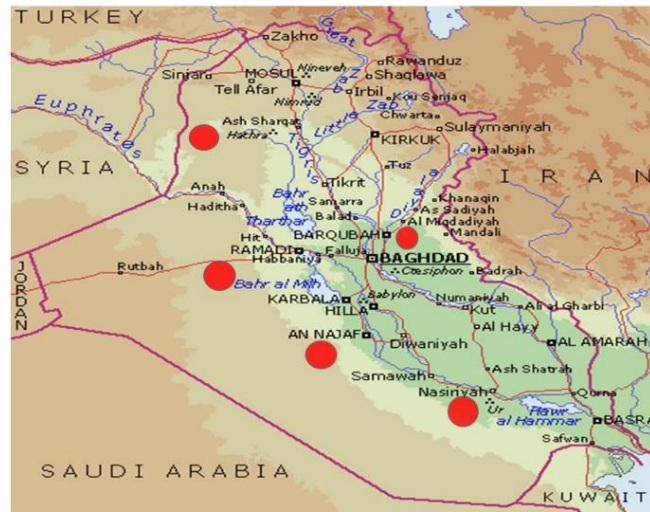


Figure.6: Shows the distribution of camels in Iraq

The Iraqi people that are living in the desert with its diverse ecozones throughout Iraq and own camels, are called “Bedouin” groups and communities (pastoralists and nomads, Figure 7). This reliance consists of utilization of camel milk, meat, and leather and wool. In addition, they used camels for packing, transport and riding.



Figure. 7: Shows the Iraqi camels and camel's breeder (photo captured at Najaf Desert, 2013)

Systematic studies of the disease conditions of camels in Iraq are scarce. Review of published literature revealed that camel diseases classified into: Common, less common and rare. Details of all camels’ diseases are presented in (Figure 8).

Karima Al-Salihi, (2016); 5 (Special issue), 1-10.
1st Iraqi colloquium on camel diseases and management.
Mirror of Research in Veterinary Sciences and Animals

| Common diseases | Less commonly diseases | Very rare conditions |
|--|---|--|
| <ul style="list-style-type: none"> ➤ 100% tick infestation, ➤ 98% gastrointestinal parasites ➤ 83% mange ➤ 44.2% hydated cyst ➤ 33% trypanosomiasis ➤ 33% nasal myiasis ➤ 21.79% plastic foreign bodies. ➤ Brucellosis ➤ Camel pox ➤ Among the most common respiratory infections were: nasal myiasis, pneumonia, pulmonary congestion, emphysema. ➤ Common digestive disorders were impaction, foreign bodies and enteritis. | <ul style="list-style-type: none"> ➤ mastitis, 3.5% ➤ ringworm, 1.2% ➤ liver abscess, 1.92% ➤ onchocerciasis , 1.91% ➤ and 1.9% infertility. <p>Infertility is the major cause of early culling of female camels</p> | <ul style="list-style-type: none"> ➤ Rabies ➤ Tetanus ➤ tumors ➤ congenital defects ➤ Dystocia ➤ retained placenta and vaginal prolapsed ➤ Plant poisoning ➤ Middle east respiratory syndrome coronavirus (MERS-CoV) ???????? |

Figure. 8: Shows the classification of diseases of camels in Iraq

Abortion in Camelids

Pregnancy loss is one of the common complaint in camelid practice in Iraq nowadays. The general approach to diagnosis is similar to that in other species. However, camelids have several unique features of placentation and pregnancy. In nearly all pregnancies, the fetal horn is the left uterine horn, and the placenta is epitheliochorial, microcotyledonary diffuse (such as in the horse) but the allantochorion adheres to the amniotic sac. Published literature regarding abortion in camels in Iraq are scarce. The causative agents of abortion of camels are presented in (Figure.9) according to Radostits *et al.*, (2007).

Only few studies have done regarding camel brucellosis in Iraq (Al-Ani *et al.*, 1998). One serological study using Rose Bengal test found that the percentage of positive animals was 6, 73% between 104 serum samples collected from different age groups of camels (Rodhan *et al.*, 2006). There are many difficulties that arise in diagnosis of camel brucellosis, because as this disease shows only few clinical signs in compare to its clinical appearance in cattle (Al-Salihi, 2013; Mousa *et al.*, 1987). In addition, camel herds usually raise in a remote area synchronizes with missing infrastructure.

Future of the camel

Camels are considered as the animals of the future. Cancer gene therapy from camels has approved by the scientists at the Department of Pharmaceutics and Analytical Chemistry, University of Copenhagen. Nanobodies produced by camels have unique properties, which can be used in future drug development. New research published in the Journal of Controlled Release, confirmed that these nanobodies can help scientists in the fight against cancer. Members of the camelid family have particular heavy-chain antibodies in their blood known as nanobodies that may serve as therapeutic proteins. One of the most powerful advantages of nanobodies is that they can be easily attached to other proteins and nanoparticles by simple chemical procedures.

Identification of Camel-Derived Antibodies for Breast Cancer Patients has been described by Prof. Serge Myldermans (Belgium) (2012). 3rd International Conference of the Society of Camelid Research and Development, Muscat 29 January-1 February 2012. In addition, a team of researchers are reported to have made a scientific breakthrough by developing a medical formula for treating cancer using camel's milk and urine.

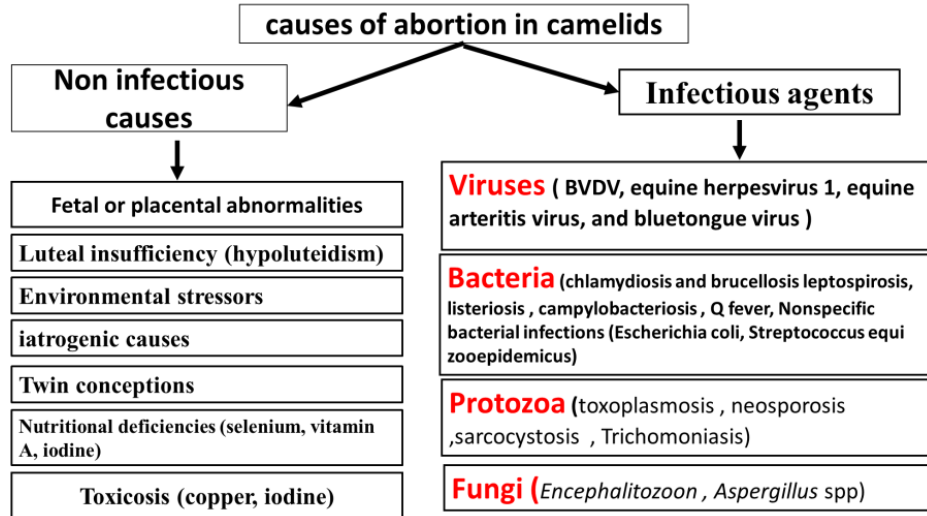


Figure. 9: Shows the causative agents of abortion in camels

The experiments were conducted in Sharjah University and the Cancer Institute in Baghdad. The Camel's milk was reported by several research to treat diabetes. However, the milk of the camel has traditionally been used to treat diabetes long time ago. Surprisingly, camel milk does seem to contain high levels of insulin or an insulin-like protein which appears to be able to pass through the stomach without being destroyed. Several research are considered the camels as the animals of the future in a changing climate.

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