

MAIN PATHOLOGIES OF CAMELS, BREEDING OF CAMELS, CONSTRAINTS, BENEFITS AND PERSPECTIVES

M. El Harrak¹, B. Faye², M. Bengoumi³

Original: English

Summary: *The dromedary camel (Camelus dromedarius, one-humped camel) is an important livestock species adapted to hot and arid environments. It is most abundant in the arid lowlands of Africa, the Middle East and Western Asia. The economic importance of this multipurpose animal is evident from the numerous benefits provided by camel products (meat, milk, wool). Moreover, the camel serves for riding, as a beast of burden and as a draft animal for agriculture and transport.*

Camels were formerly thought to be resistant to most of the diseases commonly affecting livestock, but new data have confirmed that camels are susceptible to a large number of pathogens and are believed to act as a carrier or reservoir for the transmission of several transboundary animal diseases and zoonoses.

In 2008, the OIE Ad Hoc Group on Diseases of Camelids classified diseases of camelids, the two most important categories being 'significant diseases' and 'diseases for which camels are potential pathogen carriers'. However, to date, very little is known about various micro-organisms associated with camel infections and the definitive aetiology of some multifactorial diseases has yet to be determined. Camel susceptibility to a number of pathogens needs to be investigated.

Concerning diagnostic methods, a number of tests for pathogens or antibody detection have been described. However, they have not yet been standardised or validated and very few studies have focused on control and prevention.

With the increasing demand for live camels and camel products, a disease control programme should be implemented to improve the socioeconomic conditions in camel breeders' communities. Encouraging camel sector networking and promoting applied research on camel diseases, including epidemiological studies and surveillance systems, will strengthen capacity building in the field of camel disease control.

The export industry must also be encouraged and it is highly recommended that specific guidelines be established for international trade in camels and camel products..

Key words: *Africa – camel breeding – camel disease – Camelids – Camelus dromedarius – dromedary camel*

1 Dr Medhi El Harrak, Secretary General of the OIE Biological Standards Commission, BP 4569, Avenue Hassan II, km2, Rabat-Akkari, Morocco
2 Dr Bernard Faye, International Cooperation Centre on Agrarian Research and Development (Cirad)
3 Prof. Mohammed Bengoumi, Hassan II Agrarian and Veterinary Institute, Morocco

1. Introduction

The effects of climate change are becoming increasingly apparent, with a potentially devastating impact on countries, such as in sub-Saharan Africa, where the poverty rate is expected to increase further in some of the more vulnerable and low-growth economies. Greater priority must therefore be given to preserving the natural resource base.

One of the most important natural resources in Africa is the dromedary camel (*Camelus dromedarius*, one-humped camel or Arabian camel). This animal is most abundant in the arid lowlands of Africa, the Middle East and Western Asia. There are currently almost 15 million officially declared dromedaries, a figure that certainly underestimates the true picture. Camels represent 12% of the domestic herbivore biomass in arid countries of Africa and 2% in Asia, but represent only 0.4% of the world production of meat-producing herbivores, a marginal place but nevertheless essential in arid lands.

The camel is a multipurpose livestock species of great economic importance due to the benefits provided by camel products (meat, milk, wool). Camels are essential in arid lands; they are well-adapted to hot and arid environments, desertification and scarce natural resources. In Africa, the dromedary camel has accompanied the desertification of the Sahara. This process is continuing since camel farming is expanding now in the Central African Republic, Nigeria, Tanzania, Uganda, and as far south as Namibia.

Camels are a source of high-value meat and milk protein for the population in arid areas and also provide efficient services in agriculture, environmental-friendly transport and leisure. At present, they are becoming increasingly involved in intensification processes in many parts of the world.

Camels were formerly thought to be resistant to most of the diseases commonly affecting livestock, but new data have confirmed that they are susceptible to a large number of pathogens and are believed to act as a carrier or reservoir for several transboundary animal diseases and zoonoses.

Knowledge of camel diseases is currently limited and more research is needed to elucidate the role of some of the pathogens involved in the epidemiology and pathogenesis of camel diseases. Camel susceptibility studies and epidemiological investigations should be carried out for a wide range of pathogens. Diagnostic methods have not been standardised and existing vaccines should be tested and validated for use in camels.

2. Camel breeding: constraints and benefits

Annotated bibliographies highlight the great importance of the camel for the gainful utilisation of arid lands and how the camel as an element of the desert ecosystem is able to valorise the least 'productive' parts of the world.

It is now well documented that the camel produces milk, meat, wool, hair and hides, and serves for riding, as a beast of burden and as a draft animal for agriculture and transport. It represents an important economic resource for the pastoral population in Africa's arid areas. Moreover, the cultural attachment of Sahara inhabitants to their environment and their pride in their traditional heritage need to be taken into account. For example, races of dromedaries are commonly organised at great ceremonies, such as weddings or festivals.

Arid and semi-arid regions cover an area extending from Mauritania across North Africa to the Gulf countries, Iran, Iraq and Pakistan. The economic importance of camel herding is obvious given the numerous benefits of camel products, in addition to the fact that the camel has been a unique major ecological factor in making the vast desert areas in these regions inhabitable.

In Africa, camel breeding has significant positive socioeconomic impacts on the nomadic population. Camels are highly valued for their labour productivity and continue to be the only species able to utilise the harsh conditions of the dry lands. Furthermore, they are a significant feature of the cultural identity of pastoralists and make up about 80% of their livestock. Keeping camels enables Bedouin communities to live in areas that would otherwise be uninhabited. Camels provide pastoralists with a daily source of food and a source of income through sales of surplus animals; they also help to ensure their security through capital accumulation, strengthen social links and provide the sole means of transporting goods. Some camel herders during periods of

severe drought drive their camels towards peri-urban areas where they settle close to markets, for milk and meat marketing in particular.

3. International trade in camels and camel products

Camel products, especially milk and meat, are highly appreciated by the local population. In several countries, efforts have been made during the past decade to create the necessary infrastructure to realise the potential offered by camel breeding in the relevant zones, raise awareness of the local cultural identity, help to promote the tourist sector and highlight the area's potential.

In addition, the demand from many countries (South-East Asia, Europe and the Middle East) for live camels and camel products is increasing. An export industry has been developed in some areas, leading to a change in the camel breeding and production system (sedentarisation, intensification). There is clearly the potential to satisfy a considerable demand. However, these changes require the implementation of effective disease control measures.

Due to production insufficiency, thousands of camels are being moved between neighbouring countries rather illegally. Governments are endeavouring to control this flow by building quarantine stations along borders to try to prevent the introduction of exotic diseases into their countries.

Some countries (Morocco, Saudi Arabia and the United Arab Emirates) have set up camel breeding experimental farms to improve knowledge of the camel's physiology and pathology. However, only a few research studies have been conducted there on the validation of treatment and vaccination protocols.

The OIE *Terrestrial Animal Health Code* does not include specific recommendations for trade in camels. Consequently, the OIE List of transmissible diseases should be completed and specific guidelines for trade in camels and camel products need to be established. Research on improving diagnostic capacity for camel diseases should also be encouraged so as to facilitate trade in camel products.

4. Main camel pathologies

For several decades, the scientific community has been interested in the camel for its particular metabolic adaptation to desert conditions (i.e. biological model), its pharmacological (xenobiotic metabolism) and immunological characteristics (immunoglobulin structure), unique among higher mammals. During the last decennia, camel sciences have focused mainly on blood and milk biochemistry. Furthermore, new reproduction and production techniques for intensification of camel farming have been tested in farms.

In the veterinary sciences, however, studies have rarely been undertaken on dromedary pathology. To date, only about 800 reports on dromedary diseases have been published, most of them based on isolated observations at the abattoir or other findings by the Veterinary Services. Various viral, fungal, bacterial and parasitic microorganisms have been associated with disease outbreaks in camels, but the definitive aetiology of most diseases has not yet been determined.

Also, with the advent of global warming, the risk of camels being epidemiologically involved in the spread or transmission of emerging and re-emerging diseases is also very likely to grow. Exotic diseases associated with camels are also likely to increase, as a result of camels coming into close contact with other livestock species due to the scarcity of water resources.

At the present time, with the development of new technologies, there is growing interest in camel disease research among scientific communities. However, most of the laboratory techniques used for the diagnosis of camel diseases have not yet been standardised. Furthermore, treatment or vaccination protocols need to be validated.

In 2008, the OIE set up an Ad Hoc Group on Diseases of Camelids to determine the OIE-listed diseases that should be considered significant in camelids and the diseases of other domestic animals for which camelids could potentially be pathogen carriers.

The OIE Ad Hoc Group met twice, in July 2008 and May 2010. The diseases were divided into three groups: 1) Significant diseases; 2) Diseases for which camelids are potential pathogen carriers; 3) Minor or non-significant diseases. For each disease, the available antigen detection methods and serological tests were added, followed by recommendations for diagnosis and prevention. These lists of diseases were developed, for the dromedary camel, the Bactrian camel and New World camelids (llama and alpaca).

For dromedary camels, the following diseases were considered significant, with an important economic impact:

- Viral diseases: camel pox, camel contagious ecthyma, rabies and papillomatosis.

It is important to note that dromedary camels are not susceptible to foot and mouth disease (FMD) while Bactrian camels are as susceptible as cattle to FMD. However, this statement needs to be verified for each of the relevant FMD serotypes and to take into account the potential role of camels as carriers.

- Bacterial diseases: brucellosis due to *B. melitensis*, caseous lymphadenitis, enterotoxemia, salmonellosis and colibacillosis.
- Parasitic and fungal diseases: trypanosomosis, mange, dermatophytosis, gastrointestinal parasites and tick infestation.

The Ad Hoc Group was of the opinion that current knowledge of camel diseases is limited and that more research is necessary to elucidate the role of some of the pathogens mentioned in the epidemiology and pathogenesis of the following diseases in camels:

- Viral diseases: peste des petits ruminants (PPR)-like infection, bluetongue, African horse sickness, Rift Valley fever, bovine viral diarrhoea, West Nile fever and herpesvirus infection.
- Bacterial diseases: pasteurellosis, leptospirosis, Q fever, chlamydiosis.
- Parasitic diseases: toxoplasmosis, sarcosporidiosis.
- Multifactorial diseases: neonatal diarrhoea, respiratory disease complex, abortion, sudden mortality syndrome and mastitis.
- Diseases of unknown aetiology: such as Lahaw-Gaal, Firaanfir, Laaba, Jajabsa and Yudleye.
- Emerging diseases in camel populations: cases of unusual mortality in Saudi Arabia; several cases of unexplained diseases with overmortality have occurred over the past ten years in Ethiopia, Mali, Niger, Somalia and Sudan.

4.1. Diagnostic methods

Diagnostic techniques, when available, have not been standardised or validated for use in camels. The OIE Ad Hoc Group made the following recommendations:

- c-ELISA and PCR are available for some pathogens, but need to be validated; when no c-ELISA or PCR are available, specific tests should be developed.
- For serological validation, there is a need for positive and negative camel reference sera.
- For direct and indirect ELISA, commercial anti-camelid conjugate must be validated for dromedary camels and used.
- There is a need for specimens from camels; the Ad Hoc Group encourages camel-rearing countries to collect specimens and submit them to diagnostic laboratories in order to allow evaluation of the sensitivity and specificity of existing methods.

- The Ad Hoc Group encourages representatives and laboratories in camel-rearing countries to exchange knowledge and disseminate information with OIE Reference Laboratories and Collaborating Centres for the following topics:
 - identification of a battery of diagnostic tests;
 - collection of materials;
 - means of facilitating the shipment of samples;
 - production of specific antisera;
 - development and validation of new techniques;
 - implementation of inter-laboratory testing;
 - establishment of a surveillance programme;
 - development of clinical trials;
 - sharing of initial results and publications.

4.2. Treatment and prevention

With the exception of some specific camel diseases, such as trypanosomosis and camel pox, no medical treatment or prevention protocols have been developed and validated for camels. The existing vaccines for Rift Valley fever and rabies should be validated and, if necessary, new vaccines should be developed.

The Ad Hoc Group encouraged applied research on camel diseases to:

- adapt and develop veterinary drugs and vaccines to camels;
- define specific prescription: dosage, protocol, safety and activity control, field efficacy, etc.;
- characterise clinical trial and pathological aspects of camel diseases.

5. Perspectives for camel breeding

Implementing sanitary measures for the control of camel diseases is a preliminary condition to ensure continued use of desert lands by camel herders and continuation of the pastoralist production system. This will improve their livelihood, prevent pastoralists having to move to cities and promote the export of camel products.

Camel research priorities should place the emphasis on infectious diseases, standardisation and validation of diagnostic tests and disease control and prevention, criteria that at present are either limited or absent in camel sciences. The description of each disease must include requirements for diagnostic techniques, validated vaccine or medical treatment protocols and bibliographic references.

The strategic approach is to create a network, at national and international level, of veterinarians and scientists involved in camel research and surveillance. Specialist laboratories in camel-rearing countries, with the help of OIE Reference Laboratory expertise, should identify and characterise viral, parasitic and bacterial diseases of priority and carry out investigation projects on disease susceptibility, pathogenicity, diagnosis and prevention in camels.

Laboratory specimens need to be collected and analysed to validate diagnostic methods and to constitute an extensive bank of biological material for future scientific investigations. Specimens should include sera, total blood, swabs and any other specimens of interest to check for the presence of antibodies or antigens and to monitor the incidence and distribution of camel diseases.

Investigations should also assess the risks associated with exotic emerging diseases of humans or livestock for which camels could be a potential vector or reservoir. With global warming and globalisation, insect-borne diseases (Rift Valley fever, bluetongue, epizootic haemorrhagic disease, African horse sickness, etc.) are likely to spread north, by means of a mechanism that has not yet been clearly identified. The sharing of information, experience and specimens needs to be developed in this field.

To promote the inclusion of camel diseases in the scientific literature and to raise the awareness of the international veterinary community on the subject, the OIE Ad Hoc Group on Diseases of Camelids recommended that camel diseases be included in veterinary education and professional training.

6. Conclusion

Considering the importance of dromedary camels for nomadic communities, and in view of the increase in camel movements and trade, the changes in production systems and the increased demand for camel products, all of which can increase the risk of disease transmission, it is of utmost importance:

- to convince funding agencies and governmental authorities to support camel research and development, especially in the face of current challenges (climate changes, new market opportunities, emerging diseases, poverty alleviation, etc.);
- to support camel producers in the intensification of camel production and include the impact of this intensification in research programmes;
- to encourage epidemiological studies and surveillance systems, with a view to characterising camel diseases;
- to support national laboratories and promote applied research on the diagnosis and control of camel diseases;
- to encourage networking in the camel sector and the exchange and dissemination of information.