



Characterization of the Epidemiological Situation of Dromedary Diseases in Mauritania

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ABSTRACT

Dromedary pathologies have a significant impact on animal and human health as well as on the economy and the environment. The aim of this study was to characterize the epidemiology of dromedary diseases. The survey also aims to take stock of indigenous knowledge and practices concerning camel diseases. A socio-epidemiological survey of dromedary breeders was carried out using a questionnaire administered to a population of 359 breeders in all regions of Mauritania. This survey enabled us to match the vernacular description of camel diseases used by breeders with the scientific characteristics of these diseases. The results revealed 25 diseases affecting dromedary. However, 11 diseases alone accounted for 89.5%, with individual frequencies distributed as follows: Mange or *Jrab* or *Loukech* (28.5%), trypanosomiasis or *Tabourit* (15.8%), gastrointestinal parasitosis or *Emndy* (11.1%), Pasteurellosis or *Elbared* (8.6%), tuberculosis or *Nhaz* (8.6%), tinea or *Legraa* (5.2%), sinusitis or *Boukhneniva* (3.8%), smallpox or *Jedri* (3.4%), Rift Valley fever (1.6%), mammitis or *Liram* or *Zayed* (1.6%), and respiratory infection or *Soussé* (1.2%). Breeders reported 14 other diseases, representing only 10.5%, with individual frequencies of less than 1%. The survey also demonstrated breeders' broad and long-standing native expertise in the diseases affecting dromedary. Implementation of the recommendations made in this study will improve knowledge and control of dromedary diseases, leading to a clear minimization of negative socio-economic impacts on production.

Keywords: Dromedary (*Camelus dromedarius*); Characterization; Pathologies; Impacts; Mauritania

INTRODUCTION

El Harrak et al., (2011) reported that dromedaries were previously thought to be resistant to most of the diseases usually affecting farm animals [1]. However, new data have confirmed their susceptibility to many pathogens, and it would also appear that these animals play a carrier or reservoir role in

the transmission of several transboundary animal diseases and zoonoses. In 2008, the OIE set up an ad hoc group on camelid diseases to identify which OIE-listed diseases are considered important in this species and which pathogens cause diseases in other domestic animals of which camelids may be potential carriers [2]. This OIE ad hoc group has classified the diseases into three groups:

Received:	22-January-2024	Manuscript No:	IPJASLP-24-18944
Editor assigned:	24-January-2024	PreQC No:	IPJASLP-24-18944 (PQ)
Reviewed:	07-February-2024	QC No:	IPJASLP-24-18944
Revised:	12-February-2024	Manuscript No:	IPJASLP-24-18944 (R)
Published:	19-February-2024	DOI:	10.36648/2577-0594.8.1.01

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Citation Mohamed OA, Fall M, Mohamed Ali MES, Diop AKM, Bengoumi M, et al. (2024) Characterization of the Epidemiological Situation of Dromedary Diseases in Mauritania. J Anim Sci Livest Prod. 8:01.

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- (i) Important diseases
- (ii) Diseases for which camelids are potential carriers, and
- (iii) Minor or non-serious diseases.

According to the FAO, in 2021, the national dromedary population in Mauritania is estimated at 150,3895 head, spread across all regions of the country [3]. Despite this numerical importance and its socioeconomic role, there is little information on the Mauritanian dromedary, and very little research has been carried out to identify the opportunities and constraints of its breeding, apart from a few studies on its pathologies. Over generations, breeders have learned how best to manage their herds and the meager natural resources at their disposal. As a result, they have developed considerable expertise in dromedary diseases, their diagnosis, consequences, prevention, and treatment, often based on traditional pharmacopeia and, more recently, on the use of veterinary products. In the context of development aid for livestock farming in Mauritania, knowledge and promotion of this indigenous knowledge are of prime importance, since taking it into account by professional veterinary services is, among other things, essential to the understanding of both parties and thus to the appropriate, harmonious and, consequently, effective integration of modern veterinary medicine as a development factor. This study aimed to characterize the epidemiology of camel diseases in Mauritania. This will involve drawing up a list of camel pathology vernacular names, which will be compared with the scientific names currently known.

MATERIALS AND METHODS

Survey Design and Data Collection

The data collection method was an individual cross-sectional descriptive survey carried out among 359 breeders between February and March 2023 in all regions of Mauritania (Figure 1).



Figure 1: Geographical location of study regions

The questions systematically asked concerned farmers' knowledge, attitudes, and practices regarding the dromedary diseases of greatest importance to them: Vernacular names of the disease, seasonality of the disease, frequency of the

disease, symptoms of the disease, history of the disease, age categories preferentially affected by the disease, treatments used to cure the disease, incidences and impacts of the disease, and risk factors favoring the appearance of the disease.

Analysis and Processing of Collected Data

To analyze the data, we first tabulated and entered them into an Excel spreadsheet. The quantitative and qualitative data collected in the field were processed, and descriptive statistics were produced using SPSS 27.0 software.

RESULTS

The results are presented in the form of descriptions of the diseases under their local names as they were collected. In what follows, the diseases are listed in order of importance as reported by the breeders, according to their frequency. In the majority of cases, traditional names are comparable to scientific names. The frequencies of diseases are presented in Figure 2 according to their importance declared by the breeders.

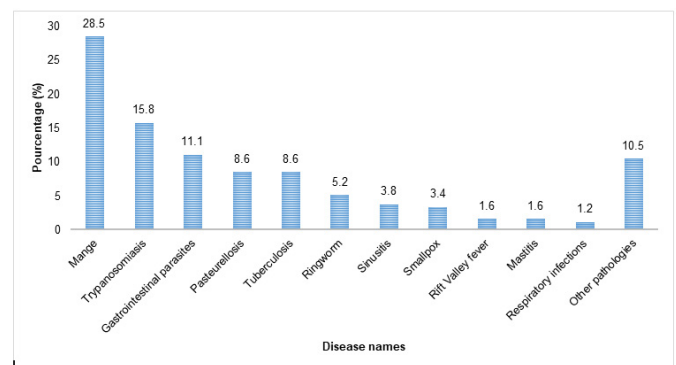


Figure 2: Distribution of camel diseases reported by breeders

Jrab or *Loukech* is Mange

Camel scabies is a very old disease known among breeders for its infectious, contagious, and virulent nature, as well as its chronicity. Breeders describe the main symptoms as hair loss, emaciation, skin lesions, and bleeding. It is one of the most common diseases in Mauritania. It is cited by 28.6% of breeders as a widespread disease in Mauritania. Scabies can appear all year round, especially in the cold season. It is during the cold season that cases are most numerous and contamination is easiest. Scabies can affect all categories of animals and can occur more than three times a year in a herd. Breeders describe widespread, irregularly distributed depilation on the animal's body, sometimes severe itching, and rapid contamination through contact when the animals are grouped. In some cases, the general condition of the affected animal may remain very good. According to breeders, it is therefore difficult to eliminate the disease once it has been declared in the herd. In economic terms, scabies can cause the death of the animal and incur medication costs, milk loss, and weight loss. The treatment used by breeders is an injection of Ivermectin. Two traditional treatments are frequently used: The first is latex from *Euphorbia balsamifera*, a medicinal plant, and herders report that dromedaries camped near this plant are less scabby. The second most widely used treatment is

machine oil.

Tabourit is Trypanosomiasis (*Trypanosoma Evansi*)

This disease seems to be well known among livestock farmers and is of major economic and health importance in Mauritania. Breeders report that the main symptoms of this disease are weight loss, hair loss on the tail, sunburn, and lacrimation. It is cited by 15.8% of livestock farmers as a widespread pathology in Mauritania. Trypanosomiasis can occur throughout the year, especially in the wet season. It can affect all categories of animals, with a frequency that can exceed three times a year in the herd. Breeders describe the disease as severe emaciation to the point of cachexia, leading to the death of the animal. Breeders report that the animal's appetite can be preserved, and the disease can persist for several years, with contamination through consumption of the products.

Concerning the economic importance of trypanosomiasis, according to breeders' descriptions, the major impacts are the death of the animal, costs incurred for the purchase of medicines, a drop in milk production, and can abort of pregnant females. To treat trypanosomiasis, farmers apply several injections: Trypanidium, Tryban, Triquin, and Cymelarsan.

Emndy is Gastrointestinal Parasites

Breeders describe the main symptoms of this disease as pronounced emaciation accompanied by lack of appetite (anorexia), reduced milk production, diarrhea, weight and hair loss, and edema of the limbs. It is cited by 11.1% of breeders as a common pathology in dromedaries in Mauritania. Gastrointestinal parasites can occur throughout the year, especially in the wet season. They can affect all categories of animals, with a frequency that can exceed three times a year in the herd. Regarding the economic importance of gastrointestinal parasites, according to farmers' descriptions, the major impacts are the death of the animal, expenditure on medicines, abortion of pregnant females, and a sharp drop in milk production. To treat this disease, breeders use Ivermectin, Albendazole, Levamisole, Tetramisole, and Bolumisole.

Elbared is Pasteurellosis

Breeders describe the main symptoms of this disease as follows: Nasal secretion, high fever in the animal, edema of the limbs, and coughing. It is cited by 8.6% of breeders as the most common disease affecting dromedaries in Mauritania. Pasteurellosis can occur throughout the year. It can affect all categories of animals, with a frequency that can exceed three times a year in a herd. Pasteurellosis is an economically formidable disease. It causes a great deal of loss to breeders. Dromedaries can run a high fever, swell certain organs such as the throat and tongue, and die very quickly. In addition to the cost of medication, the disease has a direct impact on milk production and the abortion of pregnant females. The treatment systematically used by breeders is the injection of Oxytetracycline, Strepto-penicillin, and Tylosine.

Nhaz is Tuberculosis

In Mauritania, animal tuberculosis has been well studied,

especially in cattle, but this is not the case for dromedary tuberculosis, which remains very limited. Farmers describe the main symptoms of this pathology as follows: Coughing, shortness of breath, emaciation, and cachexia. It is cited by 8.6% of breeders as a known pathology in dromedaries in Mauritania. Tuberculosis can occur throughout the year. It can affect all categories of animals, with a frequency that can exceed three times a year in a herd. Contamination is rapid and can occur through contact and consumption of products or vectors. The economic importance of tuberculosis can lead to the death of the animal, incur medication costs, abort pregnant females, and cause a drop in milk production. To remedy this disease, breeders use injections of Oxytetracycline, Streptopenicillin, and Tylosine.

Legraa is a Ringworm

This disease consists of depilations, with no tendency to generalize and no epidemic aspect in the herd, enabling breeders to clearly distinguish it from mange. When it is complicated, the problem of differential diagnosis with itchy scabies arises. Breeders know how to differentiate between scabies and ringworms, the latter being characterized by specific lesions and well-rounded depilations with swollen skin on the animal's shoulders and back.

Breeders describe the main symptoms as dry skin, nasal bleeding, lack of appetite, and itching. It is cited by 5.2% of breeders as a known pathology in Mauritania. Ringworms can appear all year round. It can affect all categories of animals, especially young ones, with a frequency that can exceed three times a year in the herd. Contamination is rapid and can occur through direct contact. Regarding the economic importance of ringworm, according to farmers' descriptions, the major impacts are the death of the animal, medication costs, abortion of pregnant females, and a drop in the production of milk and growth.

The treatment used by farmers is sulfur ointment and they use certain traditional treatments, such as fish oil, *Loudek* (dissolved humpback oil), and machine grease.

Bukheneynive is Sinusitis

Breeders describe the main symptoms of this pathology as follows: Shortness of breath, nasal bleeding, and watery eyes, and the affected animal always has its head up. Breeders describe the disease as swelling of the head, vomiting, fever, lack of appetite, hair loss, and dry skin. It is cited by 3.8% of breeders as a known pathology in dromedaries in Mauritania. Sinusitis can occur throughout the year. It can affect all categories of animals, especially young ones, and can occur more than three times a year in a herd. Contamination is rapid and can occur through direct contact. Regarding its economic importance, according to farmers' descriptions, the major impacts are the death of the animal, medication costs, abortion of pregnant females, and a drop in milk production. The treatment used by farmers is the injection of Oxytetracycline and Tylosine, and the use of fire as a traditional treatment.

Jidri is Smallpox

The main symptoms of this pathology cited by breeders are

pimples on the skin, emaciation of the animal, lacrimation, and fever. It is cited by 3.4% of breeders as a known pathology in dromedaries in Mauritania. *Smallpox* is known locally by breeders such as *Jidri* and is recognized by the observation of specific pimples on the mouths of animals, particularly camels. *Jidri* is described by breeders as the appearance of pimples on the lips and around the eyes, which develop into crusty lesions and can become generalized. The very high level of contamination and the severe mortality it causes place it among the most important constraints reported by breeders. Young animals are preferentially affected, with the disease subsequently spreading to adults. During the cold, dry season, the forms observed are particularly violent. Interestingly, this disease is considered a major problem by all livestock farmers in Mauritania. Treatment is based on injections of Oxytetracycline and Strepto-penicilline.

Rift Valley Fever

Breeders describe the disease as swelling of the ribs, bleeding, fever, and hair loss. Rift Valley fever is cited by 1.6% of breeders as a well-known pathology affecting dromedaries in Mauritania. Rift Valley fever can occur throughout the year, especially in autumn (Iekhriv) and winter. It can affect all categories of animals, especially young ones, with a frequency of once a year in the herd. Contamination is rapid and can occur through direct contact or consumption of milk and meat products and vectors.

Concerning the economic importance of RVF, according to farmers' descriptions, the major impacts are the death of the animal, abortion of pregnant females, drop in milk production and weight loss. The treatment used by farmers is the injection of Oxytetracycline and Strepto-penicilline.

Liram or Zayed is Mastitis

Breeders describe the main symptoms of this disease as follows: Swollen udders, change in milk color, swollen and painful udders, and high heat in the udders. Mastitis is cited by 1.6% of breeders as the most common disease affecting dromedaries in Mauritania. Mastitis can occur throughout the year. It affects lactating females with a frequency that can exceed three times a year in the herd. Regarding the economic importance of mastitis, it spoils milk and sometimes kills teats. The treatment used by breeders is the injection of Strepto-penicillin, Dexamethasone, and Udder ointment, and cleaning using hot salted water. The leaves of *Calotropis procera* or droppings in the mammary cache are the traditional treatment.

Respiratory Infections

Breeders describe the main symptoms of this condition as follows: Runny nose, swollen eyes, loss of appetite, and watery eyes. It is cited by 1.2% of breeders as a well-known pathology in dromedaries in Mauritania. Respiratory infection can occur throughout the year. It can affect all categories of animals, young and adult, with a frequency of twice a year in the herd. Breeders describe the disease as follows: The animal may experience general fatigue, associated with a loss of appetite (anorexia), leading to weight loss and even death in young animals. Contamination is rapid and can occur through direct contact. The treatment used by breeders is an injection of

Oxytetracycline, Tyrosine, and Penicilline.

Levlat or Douweida is Diarrhea

This is the diarrhea of dromedaries, especially young camels, also known as *Douweida*, referring to the worms that generally inhabit Acacia trees and cause this pathology.

Breeders describe the main symptoms of this disease as follows: Swollen belly, general fatigue, loss of appetite, and drop in weight. Diarrhea is cited by 0.9% of breeders as the most common disease affecting dromedaries in Mauritania. Diarrhea can occur throughout the year. It can affect all categories of animals, especially young ones, with a frequency of twice a year in the herd. It is systematically cited as a major cause of mortality in young camels.

The treatment used by breeders is Uvetril and Sulfadimidine. Traditionally, the use of tobacco strands boiled in water with tea and *Acacias tortilis* leaves in water. Given its importance, the many existing traditional treatments remain to be better explored.

Other Pathologies

These pathologies account for 10.5% and are characterized by a low frequency of less than 1%. Some of these diseases are easily assimilated to scientifically known pathologies from their vernacular names and symptoms: Botulism or Aggeyed, Otitis or Boudheyne, Inflammation of the spinal cord or Ineveta, Anthrax or Kawane, Indigestion or Burawthe or Ezedev, Cough or Elkiha, Inflammation of the mouth or Kenedel, Nasal discharge or Tkhenchich, Blood parasite or Valech. There are some diseases well cited and declared by breeders that are misidentified or not identified at all: Lemgeugla, Lerav corona, Mess, Corona, Eddem, Elgich.

Health Profile by Region

A correspondence factorial analysis was carried out to obtain a regional breakdown of the diseases surveyed. **Figure 3** shows the distribution of diseases around the regions. **Figure 4** shows the health profile by region and enables comparisons to be made between regions according to the diseases mainly encountered in each.

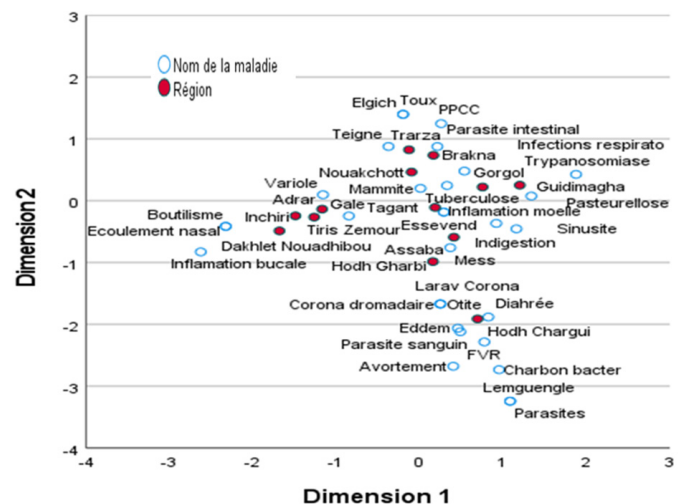


Figure 3: Regional distribution of diseases

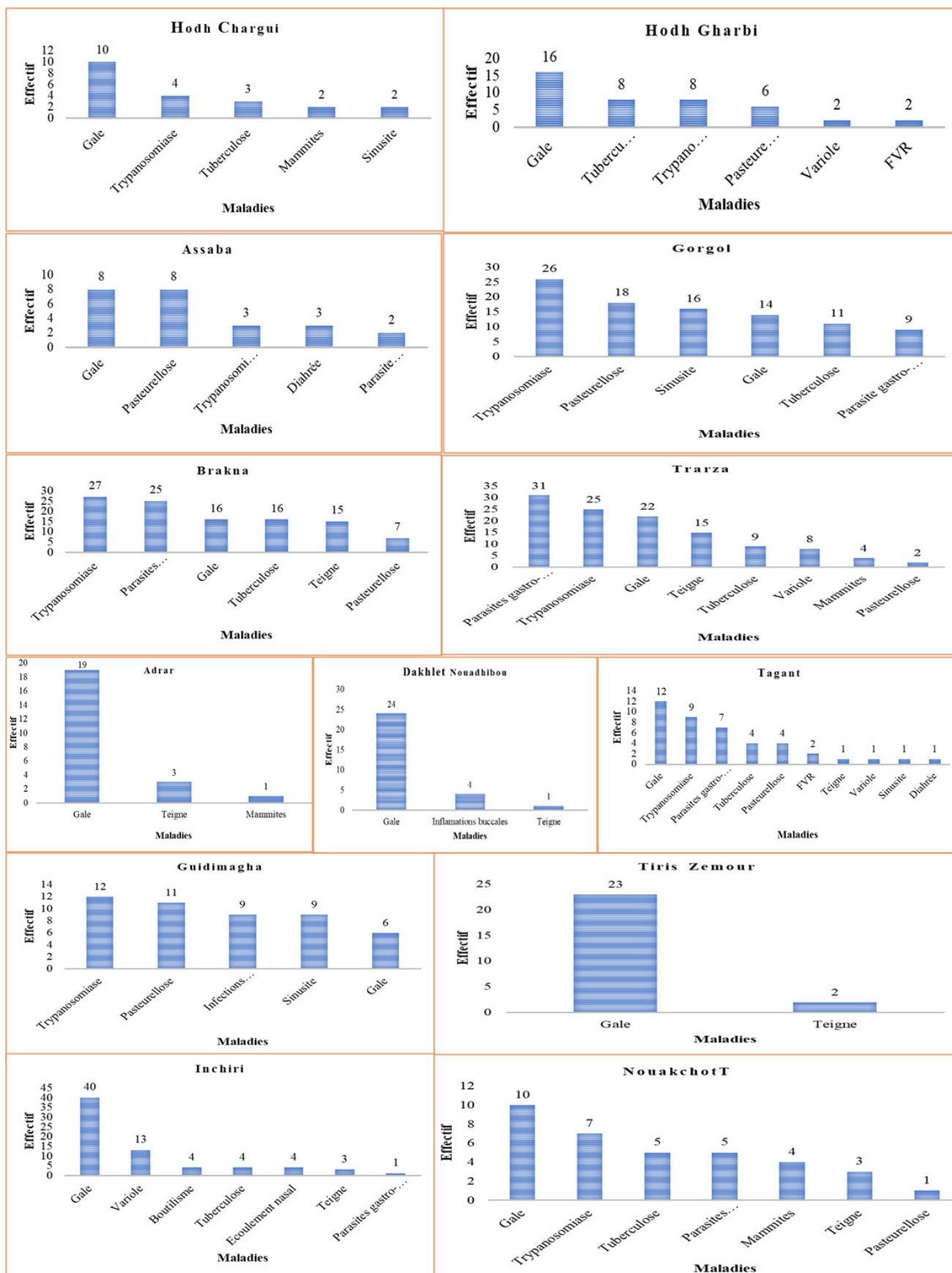


Figure 4: Health profile by region

DISCUSSION

Animal health is of vital importance to all livestock farmers. Improving animal health considerably enhances the safety and quality of animal products (particularly milk and meat), increases productivity, and reduces animal losses. Kane et al. (2003) reported that the main constraints to camel breeding in Mauritania, in order of importance, are disease (60% of responses), feed (23% of responses), and the provision of medicines and veterinary care (17% of responses) [4].

Over the generations, our breeders have acquired in-depth knowledge of camel diseases and developed their classifications, terminologies, and therapeutic strategies. Camel health is based on the fact that the indigenous camel breeds bred are adapted to arid conditions and have developed a certain resistance to disease, which considerably reduces the need for medication and the risk of antibiotic resistance. This fact can be exploited to use genetics to select disease-resistant camels. More than 25 diseases have been reported on our farms throughout Mauritania. However, the results of our survey revealed that the most frequently encountered and widespread diseases on camel farms are mange (28.5%), trypanosomiasis (15.8%), intestinal parasitosis (11.1%), Pasteurellosis (8.6%), tuberculosis (8.6%) and ringworm (5.2%). The main diseases observed by Kane et al. (2003) were *smallpox*, scabies, diarrhea, camel abscesses, tick infestation, and mastitis [4].

The existence and persistence of the same diseases for over 20 years testify to the familiarity of breeders with certain pathologies of diverse origins. In addition, the long history of these diseases probably testifies to the ineffectiveness of the means of combating them in Mauritania.

The treatment of these and other diseases requires modern diagnostic and therapeutic approaches involving the use of drugs. Important epidemiological data (age, season, location, morbidity, mortality, etc.) remain to be completed to carry out effective control actions against camel diseases (Kane and Diallo, 2000) [5].

According to Antoine-Moussiaux and Desmecht (2008), the economic losses associated with diseases, in the form of mortalities, neonatal mortalities, abortions, wasting, or drops in production, are significant and have been quantified in various regions of the world [2]. Examination of health profiles by region reveals that disease frequencies vary from region to region. However, it remains to be said that the main diseases encountered are practically reported in all regions. These frequent and common diseases have several origins, such as fungal and parasitic diseases (scabies, trypanosomiasis, ringworm, gastrointestinal parasites, etc.), bacterial diseases (tuberculosis, Pasteurellosis, etc.), viral diseases (*smallpox*, Rift Valley fever, etc.) and conduct diseases (mastitis, diarrhea, etc.). Despite the importance of breeders' knowledge of camel diseases, El Harrak, et al. 2011 point out that it is extremely important to convince authorities to support camelid research and development activities, particularly because of the current challenges of climate change, new commercial prospects, emerging diseases, poverty reduction, etc [1]. To better characterize camel pathologies, particularly viral diseases,

and raise awareness among breeders, it is useful to invest in epidemiological studies. In the case of unidentified diseases, the situation provides opportunities for researchers to carry out in-depth investigations to identify these pathologies, which may require symptomatology and even fine laboratory analyses.

CONCLUSION

In conclusion, this study provides a characterization of the epidemiological situation of dromedary diseases in Mauritania, their socio-economic impact, their distribution, potential risk factors and the knowledge and expertise of breeders concerning the pathologies. Preliminary analysis of the data revealed 25 diseases affecting dromedaries in Mauritania. These include parasitic diseases, bacterial diseases, viral diseases and management diseases. The distribution of diseases varies from region to region, with some diseases being more prevalent in the northern regions, such as scabies or mange, and others in the southern regions, such as gastrointestinal parasites and trypanosomiasis. This inventory of indigenous knowledge demonstrates the need for further field studies to map common and region-specific pathologies. Research could be carried out to determine the epidemiological parameters, the economic importance, the risk factors linked essentially to management and the environment, and the means of treatment to better combat and reduce the negative impact on production for each disease. In this respect, the development and implementation of this research work for diseases of interest represents an important research challenge in the field of animal health economics. We hope that this study will serve as a basis for further research and action to improve dromedary health in Mauritania.

AUTHORS CONTRIBUTION

The authors Mohamed Ould Ahmed, Mohamed Fall, Mohamed El Moustapha Sidi Mohamed Ali, Abdel Kerim Mademba Diop, Mohamed Salem Amar Vall, Khaled Mohamed Sidelemine, Mohamed Maarouf Sidatt, Mahfoudh Mohamed Salem, Ahmedou Brahim Abba, Cheikh Yahya Dièye contributed to the design of the survey and data collection and entry. Mohamed Ould Ahmed carried out the statistical analyses and drafted the first version of the article. All the other authors contributed to the critical revision of the manuscript, which they approved in its current version.

FUNDING

Funding provided by Camel Production Improvement Project (TF/MAU/026/MAU), FAO Representation in Mauritania.

DATA AVAILABILITY STATEMENT

Data will be made available on request.

ACKNOWLEDGEMENT

This work was carried out within the framework of the Camel Production Improvement Project (TF/MAU/026/MAU). The authors are grateful to the local populations for their welcome and frank collaboration and warmly thank the breeders from all regions of Mauritania who agreed to contribute their

knowledge to science free of charge.

CONFLICT OF INTEREST

The authors declare no competing interests.

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