

# Evaluation of Camel Well-being: Pathological Characteristics and Detection for Diseases

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## Abstract

Camels play a crucial role in supporting livelihoods, transportation, and nourishment in many regions worldwide. Ensuring their well-being is vital for preserving natural equilibrium and supporting communities that depend on them. This study investigates the pathological features of tuberculosis (TB) in chronically infected dromedary camels raised on a well-managed ranch in India. The objective is to gain insights into the illness's pathological components and evaluate the efficacy of various diagnostic procedures in identifying the illness. A collection of 120 dromedary camels from the organized farm was examined, with an emphasis on post-mortem examinations. Clinical symptoms and lesions in infected camels were analyzed in this study by means of in-depth clinical observations and pathological examinations. Furthermore, other diagnostic procedures were employed to evaluate their efficacy in TB detection, such as the 65-kilodalton heat shock protein (hsp65) Polymerase Chain Reaction (PCR), Acid-Fast Staining Stain (AFS), and Mantoux Test (MT). During the research period, 24 of the 120 camels evaluated had gross lesions suggestive of tuberculosis. There were two types of lesions in the afflicted camels: Reciprocity (n=18) and dissemination (n=6). Histopathological examination revealed typical Nodular Inflammatory Formations (NFM) lesions, with large cells and acid-fast microorganisms (AFM) occasionally observed in the Reciprocity version and frequently observed in the dissemination form. The diagnostic tests produced variable findings, with the MT discovering TB in 13 camels, the AFS showing TB in 15 camels, and the hsp65 PCR revealing TB in 24 infected camels. The study suggests that the Reciprocity type of tuberculosis is more widespread in camels, suggesting that the respiratory route is an important route of exposure in camel populations.

**Keywords:** Camel Well-Being, Pathological Characteristics, Tuberculosis (TB), Mycobacterium Bovis, Mantoux Test (MT), Acid-Fast Staining Stain (AFS), Nodular Inflammatory Formations (NFM).

## INTRODUCTION

Camels play a significant effect in desert and dryland habitats. Camel thrives through severe conditions, little flora, and very limited nutritional and water supplies, unlike a number of domesticated creatures. Camelidae is divided into two subgroups: Camelinae (older World camels) and the laminae (New World camels). There are two domesticated kinds of camels in the Older World: the dromedary or one-humped camel (Camels dromedary) and the Bactrian livestock (Camels Bactrians) (1). Several studies conducted in recent times established the dietary value of camel goods, notably dairy products, implying appealing business potential and medicinal benefits. Some agricultural practices, like machine milking, were modernized, but there is always space for development. Camel productivity and the economy are improved through genetic modification and sound farming practices. Lastly, global warming and enhanced desertification are anticipated to increase appreciation for camels' adaptation

capacities, which display unparalleled efficiency in dry environments (2). In terms of productivity, politics, and socioeconomics, camels become the most overlooked species in relation to other domesticated livestock. This disdain is derived from their close association with poor regions, which resulted in the erroneous minimal revenue stream and underestimated and ignored by sciences of the possibility of these reptiles as a multipurpose substance in humans via very little upkeep demands (3). Camel farming became central to the traditions of certain livestock farmers. Agricultural techniques vary by reproductive goal but also by surroundings, tastes, and traditions of pastoral people. Camel consumption, for instance, is slain at an early age in certain regions, while adolescents are favored in others (4).

Camel has steadily increased over recent years, reaching roughly 40 million animals, including Bactrian and dromedary species, with total predicted to become more than 60 million in the next 25 years or so. The global annual camel milk production increased in tandem with the most camels, increasing by 0.63 million tons by 1961 and 3.15 million tons in the year 2020 (5). Well-being evaluation methods are the fundamental tools for influencing new laws. These are critical for building accreditation structures, evaluating welfare circumstances among dairy farms, and advising farmers on preventative, minimizing, and remedial activities. Despite efforts to enhance welfare assessments in an array of species, advances in science and specific rules on welfare in camel farming remain limited (6). Camel diseases and wellness problems are widely known, and diagnosis is frequently right in both pastoral care and semi-intensive or intense camel husbandry. However, camels are frequently isolated from medical centers and labs, therapies must be determined by a finding, utilizing medical signs or behavioral abnormalities like unwillingness to walk, nervousness, and screams (7).

Poor fertility in camels has been noted as a major issue. The reproduction efficiency of camels beneath natural circumstances proved to be poor. As a result, fertility issues must be identified, particularly if confronting dominant species. Repeated development, refusal of partners, and difficulty with the pairing cycle are all typical proprietor problems in female camels (8). Camels suffer financial losses because of a number of medical and disease-related variables, including organisms and bacterial pathogens that trigger decreased weight gain, reproduction illnesses, abortion, breathing indications, and animal husbandry decline (9). These issues are addressed as critical stages in identifying welfare-related issues and requirements for camels. Indeed, as camel production intensifies in numerous parts of the world, the potential disadvantages to the well-being of these livestock in concentrated fields or transit are rising (10). Tuberculosis (TB) constitutes a long-lasting, identifiable granulate disease triggered by a group of *Mycobacterium tuberculosis* affecting a variety of livestock, notably camels. Camel TB typically occurs in domesticated camels with those in close contact with livestock, which have been infected by *Mycobacterium bovis*. The *Mycobacterium* is typically transmitted among livestock by particles, proximity, exchange of food and fluids, and nursing (11). Camel owners face a great risk of developing TB if their horses get infected with the *Mycobacteria* genus. Since the average person is unaware of tuberculosis and its ecological significance, and relatives occupy identical dwellings among the camel at nighttime, there's a significant risk of disease transfer between people and camel. Furthermore, a minority of heat milk before drinking it. Consumers of fresh milk from camels from the camels raising culture and its metropolitan clients are at greater risk of illness (12).

The study (13) discovered that induced pluripotent stem cells (iPSCs) are capable of differentiating to any kind of cell and are able to be employed in animal studies of biological growth, hereditary cultivation, and in silico gene preservation. The Bactrian camel serves as a huge domesticated livestock that lives in harsh conditions and has significance for the management of numerous ailments as well as the growth of the regional economy. The study (14) evaluated the reliability of seven algorithmic methods for calculating the total weight of camels with measurements of the physique from conception to 240 days of aging. With these in thoughts, 458 data were analyzed in total, comprising a body's weight and 12 biometrics quantitative measures gathered from the camels at various stages of development. The study (15) focused on the primary variables that contribute to the persistence of

Middle Eastern syndromes Respiration Corona Virus (MERS-CoV) disease in dangerous guests: medical institution dissemination. MERS-CoV spread in medical centers is mostly caused by lapses in quarantine procedures and delayed separation of suspicious patients. MERS-CoV vaccines include illness management in camels and preventing camel-to-human dissemination. The research (16) proposed a plan to preserve patients' individuality and the safety of their medical data from the Clearance Agency and additional entities. They used a technique called camel-based revolving screen signatures. It was carried just to preserve patients' security but to safeguard the system against prospective attacks. The study (17) determined to discover and describe abnormalities in Female calves killed at local slaughter plants, as well as extract potential microorganisms related to reproduction illnesses and disorders. Pathology diseases discovered included regenerative alterations, inflammation tumors, development disruptions, and no inflammatory diseases.

Pathological abnormalities in the ovaries exhibited substantial variations, with the largest percentage being seen. The research (18) investigated the pathological alterations caused by spontaneous MERS-CoV infection in camels with dromedaries. The spontaneous spread of MERS-CoV in camels has received little attention. Early tests conducted on sick dromedaries revealed no evident signs of infection. The study (19) examined the Camel providers of nourishment, transportation, employment, and money in Nigeria's northern region, which, according to the report, it also potential carriers of outbreaks of TB. Camel tuberculosis is a serious developing healthcare issue, and medical information on the illness in Nigeria is scarce. The study (20) determined the etiology of the clinical disease based on dispersed tumors seen in various body areas of the livestock. The Ziehl-Neelsen (ZN) staining and region of differentiation (RD) deletions testing were utilized to examine tissue specimens. Infections with fast-to-acid bacilli to tubercles were found in afflicted cow and dromedary bull-camel cells, according to test findings. The study's Key contributions are listed below:

### Key Contributions

- The study contributes by evaluating a large group of 120 dromedary camels from a well-organized farm.
- The study emphasizes post-mortem exams, which provide insights regarding the pathological aspects of TB in camels.
- The study evaluates the efficiency of several diagnostic techniques, such as hsp65 PCR, AFS, and MT, in TB diagnosis.
- The discovery of two sorts of tumors, reciprocity and dissemination, offers a new perspective to the investigation.

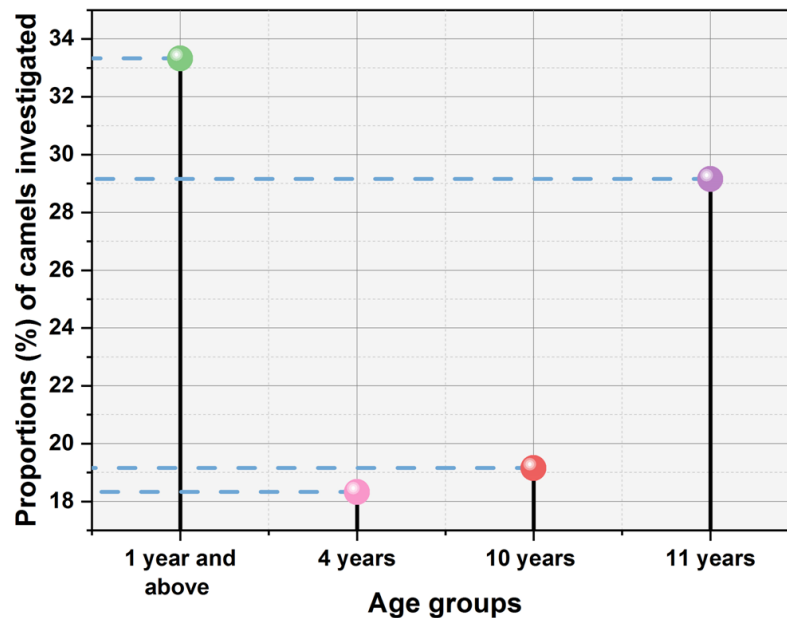
### METHODOLOGY

This section demonstrates the efforts made to do an in-depth assessment of the well-being and health of camels in a component supervised evaluation of camel well-being: Pathological Characteristics and Detection for Diseases. The research includes an assessment of the camel population's general health with the goal of identifying and comprehending possible health problems. Concentrating on "pathological characteristics" entails a thorough examination of features associated with disease, such as tumors, abnormalities, or other distinctive features that indicate specific medical issues.

### Study selection

The impacted structured camel group consisted of 375 dromedary camels. The camels had been raised outdoors over a semi-intensive supervision regime, and they were supplied pellets supply, straw, and water whenever needed. A collection of 120 camels (62 females and 58 males) were taken for normal post-mortem analyses on a supervised

farm in India. The camels were separated under the following four ages: one year and above (n=40), four years (n=22), ten years (n=23), and eleven years (n=35) (Figure (1)).



**Figure (1).** Age groups of camels

(Source: Author)

### Diagnostic methods

Following gross tumors inquiry, cells of different tissues displaying tuberculous tumors have been gathered in 15% basic saline for histopathology and in sterilized containers for extraction of DNA and PCR. DNA had been extracted with Phenol-Chloroform Extraction according to the supplier's instructions and utilized for the production of the hsp65 PCR genes (450 base pairs (bp)) of *M. bovis* using the groups of primers and synthesis method. During heating up, impressions of tuberculous tumors have been created and identified with acidic fast staining. The MT was available to 50 out of 120 post-mortem patients examined in this investigation.

### Statistical Analysis

The Pearson chi-square test (PCT) was employed to analyze the strength of the relationship among all risk factors, and SPSS 18 software for statistics was used for the examination.

## RESULTS

### Occurrence and diagnostic results

The incidence of camel TB among the group was 20% (24/120) based on the post-mortem investigation. hsp65 PCR identified *M. bovis* across all 24 camels with gross tuberculous tumors, but acidic fast staining revealed acid-fast

microorganisms in nodular inflammatory formations in 15 (62.5%) of the affected camels. The Mantoux test proved successful in 13 of the 47 camels examined. 9 (54.49%) of these patients had substantial TB diseases on post-mortem and had been verified via PCR, while two instances had no TB symptoms and were discovered adverse by PCR. The specificity and sensitivity of the Mantoux test were determined to be 54.49 and 92.30%, respectively. The tuberculosis-infected camels ranged in age between one to nineteen years. The incidence was much greater in camels aged 11 years and older (29.16%) and 10 years (19.16%) as opposed to 4 years (18.33%) and 1 year above (33.33%).  $\chi^2 = 12.08$ , the Degrees of Freedom (DF) = 3,  $p < 0.01$ .

### Clinical Signs of Camel Tuberculosis

There is no significant distinction in illness incidence between male (51.66%) and female (48.33%) camels. The medical histories of all affected camels demonstrated thinness with progressive decreased weight and in appetite as a consistent diagnostic feature. Additional signs of illness reported in affected camels had been slight fever (n = 6), cough (n = 5), regular lachrymation (n = 4), swollen shallow lymph glands (n = 4), drip from the nose (n = 3), and diarrhea (n = 2). Table (1) shows the clinical signs of affected camels.

**Table (1).** Clinical symptoms of impacted camels

(Source: Author)

Clinical Sign	Number of cases (n=24)
Slight fever	n=6
Cough	n=5
Regular lachrymation	n=4
Swollen Shallow lymph glands	n=4
Drip from the Nose	n=3
Diarrhea	n=2

### Gross tumors

#### Types of Camels Impacted and region of infection

In the foundation of the presence and location of tuberculous tumors, gross tumors among affected camels have been divided into two types: respiratory (n=18) and dissemination (n=6). Cancers were most common in the lungs (99.99%) and mediastinal lymphatic glands (99.99%) in the lung type, next with the lung membrane (32.32%) and heart sac (6.55%). The respiratory tract became larger and overcrowded, with scattered to consolidating, solid, and white to yellowish caseous tumors ranging in size from 1 to 12 cm.

The lymph glands within the mediastinum were swollen, packed, and caseated. The lung membrane and heart sac both have tiny (1.5 millimeters to 1.5 centimeters in diameter) white to gray-colored nodular growths adhering to the edges. Six dissemination camels had military or multifaceted to combining solids caseous tumors (1.5 millimeters to 4.5 centimeters in length) in the lungs (99.99%), mediastinal lymphatic system (99.99%), lung membrane (99.99%), heart sac (99.99%), the liver (99.99%), the kidneys (66.67%), the spleen (66.65%), and the heart (32.32%).

### **Microscopical tumors**

In the respiratory structure, histology of the lungs and the mediastinal lymph revealed usual granular lesions with central areas of necrosis from the case and, in a few instances, minerals enclosed by epithelioid phagocytes and occasionally large cells, as well as dispersed lymph cells and blood cells at the borders and connective tissue. 15 instances showed the rare acid-fast microorganisms.

### **Nodular Inflammatory Formations (NFM)**

The nodular inflammatory formations tumors in afflicted tissues were comparable to those seen in the respiratory form; big cells and aggregates of acid-fast bacteria appeared regularly in these lesions. Along with nodular inflammatory forms, tumors, swelling of the intestinal veins, swelling of cellular pathways, and iron overload syndrome have been identified in the splenic. Coagulation bleeding, blood vessel expansion, fibrous cell growth, and infiltration of lymph have been detected in the hepatocytes, renal, and heart, along with defects in nodular inflammatory forms.

### **DISCUSSION**

The study explores the clinical characteristics of TB in infection-prone dromedary camels, acknowledging the significant function that they serve throughout incomes, transportation, and nourishment in a variety of parts of the world. Knowing the clinical aspects of tuberculosis in camels is essential for their health but also for preserving the environment while helping the people who depend upon themselves. An extensive evaluation was conducted on 120 dromedary camels taken from a well-established herd in India, with a particular focus on post-mortem evaluations. The goal is to collect data on the clinical features of TB in these cattle and assess them. Medical assessments and scientific examinations played a crucial role in identifying the clinical manifestations and malignancies in afflicted camels. The affected camels exhibited both reciprocating and expanding damage. The histopathology study revealed the presence of distinctive NFM tumors characterized by huge cells and occasional occurrence of AFM in the Reciprocity group. Additionally, it showed a greater prevalence of AFM in its dispersed form. Various testing methods were employed to assess their efficacy in detecting TB.

Tb was detected in 13 camels using the MT method, 15 camels using the AFS method, and 24 sick camels employing the hsp65 PCR method. The diverse results obtained from various testing techniques highlight the intricacies involved in diagnosing tuberculosis in camels and underscore the importance of employing numerous tests to ensure accurate and comprehensive outcomes. Specifically, the research indicates that Reciprocity TB is greater in camel populations, suggesting that inhalation is a primary mode of transmission. This discovery illuminates the pathways of TB spreading to camels and aids in guiding targeted preventive initiatives. Ultimately, the study enhances our understanding of TB among dromedary camels by emphasizing the crucial importance thorough clinical analyses and the utilization of many diagnostic approaches to ensure a proper diagnosis. These results have important implications for the well-being of camels, the long-lasting viability of camel-related activities, and the general well-being of individuals who rely on camels.

### **CONCLUSION**

Finally, this study provides a comprehensive analysis of tuberculosis in dromedary camels, including insights into the clinical manifestations and diagnostic challenges associated with the disease. The identification of two distinct categories of spots, namely reciprocal and dissemination enhances our comprehension of TB in camels. The research's assessment of clinical evaluations showed its efficacy exhibited variability. The MT method identified TB in 13 camels, while the AFS method identified TB in 15 camels. Furthermore, the hsp65 PCR, a genetic technique,



demonstrated its effectiveness by successfully identifying TB in all 24 afflicted camels that were examined. This highlights the necessity of integrating diagnostic techniques to achieve comprehensive and dependable tuberculosis detection in camel farms. The prevalence of Reciprocity TB in camels is remarkable, indicating that inhalation is a significant route of infections. This research has implications for disease transmission dynamics and highlights the need for customized preventive efforts in camel groups that specifically target respiratory pathways. Future research aims to enhance disease detection technology and enhance our understanding of camels' health. The well-being of camels is essential to the sustenance of communities depend on livestock to perform a range of tasks. The investigation will consist of a comprehensive examination of clinical factors, with a focus on identifying potential diseases affecting the camel dromedary. Moreover, the study will examine and evaluate cutting-edge technology for diagnosis to enhance the detection of illnesses.

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