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PREVALENCE OF TUBERCULOSIS IN SLAUGHTER CAMELS (*Camelus dromedarius*) AT KANO ABATTOIR, NIGERIA BASED ON LATERAL-FLOW TECHNOLOGY

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ABSTRACT

In Nigeria and indeed Africa, camels are increasingly gaining economic importance due to their increasing value as source of meat, milk, hide and as draught animals. This study aimed at determining the prevalence of tuberculosis, based on lateral-flow technology in slaughter camels. Diagnosis of TB in camels faces many difficulties, with none of the standard available tests being able to detect the disease with some certainity. The intradermal tuberculin test, which is the traditional diagnostic tool in cattle, is not reliable in camels as it is in cattle but the serology-based test is showing potentials in various environments. A total of five hundred (500) camels, consisting of 188 males and 312 females, in Sahel part of northern Nigeria brought for slaughter at Kano abattoir were tested for TB infection using lateral-flow technology. The overall positive samples were one hundred and thirteen (113) with a prevalence rate of 22.6%. Out of these, 45 were males with a prevalence rate of 23.9% while 68 were females with a prevalence rate of 21.8%. The chi-square ($\times^2$) test of significance based on sex was not statistically significant (P>0.05). This study highlights the importance of tuberculosis in camels and its public health implications. Measures for control are also been suggested.

Key words: Camels, lateral-flow, Nigeria, prevalence

Tuberculosis (TB) is a chronic infectious and contagious disease of domestic animals, wild animals and humans (Radostits *et al*, 1994). It is characterised by the formation of granulomas in tissues especially in the lungs, lymph nodes, intestines, liver and kidney (Shitaye *et al*, 2007). It is caused by the pathogenic members of the genus *Mycobacterium* which are commonly known as members of *Mycobacterium tuberculosis* complex (*Mycobacterium tuberculosis, Mycobacterium bovis, Mycobacterium africanum, Mycobacterium microti, Mycobacterium cannetti and Mycobacterium ulcerance*) (Collins and Grange, 1983; Pfeiffer, 2003). Tuberculosis is a zoonotic disease, widely distributed throughout the world with serious effect on animals and is also of significant public health importance (O'Reilley and Daborn, 1995).

Tuberculosis (TB) in camels has been documented since the 19th century (Lingard, 1905; Leese, 1908; Littlewood, 1989). Leese (1969) reported high frequency in Egyptian camels while Mason (1917) indicated that in one Cairo abattoir the incidence of tuberculous carcasses was 2.9%. The TB-like lesions were found mostly in the liver and lungs but sometime generalised throughout the viscera. He concluded that camel tuberculosis was caused by the same bacilli as the bovine type (*M. bovis*). Wernery *et al* (2007) reported a recent outbreak of tuberculosis in a camels racing herd of 58 in which 3 camels were involved. The disease was confirmed at necropsy by finding gross lesions from which *Mycobacterium bovis* was isolated. Diagnosis of TB in camels faces many difficulties (Wernery and Kaaden, 1995), with none of the standard available tests being able to detect the disease with some certainity. The intradermal tuberculin test, which is the traditional diagnostic tool in cattle, appears to produce too high a non-specific reaction in camels. Schillinger (1987) reported false-positive result of the skin test in 10-20% of Australian camels. In Nigeria and indeed Africa, camels are increasingly gaining economic importance, especially in the northern part of Nigeria due to their increasing value as a source of meat, milk, hide and as draught animals (Abdullahi, 2006). For instance at Kano abattoir an average of 55 camels were slaughtered daily in 2005 and this figure rose to an average of 100 camels per day in 2007 (Kano, 2007).

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In a developing country like Nigeria where tuberculosis in cattle and other animals is an endemic problem and very little know about the true epidemiology of the disease in the country (Alhaji, 1976; Ayanwale, 1983; Shehu, 1988; Dusai and Abdullahi, 1994; Cadmus *et al*, 2004; Abubakar, 2007). There is no control or eradication policy on animal tuberculosis (Cosivi *et al*, 1998). There is virtually no documented report of the disease in camels in the country. It is therefore imperative that simple, and relatively none invasive method for diagnosis of tuberculosis in camels be considered. One of the most efficient and practical way of doing this is through rapid-serological test to diagnose the disease in live camels form the basis of tentative diagnosis of TB in camels. This form of diagnosis, though not confirmatory, is still better than tuberculin test that has been found to be not as reliable in camels as it is in cattle (Schillinger, 1987).

The aim of this study is to determine the prevalence of tuberculosis in camels based on lateral-flow technology. This will improve the level of epidemiological knowledge of tuberculosis in camels in Sahel part of northern Nigeria where camels are increasingly used as draught animals and source of meat, hide and milk. And also this will serve as a baseline for further research.

Materials and Methods

Study Area

The study was performed in Kano abattoir Sahel part of northern Nigeria. Kano City is located between longitude 12 to 14° North and latitude 9 to 11° East in Kano State which shares boundaries with Jigawa State to the East, Kaduna/Bauchi States to the South and Katsina State to the Southwest (Dairy of Kano State, 2007). There are two main sources of camels into Kano abattoir, Mai-Adua market, which shares boundary with Niger republic in Katsina state and Mai-Gatari also shares boundary with Niger republic in Jigawa state.

Sampling

A total of 500 slaughter camels were sampled. The camels were serially numbered a day before they were slaughtered with a permanent marker which was applied on the side of the neck for identification after they were properly restrained. About 10ml of blood was aseptically collected via the jugular vein of individual camel using 20ml syringe and 18G needle. The blood was transferred into clean labeled sample bottle without anticoagulant and allowed to stand at room temperature for sera to separate from the cellular component. The clotted blood samples were centrifuged at 704 x g for 5-10 minutes. The resultant sera was transferred into clean labeled serum sample bottles and processed as described by the manufacturers.

Data analysis Chi-square was used to analyse the relationship between sex and the disease. Prevalence was calculated using the formula:

$$\text{Prevalence} = \frac{\textit{Number of sample positive}}{\textit{Total sample collected}} x\ 100$$

Lateral-flow Technology (Rapid Test)

Based on the lateral flow technology, this one-step antibody detection assay was developed by Chembio Diagnostic System Inc., Medford, New York. The test kits contain unique cocktail of *Mycobacterium* antigen and blue latex bead-based signal detection system. Ready-to-use disposable device consists of plastic cassette containing a trip of nitrocellulose membrane impregnated with test antigen and laminated with several pads made of glass fibre and cellulose. The test requires 30µl of serum sample and 3 drops of sample diluents that will be added sequentially to the sample pad. As diluted test sample migrates to the conjugate pad, antigen conjugated latex particles bind antibody, if present in the sample. Thus creating a coloured immune complex. Driven by capillary forces, this complex flows laterally across the nitrocellulose membrane and binds to the immobilised antigen, thus producing a visible blue band in the test area of the device. In the absence of specific antibody, no band develops in the test window. The liquid continues to migrate along the membrane producing a similar blue band in the control area of device, irrespective of the presence of specific antibody in the test sample demonstrating that the test reagents are functioning properly. Result was read after 20min. Any visible band in the test area, in addition to the control line, is considered an antibody positive result, whereas no band in the test area in addition to the visible control line is considered a negative result as described by Manufacturers (Chembio Diagnostic Inc).

Data analysis Chi-square was used to analyse the relationship between sex and the disease. Prevalence was calculated using the formula:

$$\text{Prevalence} = \frac{\textit{Number of sample positive}}{\textit{Total sample collected}} x\ 100$$

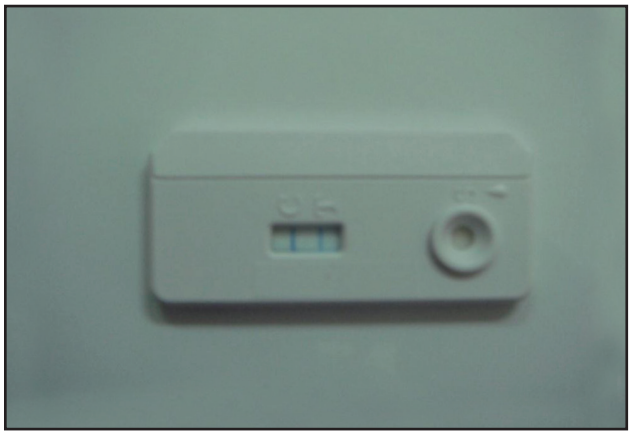

Fig 1. Lateral-flow technique, indicating positive result for TB infection.

Fig 2. Lateral-flow technique, indicating negative result for TB.

Results

A total of 500 camels, consisting of 188 males and 312 females were tested for *Mycobacterium* infection. One hundred and thirteen (113) were positive with a prevalence rate of 22.6%. Forty five were males with a prevalence rate of 23.9% while 68 were females with a prevalence rate of 21.8% (Table 1). The chi-square ($\times^2$) test was not statistically significant (P>0.05).

Table 1. Prevalence and Chi-squire test for tuberculosis in camels based on lateral-flow technology.

Sex	Camels tested	Positive	Negative	Prevalence	(P-Value)
Male	188	45	143	23.9%	(0.579)
Females	312	68	244	21.8%	
Total	500	113	387	22.6%	

(P<0.05) regarded as significant

Discussion

Control of tuberculosis in domestic and wildlife species throughout the world relies on timely detection and removal of or slaughter of infected animals and/or herd (Wernery *et al*, 2007). In camels, this strategy is difficult to conduct due to lack of adequate test to diagnose the disease in live camels. This is because the tuberculin test that is traditionally diagnostic tool in live cattle appears to produce too high non specific reaction in camels leading to a lot of false positives (Schillinger, 1987). The specific serological test used here may be useful to detect TB in camels. Because the lateral-flow technology (LT format) has several attractive features for practical use as a screening tool in the field (Wernery *et al*, 2007). This assay (Marketed as Camelid TB STAT-PAK™) is a simple and easy-to-use animal-side test which can use serum, plasma, or even fresh whole blood samples and provide "yes-or-no" read-outs within 20 min. LFT is stable at room temperature for up to 18 months and it does not require refrigeration, electricity, equipment, laboratory environment, or skilled personnel to perform. Wernery *et al* (2007) proposed that dromedaries having reactivity in lateral-flow technology should be considered TB positive. It remains to be seen if the LFT alone can provide a better diagnostic accuracy in camels, as tuberculin test in cattle or a combination of routing abattoir meat inspection and the test can secure a more reliable approach.

The prevalence rate of 22.6% reported in our study is very high compared with the previous report of 2.9% for camels in Cairo abattoir by Mason, (1917). This high prevalence however, not surprising since there is no record of proper control programme in other livestock in the country and there is high prevalence of tuberculosis in other domestic species especially cattle (Abubakar, 2007). Traditional practice exists here in Sahel part of northern Nigeria that facilitates the transmission of tuberculosis between camels, cattle, sheep, goats and humans. During watering and grazing, camels are reared and used in close proximity with their owners giving ample opportunity for zoonotic transmission. In Sahel part of northern Nigeria row camel's milk is increasingly becoming a daily delicacy, as in Arab nations. (Kudi *et al*, 1997), and the seropositivity to *Mycobacterial* infection shown in this study therefore indicates that, the disease in camels have an important public health significance in Nigeria. Tuberculosis is likely to continue to be a serious zoonotic disease in

Nigeria and neighbouring countries. Nomadism is common, and nomads often cross the borders from neighbouring countries into Nigeria in search of pasture and trade. At the moment these countries have not instituted any tuberculosis control program in their livestock.

The traditional camel's rearers and butchers must be educated for possible dangers of the disease hence need to properly pasteurise milk before consumption. Equally the persons involved with abattoir operations must be adequately trained. Since cross-transmission of TB infection is common in most domestic animals, a holistic approach should be adopted when designing a control program. Livestock herd together with camels, i.e. cattle, sheep and a lesser extent goats should be tested and positive reactors should be slaughtered with adequate compensations to the owners by the government. Intergovernmental co-operations between countries is required to effectively prevent cross-border transmissions of the disease. Control could be achieved through mass test and slaughter with adequate compensations and mass education to all livestock handlers. Public health could be guided by making sure that strict abattoir meat inspections is maintained and only safe meat are supplied to the populace.

Conclusion

From this study, 22.6% prevalence rate of a sample of 500 slaughtered camels in Sahel part of northern Nigeria were found to be infected with TB. Transmission of this agent among other domesticated species is believed to be the most likely source of the infection since camels are traditionally herded together with other species of animals. Control could only be achieved when all susceptible domestic species are considered together and intergovernmental co-operation is initiated to prevent cross-border spreads. Proper abattoir hygiene, proper post-mortem meat inspection and clean handling of milk before consumption are necessary to prevent infection in humans. However, this study indicate that a widespread and detailed epidemiological study is needed to ascertain the true extent of tuberculosis in Nigerian livestock including camels before initiation of a control program.

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Book Review

Book: Camelid Infectious Disorders

Authors: Ulrich Wernery, Jorg Kinne and Rolf Karl Schuster

Year: 2014

Publisher: O.I.E., Paris

A unique reference book entitled, "Camelid Infectious Disorders" will prove a milestone in the field of camel science. The book is spread in 500 pages with five chapters, i.e. bacterial, viral, fungal and parasitic diseases in addition to the vaccination programme. The book has a very important chapter in the beginning, namely- "Biology and evolution"; contents of which are indeed required by many scientists or practitioners during their research or manuscripts writing. Eminent and experienced authors like Ulrich Wernery, Jorg Kinne and Rolf Karl Schuster have documented their deep knowledge spectrum of camelid infectious disorders through this book. Every chapter is full of information not only in terms of text but the description goes supported by table, flow charts, high pixel photographs (both gross and microscopic), colorimetric tetrazolium cleavage test, multiplex polymerase chain reaction, *Clostridium perfringens*, ELISA test etc. The postmortem findings of many infectious diseases are well depicted through several figures with classic or pathognomonic signs. The bacterial diseases have been described under different heads, i.e. systemic diseases, fatal pollution, minor bacterial diseases and diseases of digestive respiratory, urogenital, nervous system and integument. The viral diseases section describes pathogenic and nonpathogenic diseases whereas fungal diseases are described as specific or miscellaneous. The parasitic diseases are described as protozoan infections, helminthoses and arthropod infections. This section occupies 112 pages hence becomes an important part of this book. Life cycle and images of different parasites are illustratively described. A chapter on vaccination programmes enlists the type of disease, vaccine, age at first and repeat vaccination, booster and related particularities. This would help camel vets to follow such programmes with appropriate vaccines. This book reflects amazing talent of authors to identify and classify a wide number of camel diseases which need a mandatory attention of a camel vet. The book has two appendices. First one enlists the most important books on camels where I could spot four books edited by me. The second one reports infectious diseases of interest for camelids and report of the second meeting of the OIE adhoc group on diseases of camelids.

I congratulate the authors and OIE for bringing out such a useful and important publication on camel diseases.

Dr. T.K. Gahlot

Editor, JCPR