Serological and bacteriological study of brucellosis in camels in central Saudi Arabia *

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Summary: Sera from 2,630 apparently normal adult camels (Camelus dromedarius) raised in central Saudi Arabia (Riyadh and Al-Kharj cities) were examined serologically by the Rose Bengal and standard United States of America Brucella plate agglutination tests.

The overall seroprevalence of brucellosis in the restricted populations of tested camels was 8%. The seroprevalence of brucellosis among camels raised in small numbers in the backyards of 24 houses in Riyadh and those intensively raised on one large camel farm near Al Kharj were 4.3% and 8.6% respectively.

Fresh milk samples from 100 brucellosis seropositive camels from Riyadh and Al Kharj were cultured on Brucella-selective media. Brucella melitensis biovars 1 and 2 were isolated and identified from 26 camels.

Epidemiologically, brucellosis in camels in central Saudi Arabia appeared to be connected with B. melitensis infection of sheep and goats, and also represents a serious public health risk.

KEYWORDS: Brucella melitensis Brucellosis - Camel diseases Camels - Camelus dromedarius Saudi Arabia.

INTRODUCTION

Serological evidence for Brucella infection in one-humped camels has been reported from several countries. The serological surveys conducted have shown contrasting reactor rates: Egypt 10% to 20% (13), Ethiopia 51% (27), Tunisia 3.8% to 5.8% (11), Chad 33% (10), Nigeria 1.3% (20), India 3.8% to 5.2% (18), Somalia 10.4% (6) and Sudan 4.9% (1). In addition, seroprevalence of brucellosis among two humped camels (Camelus bactrianus) was 15% in the Soviet Union (21) and 1.6% in Mongolia (29). Brucella abortus has also been isolated from the aborted foetuses, genital discharge, urine and milk of Mongolian camels.

Among livestock sacrificed in Makkah, southern Saudi Arabia, during the 1977 Hajj season, 2 of 48 imported camels from Sudan and 4 of 143 local camels were found to be seropositive for brucellosis (23). In addition, 2 of 146 local camels in

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Al-Hassa, eastern Saudi Arabia, were seropositive (14). In these limited surveys of camel brucellosis in Saudi Arabia, no reported attempts were made to isolate the species of Brucella organisms.

The present serological and bacteriological studies were undertaken to determine the seroprevalence and species of Brucella organisms in restricted populations of single-humped Arabian camels raised in the cities of Riyadh and Al-Kharj in central Saudi Arabia (Fig. 1).

**MATERIALS AND METHODS**

**Samples**

A total of 2,630 blood samples were received, from apparently normal adult camels (Camelus dromedarius) for routine serological examination for brucellosis, from July 1989 to July 1991. Of these samples, 2,327 represented all adult camels raised in one large herd (44 males and 2,283 females) of local (1,289 Magaheem and 342 Magateer) and imported (696 Pakistani) breeds. This camel herd was raised under an intensive management system in Al Kharj. The remaining 303 blood samples represented all camels raised in the backyards of 24 houses in Riyadh city. The latter were all female camels of the local Magaheem breed kept as an immediate source of milk for the families.

Milk samples from 100 brucellosis seropositive camels (8 from Riyadh and 92 from Al-Kharj) were aseptically collected and cultured on several plates of selective medium for Brucella isolation.

**Serology**

The serum samples were initially screened for the presence of Brucella agglutinins by the Rose Bengal test. Positive reactor sera were then retested by the standard United States of America (US) plate agglutination procedure (4). Agglutinations at 1:100 and higher were recorded as positive reactions (22).

**Cultures**

Each milk sample was streaked (by sterile cotton swab) onto three or four plates of Brucella selective medium. This medium was prepared from brain heart infusion agar, to which 5% defibrinated sheep blood, 1% sterile dextrose and Brucella selective supplement (12) were added. The streaked plates were incubated at 37°C in the presence and absence of 10% CO₂ atmosphere for at least seven days. The isolated Brucella cultures were identified morphologically, microscopically, biochemically and serologically according to the procedure recommended by Alton and colleagues (4). The biotyping of the isolates was carried out at the Central Veterinary Laboratory, New Haw, Weybridge, United Kingdom.

**RESULTS**

**Serology**

Of the 2,630 serum samples tested, 212 were found to be brucellosis seropositive, giving an overall prevalence of 8%. However, the serological prevalence of brucellosis among the tested camels raised in backyards in Riyadh and those raised on the farm
in Al-Kharj was 4.3% and 8.6% respectively. Of the 303 local camels in Riyadh, only 13 of 194 tested at 8 houses were found to be brucellosis seropositive. The remaining 109 camels tested at 16 houses were seronegative for brucellosis.

In the camel herd in Al-Kharj, 4 of 44 males and 195 of 2,283 female camels were found to be brucellosis seropositive. There was no significant difference in the seroprevalence of brucellosis between the different age groups of camels tested. Brucellosis seroprevalence in the various camel breeds was 35 of 342 (10.2%) in Magateer, 124 of 1,289 (9.6%) in Magaheem and 40 of 696 (5.7%) in Pakistani breeds.

In this study, there was agreement between positive reactions with the Rose Bengal test and \textit{Brucella} antibody titres of 1:100 or higher in the US plate agglutination test.
Bacteriology

Of 100 milk samples cultured, B. melitensis was isolated from only 26 (26%) of female camels. Among these, 4 were from the total of 8 Riyadh camels tested and 22 were from Al Kharj (92 tested in total). Of the four isolations of B. melitensis from Riyadh camels, three were biovar 1 and one was biovar 2. Of the twenty-two B. melitensis isolates from Al Kharj camels, twelve were biovar 1 and ten were biovar 2.

DISCUSSION

The camel population of Saudi Arabia is estimated to be approximately 600,000. Although the majority of camels are grazed by nomads following traditional methods of husbandry in the desert, some camels are bred under intensive management systems for commercial milk production, while others are raised in small groups, either in small farms or in the backyards of houses as an immediate source of meat, milk and wool. Commercial camel milk production started in Saudi Arabia in 1987. Milking is performed by hand, since mechanical milking has not been successful due to irregular teat size and disturbance caused by the loud noise of machines. The camel milk is pasteurised before being sold to stores.

The prevalence of brucellosis in livestock and human beings in Saudi Arabia has been reported by several authors. The infection has been confirmed in sheep, goats, dairy cattle and humans (mostly farmers, animal handlers and their families). B. melitensis biovars 1, 2 and 3 were responsible for all cases of livestock infection, except among cows on one dairy farm which had B. abortus biovar 1. Consequently, B. melitensis accounted for 92% of human cases and B. abortus for 8%, while B. suis was not found in animals or humans (2, 3, 5, 8, 9, 14, 15, 16, 17, 19, 23, 24, 25, 26, 28.)

Complaints by camel owners of abortions in camels and growing awareness of Brucella infection in humans in Saudi Arabia have increased interest in Brucella infection in camels and encouraged owners to bring samples for examination. In the present investigation, owners of camels in Riyadh reported sporadic cases of abortion in pregnant camels and Malta fever in some camel-keeping families. The prevalence of abortion in camels on the Al-Kharj farm was about 10%, in the absence of any other clinical signs. In addition, 20% of the camel handlers and milkers on the Al Kharj farm had Malta fever due to B. melitensis infection at the time of the present study. The human cases were diagnosed and treated by the local health authorities. Furthermore, B. melitensis biovars 1 and 2 were isolated at the National Agriculture and Water Research Centre (NAWRC) from the milk and aborted foetuses of sheep and goats raised together with camels on the Al-Kharj farm. Moreover, brucellosis seroprevalence among sheep and goats on the farm was found to be 16.2% (499 of 3,081) at the NAWRC.

In camels, there is as yet no agreement on the diagnostic agglutination titre for brucellosis. However, in one study by Arbusov in 1940 (7), agglutination titres higher than 1:20 were considered as positive evidence of brucellosis in camels. In a separate study by Zhalobovski and Palgov in 1950 (30) the specific titres were 1:40 or above. In the present investigation, titres of 1:100 or higher were taken as diagnostic evidence for camel brucellosis (22). Moreover, in the present study, there was full correlation
between all sera showing 1:100 or higher titres in the US plate agglutination test and positive reactions with the Rose Bengal test. Following these criteria, the overall brucellosis seroprevalence among the tested camels was 8% (212 of 2,630). This prevalence was much higher than previously obtained in the limited surveys in the southern (23) and eastern (14) provinces of Saudi Arabia. In addition, *Brucella* seroprevalence was much higher in camels raised under intensive management systems than among those kept in the backyards of houses in small groups. This finding is in agreement with the results obtained by Radwan and colleagues (22) in livestock in Saudi Arabia, and could be due to a number of factors, including the overcrowding of camels in a restricted area, the presence of *B. melitensis* infected sheep and goats on the same farm as the camels, the absence of control measures on the farm and the presence of camels imported from a country known to be infected. Furthermore, in Mongolia, a high rate of *Brucella* infection occurred in two-humped camels, especially when they were in contact with infected large and small ruminants (29).

Male and female camels on the Al-Kharj farm showed a similar brucellosis seroprevalence. This observation was in agreement with a study on Sudanese camels (1). Furthermore, brucellosis seroprevalence did not differ between the various age groups of adult camels. These results suggest a similar susceptibility to brucellosis among male and female camels of different age groups.

Although the overall brucellosis seroprevalence was relatively low in camels kept in small groups in backyards in Riyadh (4.3%), the group infection rate was very high (eight of twenty-four). In the eight positive houses, the number of positive camels per house ranged between one and three. In addition, the close proximity of the owners and their families to these camels on a day to day basis makes them more dangerous to human health than large herds on ranges. The eight positive houses in Riyadh also had *B. melitensis*-infected sheep and goats (diagnosed at the NAWRC). Under these conditions, the risk of transmission of brucellosis to other camels and human beings is particularly high during abortion, parturition and milking of infected animals.

Although the nomadic lifestyle may be disappearing in Saudi Arabia, people with such a heritage retain a taste for camel, goat and sheep milk. Fresh and unpasteurised milk is considered best while still warm, as boiling is reputed to remove its “goodness”. This milk is mostly produced on a small or domestic scale in the backyards of houses for family and friends. Such milk is not pasteurised and, together with its products (e.g. *Laban* or buttermilk), is usually consumed raw. In the present study, *B. melitensis* biovars 1 and 2 were shed in fresh camel milk. The overall prevalence of shedders of *Brucella* organisms in milk among the 100 seropositive camels from which cultures were grown was 26%. Of the thirteen seropositive camels raised in Riyadh, four of eight females examined shed *Brucella* in their milk. Furthermore, among the 199 seropositive female camels on the Al-Kharj farm, 22 of the 92 which were examined shed *Brucella* in their milk. *Brucella* organisms are known to be shed intermittently in the milk of cows, however it is not known how long *Brucella* shedding persists in camels.

The selective medium used in this investigation was reported to give a higher isolation rate of *Brucella* organisms from fresh milk than any of the other currently known selective media and is equivalent to guinea pig inoculation (12). The present knowledge of details on the epidemiology, pathogenesis and clinical appearance of camel brucellosis is very poor. There is a lack of information on the frequency of transmission from camel to camel and from sheep and goats to camels. Brucellosis in the restricted populations of camels in central Saudi Arabia appeared to be
connected with *B. melitensis* infection of sheep and goats. There is a need for future isolation of *Brucella* organisms from materials collected from camels to determine the periods of shedding, the pathological consequences of infection (if any) and the extent of the potential zoonotic disease risk from *Brucella* infection in camels.

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Résumé : Des sérums prélevés chez 2 630 camélidés (*Camelus dromedarius*) adultes, apparemment normaux, élevés dans la région centrale d'Arabie saoudite (villes de Riyad et Al-Kharj) ont été soumis au test du rose Bengale et à l'épreuve standard d'agglutination sur plaque pour *Brucella*, utilisée aux États-Unis d'Amérique.

Cette étude sérologique a révélé que la prévalence globale de la brucellose dans cette population restreinte de camélidés examinés était de 8%. Dans 24 petites exploitations de Riyad, ce taux était de 4,3 % et dans un élevage intensif près d'Al-Kharj, il était de 8,6 %.

Des échantillons de lait frais de 100 chamelles de Riyad et Al Kharj qui avaient réagi aux épreuves sérologiques ont été mis en culture sur un milieu sélectif. *Brucella melitensis* (biovars 1 et 2) a été isolée et identifiée dans 26 cas.

Sur le plan épidémiologique, la brucellose des camélidés dans la région centrale d'Arabie saoudite, qui paraît liée à l'infection à *B. melitensis* chez des ovins et des caprins, constitue un risque important pour la santé publique.


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**ESTUDIO SEROLÓGICO Y BACTERIOLÓGICO DE BRUCELOSIS EN CAMELLOS EN ARABIA SAUDÍ CENTRAL.** – A.I. Radwan, S.I. Bekairi y P.V.S. Prasad.

**Resumen:** Los sueros de 2.630 camellos adultos (*Camelus dromedarius*) aparentemente normales, criados en la región central de Arabia Saudí (ciudades de Riad y Al Kharj), se examinaron serológicamente con las pruebas rosa de Bengala y de aglutinación en placa para Brucella (estándar estadounidense).
La seroprevalencia general de brucelosis en las poblaciones restringidas de los camellos sometidos a las pruebas fue del 8%. No obstante, la seroprevalencia de brucelosis entre los camellos criados en número reducido en los patios de 24 casas en Riad y los de una granja cerca de Al-Kharj, donde se practica la cria intensiva, fue del 4,3% y del 8% respectivamente.

Las muestras de leche fresca de cien camellas seropositivas a la brucelosis, procedentes de Riad y Al-Kharj, fueron cultivadas en un medio selectivo de Brucella. Los biotipos 1 y 2 de B. melitensis se aislaron e identificaron en 26 camellos.

Epidemiológicamente, la brucelosis en camellos en la región central de Arabia Saudí parecía estar relacionada con la infección por B. melitensis de ovinos y caprinos y representa un riesgo grave para la salud pública.

PALABRAS CLAVE: Arabia Saudí - Brucelosis - Camellos - Camelus dromedarius - Enfermedades de los camellos - Infección por Brucella melitensis.

**REFERENCES**


