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ORIGINAL ARTICLE

Viral and bacterial infections associated with camel (*Camelus dromedarius*) calf diarrhea in North Province, Saudi Arabia

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Abstract Diarrhea and deaths in new-born camel calves were noticed by veterinary investigators and pastoralist in Saudi Arabia to be very high. Hence, it is thought to be necessary to investigate this problem from the virological and bacteriological point of view. The role of pathogenic bacteria and viruses in six different towns of North Province (Al-Assafia, Arar, Domat Aljandal, Hail, Skaka and Khoa) in Saudi Arabia was studied. Survey was conducted in diarrheic camel calves aged 12 months or younger. In our study calf diarrhea was reported in 184 out of 2308 camels examined clinically during one year, the prevalence of diarrhea was found to be 8.0% in calves ranging from one month to one year. In the present study group A rotavirus and *Brucella abortus* were detected in 14.7% and 8.98%, respectively, using ELISA technique. *Escherichia coli* was isolated from diarrheic calf camel (58.2%) 99/170 samples during dry and wet season. *Salmonella* spp. and *Enterococcus* spp. were detected in 12% and 8.8% of the specimens, respectively. In this study enterotoxogenic *E. coli* (ET *E. coli*) was isolated from 7% of diarrheic camel, which indicates the strong correlation between the camel calf diarrhea and the detection of enterotoxogenic *E. coli*. This study represented the first report for the detection of group A rotavirus and *B. abortus* antigen and antibodies in calf

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camels in Saudi Arabia. It is recommended that the disease should be controlled by vaccination in calf camels.

1. Introduction

The camel has played such an important role in Arab culture that there are over 160 words for camel in the Arabic language. There were 11.24 million camels in the Arab world which represent 61% of camel numbers in the world (Farid, 1990) and 15% of the total number of animal units. They produce about 9%, 24% and 8% of the total meat, milk, and wool, respectively, in the Arab world. The amount of meat and milk produced from camels is 289.2 and 213 thousand tons, respectively (Wardeh, 1990). Hamam (1993) reported that camel meat constituted 30% of the meat produced in the Kingdom of Saudi Arabia. The camel plays an effective and primary role in the history of the Kingdom of Saudi Arabia and represents a national wealth and source of income to the majority of citizens particularly in desert areas. Improvement of camel breeds production and health would preserve the recent increasing demand for camel meat and milk of distinguished quality (Wernery and Kaaden, 1995).

Concerning camel disease, camels were formerly considered resistant to most of the diseases commonly affecting livestock, but as more research was conducted, camels were found to be susceptible to a large number of pathogenic agents. Many factors contribute to calf mortality, among which is calf diarrhea (Agab, 1993). Neonatal camel calf diarrhea is an economically important disease causing great losses in camel calves all over the world (Mohammed et al., 2003). High calf mortality is considered one of the major constraints to higher productivity in camels in which calf diarrhea is regarded the major cause (Salih et al., 1998). Mortality in camel populations was found to be higher in camels less than six months of age (Khanna et al., 1992). Ali et al. (2005) reported a morality of 39.9% in Sudan due to calf-camel diarrhea. Most of the fatal diarrhea cases among newly born camel calves are suspected to be caused by namely viruses, bacteria and protozoa.

Viruses can be primary pathogens in the neonatal calf diarrhea and the most common viruses causing diarrhea found throughout the world are group A rotavirus and corona virus. Primary infection of newborn calves with these viruses can cause severe intestinal alterations and diarrhea. Abubaker et al. (2006) reported that the main etiological agents in camel calf diarrhea are bacterial agents. Earlier, neonatal calf diarrhea was attributed to *Escherichia coli* and was designated calf scour (Moore, 1989). Concerning the bacterial infection Fouda and Al Mujalii (2007) in a bacteriological examination revealed that *E. coli* and *Proteus* spp. were the incriminated microorganisms causing diarrhea and *Staphylococcus aureus* was the causative agent of respiratory troubles in diseased calves. Salih et al. (1998) mentioned that bacteriological examination of fecal sample collected from diarrhetic camel calves revealed that 69 (66%) out of 121 yielded *E. coli*. Furthermore, Salwa (2004) isolated 81 *E. coli* of 100 fecal specimens collected from diarrheic calves. Zakia (2004) examined 71 fecal specimens collected from diarrhetic camel calves. The results revealed the detection of *Clostridium perfringens* in 27, *E. coli* in 9 and both *E. coli* and *Clostridium* in 7 samples. More over Abubaker et al. (2006) isolated 52 (27.3%) *E. coli* from 190 diarrheic specimens collected from young camels in Saudi Arabia. Al Afaleq et al. (2007) conducted a Serosurveillance of camels (*Camelus dromedarius*) to detect antibodies against viral diseases in camels. The overall results indicated that out of 2472 examined sera samples, 10.6% had antibodies against the viruses investigated in the study.

The incidence of infection was 18% for bovine viral diarrhea. To study the risk factors associated with some camel viral diseases, Khalafalla and Ali (2007) detected group A rotavirus in 20% of diarrheic camels in Sudan. The main age group affected was 0–3 months. Higher prevalence of group A rotavirus infection was noticed during wet season than dry and winter seasons. Risk factors for these viral diseases contributing to disease transmission in free ranging camels are identified and discussed. Agab (2006) reported the diseases and causes of mortality in intensively kept dromedary camels in a dairy camel farm in Al-Qassim region, central Saudi Arabia. Out of 2316 adults and weaned calves and 126 suckling calves, 942 camels were affected with one or more disease conditions, giving a crude morbidity rate of 38.6%. The most common diseases encountered among the camels of the farm were (22.6%) mastitis, (20.9%) camel dermatophilosis, and (10%) calf diarrhea.

Our investigation sought to determine the epidemiology of viral and bacterial infection in several cities in North Province, Saudi Arabia by using different serologic tests, as well as bacteriologic tests, to identify viral and bacterial organisms isolated from serum and feces specimens of camel calf diarrhea.

2. Material and methods

2.1. Areas of study

The present study was conducted in North Province, Saudi Arabia. Six areas (Al-Assafia, Arar, Domat Aljandal, Hail, Skaka and Khoa) of study have been selected which are rich in camel population that represents all camel breeds and various tribes with those rear camels. Each of times areas had been visited twice to collect data, fecal and serum samples from diarrheic, and healthy camel.

2.2. Data collection

Data about the incidence of camel calf diarrhea, age and sex of the affected calves were collected. A total of 308 camels of different sex age and health status were investigated for bacterial and viral carriage and disease. The camel owners in the areas of study were interviewed. Data about the incidence of camel calf diarrhea, the morbidity and mortality rates of the disease were collected and analyzed.

2.3. Sample collection and preparation

A total of 280 faecal and 308 serum samples from diarrheic and healthy calves and camels were collected. Blood was