

*Full Length Research Paper*

# Adenovirus type 3 infections in camels in Sudan

K. S. Intisar<sup>1</sup>, Y. H. Ali<sup>1</sup>, A. I. Khalafalla<sup>2</sup>, K. M. Taha<sup>3</sup> and Mahasin E. A. Rahman<sup>1</sup>

<sup>1</sup>Central Veterinary Research Laboratory, P. O. Box 8067, Al Amarat, Khartoum, Sudan.

<sup>2</sup>Department of Microbiology, Faculty of Veterinary Medicine, University of Khartoum, Shambat, 13314 Khartoum North, Sudan.

<sup>3</sup>Atbara Veterinary Research Laboratory.

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The incidence of adenovirus type 3 infections in camels in Sudan was studied. Lungs of Camel with pneumonia lungs (n = 239) were collected from slaughter houses at four different areas in Sudan. Adenovirus type 3 antigen was detected in 1.3% of 239 tested camel lungs by the use of sandwich ELISA. Specimens from Northern (3.3%) and Central Sudan (1.2%) were found to be positives. Direct fluorescent antibody test (FAT) was used to confirm the adenovirus ELISA positives; all ELISA positives were found to be positive using FAT. Seroprevalence of adenovirus type 3 was investigated, camel sera (n = 260) were collected from the same areas in Sudan. Collected sera were examined for adenovirus antibodies using indirect ELISA. The overall detected seroprevalence was 90%; highest prevalence was in South Central (100%) then Western (94.3%) and Central Sudan (92.5%). The lowest seroprevalence was in Northern Sudan (80%). The most detected degree of positivity was +3 then +5. This represents the first report for the detection of adenovirus type 3 antigen and antibodies in camels in Sudan. It was noticed to cause pathologic effect in camel lungs.

**Key words:** Camel, Adenovirus 3, ELISA, Sudan.

## INTRODUCTION

Adenovirus type 3 is one of the known causative agents of respiratory infections in cattle; its prevalence has been reported worldwide. In camelidae, adenovirus is classified under non pathogenic viral infections (Wernery and Kaaden, 2002); the authors suggested this classification due to the rare reports that associate adenovirus isolation or antigen detection with clinical manifestations or post mortem findings. Galbreath et al. (1994) reported the isolation of adenovirus from lungs of young llamas with pneumonia and hepatitis. Serologically, few works on adenovirus 3 in camels were reported. In Nigeria, Olaleye et al. (1989) detected antibodies to adenovirus in 1.3% of dromedaries; however, seroprevalence of adenovirus in 270 llamas in USA was 93% (Picton, 1993). In Argentina, Puntel et al. (1999) reported the detection of 5.13% seroprevalence of adenovirus in llamas. Hadia et al. (2001) detected adenovirus antibodies in 43 of 120 tested camels in Egypt. In Sudan, Eisa (1973) reported the first

detection and isolation of adenovirus 1 from a bovine calf. The present study is to investigate the occurrence of adenovirus 3 respiratory infections in camels in Sudan.

## MATERIALS AND METHODS

### Samples collection

A total of 239 pneumonic lung specimens were collected from slaughter houses at four different localities in Sudan; Central (Tambool and Abudlaiq cities), Northern (Atbara city), Eastern (Gedarif and Kassala cities) and Western Sudan (El Obeid and Nyala). Specimens were transferred on ice to the Central Veterinary Research Laboratory at Khartoum and kept at -20°C till used.

Camel sera were collected (n = 260) from the same areas of lung collection with some sera from South Sudan Central (Blue Nile). Sera were kept at -20°C till used.

### Preparation of camel lung tissue specimens

One gramme of lung tissue was put in aseptic pestle and mortar with 2 ml of lysis solution supplied with the Kit. The lung tissue was cut into pieces with a pair of sterile scissors, homogenized by

\*Corresponding author. E-mail: [intisarkamil@yahoo.com](mailto:intisarkamil@yahoo.com).

**Table 1.** Detection of adenovirus type 3 antigen in camel lungs in different localities in Sudan using ELISA (2000-2006).

Area	Total tested	Total positive	Total negative	% positive
Eastern Sudan	87	0	87	0
Central Sudan	84	1	83	1.2
Northern Sudan	61	2	59	3.3
Western Sudan	8	0	7	0
Total	239	3	236	1.3

grinding and then the homogenate was transferred to 15 ml sterile tube and centrifuged at 2000 rpm for 10 min. The supernatant was collected in new sterile tubes for testing.

#### **Sandwich ELISA for adenovirus 3 antigen detection**

Sandwich ELISA kits for detection of adenovirus 3 antigen were obtained from Bio-X Diagnostics, Jemelle, Belgium. The test was performed according to the instructions of the manufacturer.

#### **Direct fluorescent antibody technique (FAT)**

FAT was used to confirm the ELISA positive results for adenovirus 3. The conjugate used was obtained from Bio-X Diagnostics, Jemelle, Belgium.

#### **Adenovirus 3 antibody detection**

##### ***Indirect ELISA for antibody detection of adenovirus 3***

Indirect ELISA kits for detection of antibodies to adenovirus 3 were obtained from Bio-X Diagnostics Company, Jemelle, Belgium. The test was applied on all collected samples (n = 260) according to the instructions of the manufacturer.

## **RESULTS**

#### **Adenovirus type 3 antigen detection**

Using sandwich ELISA kits (for adenovirus 3 antigen) 3 out of 239 pneumonic camel lung specimens were found positive (1.3%). Adenovirus 3 antigen was detected in specimens from Central and Northern Sudan, the details are presented in Table 1.

#### **Direct fluorescent antibody technique**

FAT was used to confirm the ELISA positive results for adenovirus type 3. All ELISA positives were found to be positive by FAT.

#### **Adenovirus type 3 antibody detection**

Indirect ELISA kits for detection of antibodies to adenovirus 3 were applied on 260 camel sera with 90%

positivity. The highest prevalence was detected in Western (94.3%), Central (92.1%) then Eastern Sudan (85%). 3+ was the highest detected titer followed by 2 +. The details are shown in Tables 2 and 3.

## **DISCUSSION**

Respiratory infections are considered one of the main factors that decrease animal production. Camels are known to be less susceptible to various diseases affecting ruminants; however evidence for the significant role of respiratory infections in camels had been reported. Dioli and Stimmelmayer (1992) reported that viruses associated with respiratory infections in camels are parainfluenza 3 (PI3), influenza virus A and B, adenovirus, respiratory syncytial virus (RSV) and infectious bovine rhinotracheitis (IBR).

Adenovirus is known to cause various diseases in different animal species as well as humans. In cattle about 10 serotypes are identified, all causing asymptomatic disease or mild upper respiratory illness. However, in 1993, an epidemic in mule deer in California characterized by pulmonary edema and erosions, ulcerations and hemorrhage and abscess of intestinal tract was found to be caused by adenovirus (Murphy et al., 1999).

Eisa (1973) was the first to report the detection and isolation of adenovirus 1 from a bovine calf in Sudan. In this study, adenovirus antigen was detected in camel lung tissue specimens using ELISA. Low percentage of positivity was observed (1.3%) but it is sufficient to indicate that adenovirus is responsible for the pneumonia since all specimens were collected from lungs that showed pneumonia. Positives results were from Central (Tambool) and Northern Sudan (Atbara) . This is the first report of adenovirus antigen detection in camels in Sudan and probably elsewhere. This finding is supported by the previous reports on the association of adenovirus with pneumonia in camelidae (Galbreath et al., 1994) as well as the isolation of adenovirus from diarrhetic llamas and alpacas in USA (Mattson, 1994).

With regards to serological evidence of Adenovirus infection in camelidae, Olaleye et al. (1989) reported the detection of adenovirus antibodies in 1.3% of camel sera in Nigeria and Hadia et al. (2001) detected adenovirus antibodies in 35.8% of 120 camel sera collected from

**Table 2.** Detection of adenovirus type 3 antibodies in camel sera in different localities in Sudan using ELISA during 2000-2006.

Area	Total tested	Total positive	Total negative	% positive
Eastern Sudan	71	61	10	85.9
Central Sudan	38	35	3	92.1
Central to South	10	10	0	100
Northern Sudan	35	28	7	80
Western Sudan	106	100	6	94.3
Total	260	234	26	90

**Table 3.** Degree of positivity (titer) of adenovirus type 3 antibodies in camel sera in Sudan Detected using indirect ELISA

Area	Degree of positivity						Total
	-	+	2+	3+	4+	5+	
Eastern Sudan	10	11	14	8	16	12	71
Central Sudan	3	6	3	9	5	12	38
Central to South	0	1	2	3	1	3	10
Northern Sudan	7	3	3	6	6	10	35
Western Sudan	6	17	21	34	14	14	106
Total	26	38	43	60	42	51	260

slaughter houses in Egypt. The detected seroprevalence of adenovirus in this study was 90% which is considered a high prevalence and is far higher than that reported in previous publications that corroborate our antigen detection results. This indicates that adenovirus infection in camels of Sudan is widely distributed. Highest percentage was detected in sera from South Central (Blue Nile and Sinnar), Central (Tamboul [100%]) then Western Sudan (Kordofan [94.3%]) and the lowest prevalence was (80%) in Northern Sudan (Atbra).

However, we should consider high the sensitive technique used in this study (indirect ELISA with anti-camel conjugate) that might result in higher positive cases. In new world camelids, high prevalence of adenovirus (93%) was seen in llamas (Picton, 1993) using ELISA.

The highest detected titers of adenovirus antibodies were +5 (21.8% of positives) and +3 (25.6% of positives), which might have resulted from a recent and/or multiple infections. Further studies are needed to determine immune response to adenovirus in camels.

Detailed molecular biology based study for characterization, cloning and sequencing of adenovirus type 3 detected in this study as well as other serotypes are highly recommended to compare these viruses with those in circulation in other domestic animals (cattle, sheep and goats) in Sudan.

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