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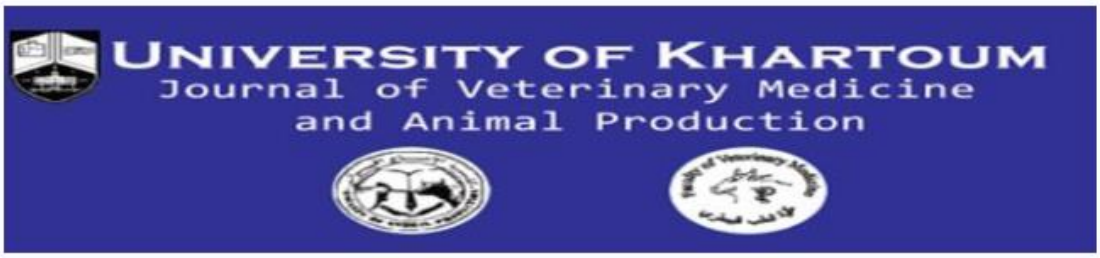

The prevalence of *Trypanosoma evansi* in Camels (*Camelus dromedaries*) in South Darfur State

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Abstract

Trypanosoma evansi infection is considered as most important disease of camel in the Sudan. The aim of this study was to investigate the *T. evansi* infection of dromedary camel, using the parasitological, serological and molecular tools. A two-year three seasons study of the prevalence of trypanosomosis in camels (*Camelus dromedarus*) was conducted in Nyala area (South Darfur State). Jugular vein blood samples were randomly collected from 350 camels and examined parasitologically by Giemsa stained blood smears (GSBS) for the presence of the trypanosomes, serologically for detection of anti-trypanosomal antibodies by card agglutination test (CATT) and molecularly for detection of the *T. evansi* amino- acid sequence through PCR using *T. brucei* spp specific primers. Out of the 350 samples 37(10.6%) were positive by smears, and 126 (36%) were positive by CATT through anti-trypanosomal antibodies, while 140 (40%) were positive by PCR. The obtained results showed that PCR have higher sensitivity and specificity (90%), while CATT and smears gave less sensitivity 69% and 31% respectively. The prevalence was significantly greater in the rainy season than the dry season.

المستخلص

أجريت هذه الدراسة لتقييم مدى إنتشار مرض المثقبات الإيفانزاي في الجمال بإستخدام تقنية البوليمريز التفاعلي التسلسلي (PCR) والطرق الباراسيتولوجية عن طريق المسحة المصبوغة (smears) والطرق السيرولوجية (CATT), في منطقة نيالا بولاية جنوب دارفور, وهو من أهم الأمراض التي يصيب الإبل في السودان. تم جمع 350 عينة دم من الوريد بصورة عشوائية من الإبل وتم تشخيصها ووجد أن 37 (10%) عينة من المجوع الكلي موجبة عن طرق المسحة المصبوغة و126 (36%) موجبة بإستخدام الطرق السيرولوجية (CATT) بينما 140 (40%) عينة كانت موجبة عن طريق تقنية البوليمريز التفاعلي التسلسلي. أظهرت النتائج حساسية عالية وتخصص نوعي لفحص البوليمريز التفاعلي التسلسلي (90%) وبدرجة أقل للإختبارات السيرولوجية (69%) والمجهرية (31%). أيضاً أثبتت الدراسة أن إنتشار المرض يكون أكبر في موسم الأمطار من موسم الجفاف.

Introduction

Trypanosomosis caused by *Trypanosoma evansi* constitutes serious and economically important infections in camels in Sudan and elsewhere. The parasite is transmitted by biting flies such as *Tabanus* and *Stomoxys spp.* which are widely distributed in Sudan. Investigations on the disease which started early as 1905 had been compiled in a bibliography of camel entitled "The one-humped camel (*Camelus dromedaries*) in the Sudan" by A/Majid (2000).

Materials and Methods

The study was carried out in Nyala area South Darfur State; from January 2013 to April 2015. Blood samples were drown from each camel whose owners agreed to participate. A total of 350 camels were enrolled in the current study, including different age and sex groups. Samples were collected randomly from each camel through jugular vein seasonally (Whole blood samples were collected by sterile searing into 10 ml EDTA- coated tubes. A drop of blood was subjected parasitological examination using GSBS, spreader, fixed with alcohol, stained with

Gieemsa and examined microscopically (100X), another drop part was spotted at what man filter paper for DNA extraction of trypanosomes by PCR according to Sanger (1981). Blood samples were also collected in a dry clean and sterile centrifuge tubes without EDTA for serum preparation which was preserved at -20°C for detection of trypanosome antibodies using CATT as described by Magnus (1988).

Results

The prevalence of *T. evansi* infection in camels was found to be as follows: Out of 350 tested camels; 37(10.5%), were found positive using thick and thin smear films, 126 (36%) were found positive using CATT while 140(40%) were positive by PCR (Table 1).

The sensitivity was 42% in smears, 78% CATT and 98% PCR, the specificity was 31%, 69% and 67% in smears, CATT and PCR respectively.

The results of infection rates in males and females camels showed that out of 224 males 90 (71.4%) were positive by PCR and out of 126 females 36 28%) were positive.

The suspected camels were categorized into 3 groups, less than 2 years, 2-10 years, more than 10 years. Using SPSS the infection rate was order camel 69(19%), 23(66%) and 50(14.3%) respectively Table (3).

Examination of the herds showed that 75(59.5) were positive during autumn, 21(16.6) during summer and 30(23%) during winter (Table 4).

Table 1: The prevalence of *T. evansi* in camels by various tests

Type of the test	Total number	Infected camels	Sensitivity	Specificity
Thin blood smear	350	37(10.5%)	41%	31%
Thick blood smear	350	37(10.5%)	41%	31%
CATT/*T. evansi*	350	126(36%)	78%	69%
PCR	350	140(40%)	98%	67%

Table 2: The prevalence of *T. evansi* in camels according to sex

Sex	Number of camels	Positives	Percentage
Male	224	90	71.4%
Female	126	36	28.6%
Total	350	126	100%

Table 1: The prevalence of *T. evansi* in camels according to age group

Age groups	Number of camel's and (%)	Numbers of infected camel's and (%)
<-2 years	69(19.7%)	40(28.6%)
3-10 years	231(66%)	57(40.7)
≥10 years	50(14.3%)	43(30.7)

Table 4: The prevalence of *T. evansi* in camels in various seasons

Season	Number of camels	Number of infected camels	Infection rate (%)
Autumn	350	75	59.5%
Summer	350	21	16.6%
Winter	350	30	23.8%

Discussion

Camel trypanosomosis is considered as a fundamental constrain for camel health and productivity in all camel breeding areas of the World (Atarhouch, 2003). Diagnosis is the key for effective control of *T. evansi*. Diagnosis based on conventional parasitological methods and/or clinical sign's of disease has a low sensitivity, as the infection's is not pathogenomic (Luckin, 1992).

In this study, the parasitological methods used for diagnosis of camel trypanosomosis showed lowest rate. This indicates that this test is not highly sensitive. These results are in agreement with Godfry and Killick- Kendrick's (1962) who was one of the earlier workers who stated that these methods detected only about 30% of infected animals, because infection with trypanosomes in camels is usually chronic that exhibit very low parasitaemia. Moreover, this is supported by Paris *et al.* (1882) who recorded parasitological methods used for detection of trypanosomes are not sensitive enough for diagnosis of Surra in camels. For that Mahmoud and Gray (1980) called for a need for alternative more sensitive diagnostic techniques.

The data revealed that 43.3% of the camels showed anti-trypanosomes antibodies when tested by CATT. These findings indicate the level of sensitivity of this test. That all samples found positive by smears were also positive by CATT reflects the reliability of this test. These findings are similar with those of Diall *et al.* (1994) and Gutierez *et al*. (2006) who reported sensitivity of CATT test to varied from 86-100%. Such results stimulated Pathak *et al.* (1997) to advocate that CATT be used to study the seroprvalence of *T. evansi* in addition to that it is simple, quick and field test.

PCR claimed the highest rate of infection indicating high sensitivity level which was 90%. Similar results were reported in buffalos (Omanwar, 1999 and Holand, *et al.*, 2000) and horses (Clausen *et al.*, 1998).

Application of PCR for detection of *T. evansi* in camels is limited. In Kenya, Masiga and Nyang'ao (2001) identified trypanosomes species from camels using PCR and procyctine transformation test. The first trial to detect *T. evansi* in camels in Sudan using nested PCR was conducted by Aradaib and A/Majid (2006).

During this study there were variations at the intensity of infection according to the different seasons of the years, the prevalence was significantly greater in the rainy season than in dry season (i.e. in autumn).

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