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Asian Pacific Journal of Tropical Biomedicine

journal homepage: www.elsevier.com/locate/apjtbEpidemiological investigation <http://dx.doi.org/10.1016/j.apjtb.2015.09.018>Incidental findings of *Cysticercus tenuicollis* metacestodes in five oryx species

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ARTICLE INFO

Article history:

Received 20 Apr 2015

Received in revised form 4 Jul 2015

Accepted 20 Sep 2015

Available online 10 Nov 2015

Keywords:

Al Ain Zoo

Arabian oryx

Beisa oryx

Cysticercus tenuicollis

Fringe-eared oryx

Gemsbok

Mortality records

Scimitar-horned oryx

Taenia hydatigena

ABSTRACT

Objective: To determine the prevalence of *Cysticercus tenuicollis* (*C. tenuicollis*) metacestodes in five oryx species kept in Al Ain Zoo animal collection.**Methods:** This study was based on a retrospective analysis of post-mortem records covering a four year period (July 2010 to July 2014).**Results:** A total of 213 individual animals were recorded dead during the four year period (July 2010 to July 2014). Out of this, 12 (5.6%) were recorded with *C. tenuicollis*. More females (8) than males (4) were recorded to have *C. tenuicollis*, although this was not statistically significant ($P = 0.3737$).**Conclusions:** This study shows that, Arabian oryx, beisa oryx, fringe-eared oryx, gemsbok and scimitar-horned oryx are susceptible to *C. tenuicollis*. Based on the epidemiology and the life cycle of this parasite, it is possible that these captive animals ingested the parasite through contaminated feed which could have happened in the pasture land or stray dogs and wild canidae (*e.g.* fox) visited the zoo contaminating the oryx feed. Stray dogs and wild canidae should be prevented from visiting pasture land and a captive animal facility.

1. Introduction

Cysticercus tenuicollis (*C. tenuicollis*) is the larval stage (cysticercoid, metacestode) of *Taenia hydatigena* (*T. hydatigena*), a tapeworm parasite of dogs and other canids (coyotes, wolves, foxes, very occasionally cats) [1,2]. The intermediate hosts of *T. hydatigena* are domestic (sheep and goats) and wild ruminants (deer) [3]. The metacestode occurs worldwide, mainly in rural areas of countries with large sheep population.

Metacestodes are found attached to the omentum, mesentery, and occasionally on the liver surface; however, unusual locations of *C. tenuicollis* have been described as lungs, kidneys, brain, ovaries, uterine tubes, uterus, cervix, and vagina. The predilection site of adult tapeworms in their final host (dogs and other canids) is the small intestine [4]. Adult *T. hydatigena* tapeworm is found in the intestine of carnivores. The eggs hatch in the small intestine of the intermediate hosts and the released oncospheres enter liver through blood circulation. The metacestode migrate through the hepatic parenchyma to the peritoneal cavity [5]. It matures over a period of five to eight weeks and it is then found attached as a bladder worm called *C. tenuicollis* to the mesentery, serosal surface of the abdominal organs, and omentum [6].

Pathogenicity of adult parasites is not high for definitive hosts. However, large numbers of developing cysticerci migrate in the liver of intermediate hosts, producing hemorrhagic and

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Peer review under responsibility of Hainan Medical University.

Foundation Project: Funded by Al Ain Zoo through a Grant Number 15/917001.

fibrotic tracts known as “hepatitis cysticercosa”, a condition whose pathology resembles that of acute fasciolosis [3,7]. Severe infection of liver tissues may result in liver/carcass condemnation at slaughter and hence this is a disease of economic importance in livestock production [7].

Diagnosis of infection in animals is based on the finding of the cysts during meat inspection or necropsy procedure, although other methods such as ELISA, biochemical and hematological tests can be useful for diagnosis of live animals [7].

This study was aimed at documenting prevalence of *C. tenuicollis* metacestodes in five oryx species kept in Al Ain Zoo animal collection, through a retrospective analysis of post-mortem records.

2. Materials and methods

This study was based on a retrospective analysis of post-mortem records covering a four year period (July 2010 to July 2014) in Al Ain Zoo (latitude 24°10'45.37" N, longitude 55°44'19.99" E), Abu Dhabi, in the United Arab Emirates. The zoo hosts five oryx species, namely, Arabian oryx (*Oryx leucoryx*), beisa oryx (*Oryx beisa*), fringe-eared oryx (*Oryx beisa callotis*), gemsbok (*Oryx gazelle*) and scimitar-horned oryx (*Oryx dammah*). Post-mortem records were analyzed and only animals from the five species were included in the study. Data collected included: species, age, sex, presence/absence of cyst, location of cyst(s) and the cause of death of the animal. Data was entered in excel for analysis and GraphPad Prism® was used for statistical analysis.

3. Results

A total of 213 animals were recorded dead during the period under review (July 2010 to July 2014). Out of this, 12 were recorded with *C. tenuicollis*, accounting for 5.6% as shown in Table 1. Animals identified with the metacestode were all adults and more females (8) than males (4) were recorded to have *C. tenuicollis*, but not statistically significant (P value 0.3737, odds ratio = 0.485, 95% confidence interval 0.1416–1.664, Fisher's exact test, GraphPad Prism 6). The metacestodes were found attached in different organs as follows: lung (1), liver (1), liver and omentum (4) (Figure 1), omentum (4) and mesentery (2).

Table 1

Number of animals from the 5 species recorded dead and diagnosed with *C. tenuicollis* metacestodes during the four year period (July 2010 to July 2014).

Species	Number dead	Number with cyst	
		Male	Female
Arabian oryx	76	1	1
Beisa oryx	33	0	3
Fringe-eared oryx	20	0	1
Gemsbok	10	0	1
Scimitar-horned oryx	74	3	2
Total	213	4	8

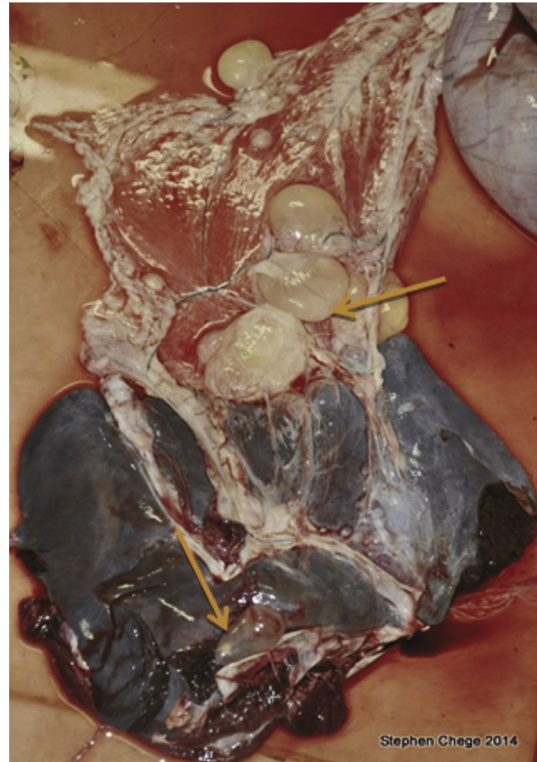


Figure 1. *T. hydatigena* cysts attached to the liver and omentum (indicated by arrow) in a scimitar-horned oryx.

4. Discussion

T. hydatigena is cosmopolitan in distribution and occurs in the small intestine of dogs, red foxes, wolves and other wild carnivores. The intermediate hosts are domestic and wild ruminants. The intermediate hosts get infected by ingesting feeds contaminated with dog or carnivore feces containing the eggs of *T. hydatigena*. Few pathological changes occur with *T. hydatigena* cysticerci infection, but severe infections can be hazardous to the animal's health. In our study, there was no noticeable pathology on the organs affected.

C. tenuicollis has been documented in Arabian oryx [8], beisa oryx [9], gemsbok [10], but to the best of our knowledge, it has not been documented in fringe-eared oryx and scimitar-horned oryx. In this study, the prevalence was low (5.6%) in contrast with higher prevalences reported in domestic animals (24.1% in sheep of Turkey [2], 79% in sheep and 53% in goats in Ethiopia [11], and 18.04% in goats and 28.4% in sheep in Iran [12,13]). This lower prevalence in the zoo animals may be due to the fact that the grazing behavior is different, as in captive facilities there is little contamination of feed with the parasite reservoir feces as compared to free-ranging livestock situation.

Only adults were found positive to *C. tenuicollis* and this is consistent with other findings [14], indicating that prevalence of *C. tenuicollis* increases with age, as older animals having lived longer pick large number of eggs during feeding of contaminated feed. Although more females than males were recorded with *C. tenuicollis* metacestodes, there was no

statistical difference between males and females. This is in contrast with other findings [2,12], who found that infestation in male sheep and goats was higher than in females.

Our study found that the predominant predilection sites for the metacestodes were the liver and omentum, followed by mesentery and lung, in contrast with others who reported that omentum [2,14] and liver [15] as the predominant predilection sites for *C. tenuicollis*.

There is very scanty information on the prevalence of *C. tenuicollis* or status in wildlife in the United Arab Emirates and hence further research is recommended.

Our study have shown that the five oryx species are susceptible to *C. tenuicollis* and based on the epidemiology of the life cycle of the parasite, it is possible that the captive animals ingested the parasite through contaminated feed which could have happened in the pasture land or stray dogs and wild canidae (e.g. fox) contaminated oryx feed in the enclosure. There is a need to have a barrier around the zoo premises as a biosecurity measure.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgments

We thank the management of Al Ain Zoo for their continued support and the veterinary team who have always strived to keep up-to-date data. Al Ain Zoo funded this work through a Grant Number 15/917001.

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