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Prevalence of Taenia in selected Canids and felids living within wildlife sanctuaries in Kenya

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Abstract

Humans get cystic echinococcosis by ingesting eggs of dog tapeworm, *Echinococcus granulosus*. This disease is distributed worldwide in both humans and ungulates, and is a major public health problem in people living within wildlife-livestock interfaces, especially in Kenya. A total of 832 faecal samples of lions *(panthera leo*), hyenas (*Crocuta crocuta*), jackals (*Canis Mesomelas*) and wild dogs (*Lycaon pictus*) were screened for taeniid eggs by microscopy. The overall prevalence of taenia infection in the study population across all sanctuaries was 14.4% with the highest prevalence recorded in Maasai Mara game reserve. In Meru National park, where 74 faecal samples mainly from lions and hyenas were collected, thirteen (10.8%) were positive for taeniid eggs, whereas from Maasai Mara game reserve out of the 284 samples collected, fifty six (46.7%) were found positive for the infection. The prevalence of taenia infection across the parks varied significantly (X^2=24.8, d.f 5, P<0.000) with the lowest recorded in Tsavo West National Park. Among studied animals, lions samples (*panthera leo*) recorded the highest taenia infection levels compared to the other examined animal samples (X_2=21.5, P<0.000). The results of this study indicate that the wild life animals form a possible major source of *Echinococcus* infection to humans, especially in areas of human wildlife interface. To reduce the risk of taenia infection to humans from infection by the wildlife cycle, based on our results, restriction of human wild life interface by fencing around the sanctuaries will have significant impact on transmission. In addition, and based on several known existence of sub species of taenia, more studies especially on molecular differentiation of taenia eggs is necessary for development of Molecular diagnosis.

1. Introduction

Taeniid Eggs are produced by adult stage of cestodes. Eggs of dog tapeworm, which causes *hydatidosis is* able to survive in a wide range of animals, ranging from domestic mammals to wild life mammals (Schantz and Schwabe., 1969; Montresor *et al.*, 2006; Romig *et al.*, 2011; Kagendo *et al.*, 2014*)*. Eggs shed by both domestic and wild definitive hosts can survive in the environment for a long period, mostly up to one year as they are highly resistant to environmental stress, more especially if in damp and cool conditions like watering holes (Magambo *et al.*, 1998). Production of the eggs by definitive host can be cyclical and each taenia worm can lay up to 1000 eggs by sexual means every 10 days up to 2 years with each sexually shed egg containing an embryo that serves as the infective stage (Lindsey, 2003). Once passed in faeces the eggs may be

transported either by wind, water or insects and end up contaminating vegetation and when accidentally ingested by the intermediate hosts, infection is caused (Magambo *et al.,* 1996). Jenkins and Macpherson., 2003; Elmore *et al.,* (2013) indicate that *E. granulosus*-infected wild-life in Australia acted as important reservoirs in the spread of *E. granulosus* to both domestic animals and humans. Endoparasites in the feces of arctic forxes in a terrestrial ecosystem in Canada: International Journal for parasitology: parasites and wildlife 2;90-96). Humans become infected accidentally after ingestion of eggs most frequently when individuals get in contact with infected dogs or other infected carnivores or through ingestion of food and drinks contaminated with faecal material containing the parasites eggs. Human infections with taenia results in formation of hydatid cysts in various parts of the body, liver and lungs being the most common sites (Lindsey, 2003; McManus and Thompson 2003; Yang, 2005). Infection is often asymptomatic until a mechanical complication occurs and the resulting disease is of major medical and economic significance in many parts of the world (Peter, 1990).

Several indicated existence of taenia infections in African wild life (Magambo *et al.,* 2006; Huttner and Romig 2009) In view of the fact that Kenya is an agricultural country and a greater part of its landmass is marginal to semi-arid and Pastoralism is a main economic activity, little data exists on the role of wild canines, on transmission of taenia from wild life animals to human population. In addition, due to limited existing data, on which canine or definitive host has higher parasite infection, the results of this study are vital to designing intervention to control the spread of taenia infections. Thus this study was conducted in several wild life sanctuaries targeting different carnivores that are reservoirs of taenia infection to determine infection prevalence and possible role in transmission especially in areas where there is human wild life interface.

2. Materials and Methods

2.1 Study Area and Population

This study was done in Meru, Samburu, Maasai Mara, Nairobi and Tsavo wild canids and felids sanctuaries in Kenya. The study employed a cross sectional and analytical laboratory based study design and used feacal samples of lions (*Panthera leo*), sported hyenas (*Crocuta crocuta*), wild dogs (*Lycaon pictus*) and Jackal (*Canis Mesomelas*).

2.1.1 Sampling Methods

Faecal samples were collected opportunistically from the field into stool cups containing 70% ethanol and transported to the laboratory for analysis. A "Field guide to tracks and signs of southern and East African Wildlife" by Chris and Tilde Stuart as well as different shapes and colours were used for identification of the faecal samples. Security in the parks was provided by Kenya wild life service game wardens.

2.1.2 Laboratory Investigation

Taeniid eggs were recovered from faecal materials by first washing off preserving ethanol with phosphate buffer saline added 0.3% tween 20 and floating the eggs in Zinc chloride (Zncl) before sieving using 44um and 21 um sieves respectively. Trapped eggs on the 21 um sieves were then eluted with Tris EDTA buffer (TE) as described by Mathis et al., 1996. The product was used to prepare wet smears and examined under the light Microscope for taeniid eggs.

3. Results

3.1 The Prevalence of Taenia infection in Study Animals

A total of eight hundred and thirty two faecal samples collected from five major carnivores including lions (*Panthera Leo*), sported hyenas (*Crocuta Crocuta*), wild dogs (*Lycaon Pictus*) and jackals (*Canis Mesomelas*) from Kenya National parks and game reserves were examined for taenia eggs. Majority of these samples, 534 (64.7%) were collected from lions, followed by those from hyena 128(15.4%), eighty six (10.3%) from wild dogs and eighty (9.6%) from jackal faecal samples. The overall prevalence of Taenia infection was 14.4% and varied with animal type (X^2=21.5 P<0. 000). Lions accounted for the highest prevalence at 18.4% with the least prevalence found in jackals 2 (1.7%) (Table 1)

Table 1: Total Prevalence of Taeniid Eggs in Different Study Animals

Definitive host	Number of Faecal Samples Examined	Number of Samples Positive for Taenia Eggs	Overall Percent Prevalence
Lion *(Panthera leo)*	538	99	18.4%
Spotted hyena*(Crocuta crocuta)*	128	12	9.4%
Wild dogs *(lycaon pictus)*	86	7	8.1%
Silver-backed jackal *(Canis mesomelas)*	80	2	2.5%
Total	**832**	**120**	**14.4%**

(X^2=21.5 P<0. 000)

3.1.2 Prevalence of Taenia Infection by Sanctuary

The overall prevalence of taenia infection also varied with sanctuaries and with the highest prevalence was recorded in Maasai Mara game reserve. In Meru National park, where 74 faecal samples were collected, 13 (10.8%) were positive for taeniid eggs and Maasai Mara game reserve out of the 284 samples collected, 56 (46.7%) were found positive for the infection. The difference in prevalence of taenia infection across the parks was significant (X^2=24.8, df 5, P<0.000) with the lowest recorded in Tsavo West National Park (Fig 1).

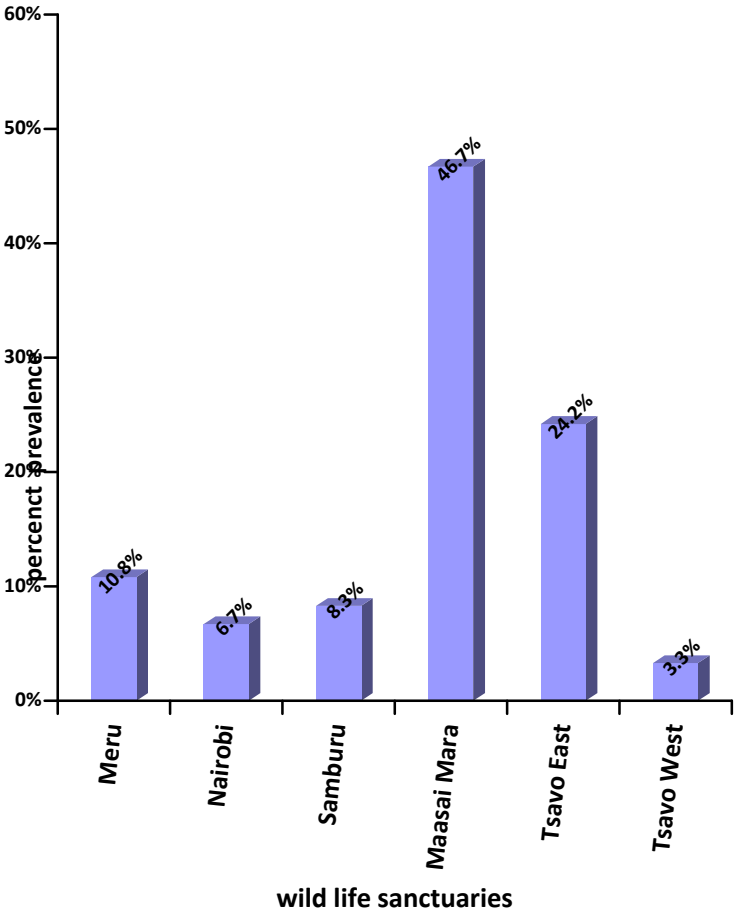

Fig 1: Prevalence of Taeniid Eggs Across Sanctuaries.

3.1.3 Prevalence of Taenia by Park and Animal

Prevalence of taenia in Maasai Mara game reserve was high in lions (*Panthera leo)* at 53 (32.3%) followed by hyenas *(Crocuta crocuta)* 4.7%. No taenia eggs were recovered from feacal samples of 26 wild dogs (*Lycaon Pictus*) and 30 Silver backed jackals (*Canis Mesomelas*) in this sanctuary (Table 2).

Table 2. Prevalence of Taenia in Maasai Mara Game Reserve

Sanctuary	Definitive host	Number of faecal samples examined	Number of samples positive for taenia	Percent prevalence
Maasai Mara	Lion *(Panthera leo)*	164	53	32.3%
	Spotted hyena*(Crocuta crocuta)*	64	3	4.7%
	Wild dogs *(Lycaon pictus)*	26	0	0
	Silver-backed jackal *(Canis mesomelas)*	30	0	0
	Total	**284**	**56**	**19.7%**

In Tsavo East National parks, where 180 faecal samples were collected again the highest prevalence was recorded in lions (*Panthera leo*) at 26 (18.1%). The hyena (*Crocuta crocuta*) had a prevalence of 21.4%. No taena eggs were recovered from the eight silver backed jackals (*Canis Mesomelas*) and fourteen wild dogs (*Lycaon pictus*) faecal samples.

Table 3: Prevalence of Taeniid Eggs Among the Canines in Tsavo East National Park

Sanctuary	Definitive host	Number of faecal samples examined	Number of samples positive for taenia	Percent prevalence
Tsavo East	Lion*(Panthera leo)*	144	26	18.1%
	Spotted hyena *(Crocuta crocuta)*	14	3	21.4%
	Silver-backed jackal*(Canis Mesomelas)*	8	0	0.0%
	Wilddogs *(Lycaon pictus)*	14	0	0.0%
	Total	**180**	**29**	**16.1%**

Three of the ten (30%) hyena (*Crocuta crocuta*) samples from Meru National parks were found positive for taeniid eggs. Overall prevalence was however high in samples of lions (*Panthera leo*) in this park at nine (24.3%). Only one (6.7%) of the fifteen wild dogs (*Lycaon Pictus*) samples was positive for taenia and none in twelve jackals (*Canis Mesomelas*) samples collected.

Overall prevalence in Nairobi national park was 8 (15.1%). In thirty four lions samples the prevalence was 7 (20.6%)) while in thirteen faecal samples of jackals, one (7.7%) had the infection. Of the six samples from hyenas none had taenia infection. No wild dog samples were found in this park.

Taenia prevalence in Samburu game reserve was 10 (10.5%). Individual animal prevalence included 12.9% in lions (*Panthera leo*), 6.5% in hyena (*Crocuta crocuta*), 12.0% in Wild dogs (L*ycaon pictus*) and 12.5% in jackal (*Canis Mesomelas*) faecal samples. The least prevalence was recorded in Tsavo west National Park where out of 146 samples collected from the four studied animal categories, only four (2.7%) were positive for taenia infection. These included 3 (15.0%) wild dogs (*Lycaon pictus*) and 1 (5.0%) hyena (*crocuta crocuta)* samples.

Table 4: Prevalence of Taeniid Eggs Among the Canines in Meru , Nairobi, Samburu and Tsavo West Wild life Sanctuaries

Sanctuary	Samples	Lion (*Panthera leo)*	Spotted hyena *(Crocuta crocuta)*	Silver-backed jackal*(Canis mesomelas)*	Wild dogs *(Lycaon pictus)*
Meru National park	No. Sampled No. positive	37 9(24.3%)	10 3(30%)	12 0(0%)	15 1(6.7%)
Nairobi National park	No. Sampled No. positive	34 7(20.6%)	6 0(0%)	13 1(7.7%)	0 0(0%)
Samburu Game reserve	No. Sampled No. positive	31 4(12.9%)	31 2(6.5%)	8 1(12.5%)	25 3(12.0%)
Tsavo west National park	No. Sampled No. positive	89 0(0%)	20 1(5.0%)	17 0(0%)	20 3(15.0%)

4. Discussion

Prevalence of taenia infection was high in the lion (*Panthera leo*) populations in this study as compared to other study animals. Many studies have been reporting existence of helminhts and other zoonotic parasites within wildlife conservation areas (Gómeza *et al.,* 2013; Guerra et al 2013) . The results of this study does not agree with studies of Peter *et* al., (1990) who found out that the highest infection rates was in wild dogs (*Lycaon pictus*). The population of wild dogs is reported to be in decline in Kenya by recent studies (Gathura *et al.,* 1990*;* Mahmud *et al.,* 2010) and probably this explains why results of this study appear different. Hyenas also show a high infection rate in almost all the parks which agree with the study by (*Ann et al.,* 2003) whose findings are in concurrence for hyenas in Maasai mara. However in Nairobi National park where only six hyena samples were collected, none had taenia infection. This is likely to be because Nairobi National Park is smaller in size compared to the other parks and also animal populations in this park are fewer. Nevertheless it is worth noting that a bigger percentage of lion samples collected in this park had taenia eggs. Very low infection rates were recorded in both wild dogs and jackals in the park.

Overall, the prevalence of taenia infection in wild dogs and jackals across all the parks where samples were collected turned out to be low as compared to those of lions and hyenas. Notwithstanding the low numbers of animals sampled, the study presents an entry point for future large scale studies of the epidemiology and ecology of diseases such as *Echinococcosis* and other taenia related infections in Kenya and other African countries. Further and more importantly the study indicates significant existence of taenia infection in Kenyan wildlife animals and provides opportunities for more targeted studies on molecular epidemiology to enable differentiation of taeniid eggs into different species for development of an appropriate quick diagnostic technique as well as ways to effectively improve control measures against the infection.

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