

Prevalence of *Tritrichomonas foetus* and Common Gastrointestinal Parasites In Iowa Shelter Cats

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Abstract

It has been found that up to 40% of shelter animals may be infected with gastrointestinal (GI) parasites. Infection can cause GI disease in animals, but also poses a health risk to humans.¹ A newly recognized GI parasite, *Tritrichomonas foetus*, may be a factor in the development of chronic diarrhea in cats.² *T. foetus* is difficult to identify with light microscopy, and also may be commonly mistaken for *Giardia* sp. or *Pentatrichomonas hominis*.³ In addition to challenging our diagnostic ability, at present there are no effective treatments for eradication or control of *T. foetus* infection.⁴ In fact, attempts to treat cats with *T. foetus*-associated diarrhea in continued high-density housing results in prolongation of clinical signs. Shelter cats are frequently euthanized as a result of their uncertain future health and potential to infect other cats. Polymerase chain reaction (PCR) has been shown to be an effective method of identifying *T. foetus*.⁵ The objective of this study was to determine the prevalence of common GI parasites in shelter cats, as well as to assess the prevalence of *T. foetus*. 100 cats housed in five different Iowa animal shelters were sampled. Presence of GI parasites was determined using zinc sulfate and sugar solution fecal floatations. The prevalence of *T. foetus* was measured using real-time PCR. By means of fecal floatation analysis, it was found that 37% of cats tested were positive for at least one species of a common GI parasite. Real-time PCR analysis found all samples to be negative for *T. foetus*. Our PCR assay was sensitive for *T. foetus* concentrations as low as 10 femtograms (10⁻¹⁵ grams) of DNA/μL. These results may be helpful to animal shelters in establishing effective deworming protocols, as well as help to build upon what is currently known about diagnostic assays for *T. foetus*.

Introduction

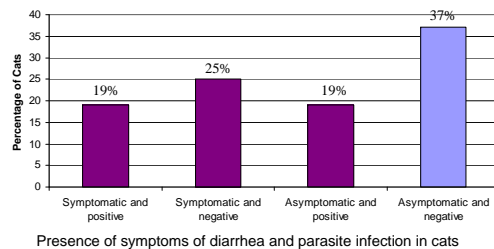
In 2003, an ISU Maddie's summer scholar project found 37.9% of cats and dogs in the Midwest to be gastrointestinally parasitized.⁶ A Georgia study published in 2004, found GI parasitism rates of 39.6% in shelter cats.⁷ In addition to these common GI parasites, *T. foetus* is a newly recognized feline intestinal pathogen that causes large bowel diarrhea in infected cats. *T. foetus* is a flagellated protozoan parasite which establishes a chronic infection in the feline ileum, cecum and colon.⁸ Infected cats frequently reside in densely populated housing⁹, commonplace in animal shelters. Trichomonads have a direct life cycle and infection appears to be spread by fecal-oral transmission. Cats experiencing *T. foetus*-associated diarrhea commonly have cow-pie stools and fecal incontinence, resulting in contamination of the cat's coat and environment with infectious trophozoites. *T. foetus*-associated diarrhea waxes and wanes and is unassociated with other signs of systemic illness. *T. foetus* has been described in other species as well. It is a prevalent and economically important venereal cause of infertility and abortion in naturally bred cattle. The organism has also been described as a parasite of the porcine gastrointestinal and nasal mucosa. In light of the relative lack of host specificity of this organism, and the intimate association between infected cats and their human companions, the potential for zoonotic transmission should be considered.

Statement of Problem

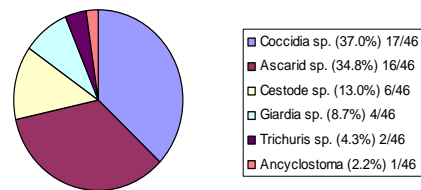
- Diarrhea in shelter cats is a problem nationally; numerous shelter cats are euthanized as a result of their uncertain future health and potential to infect other cats
- Knowledge of parasitism in shelter cats, which may or may not contribute to diarrhea, is of importance to shelters and adoptive families
- *T. foetus* is a newly recognized feline GI pathogen that causes chronic large bowel diarrhea in infected cats and can be misidentified with light microscopy
- Real-time PCR may be the most effective method of identifying *T. foetus*



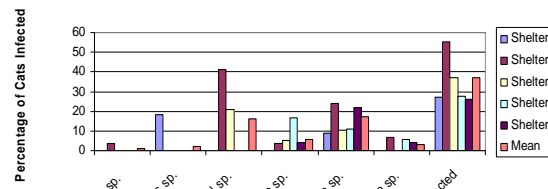
Cat housed in Iowa animal shelter during sampling June 2005



Presence of symptoms of diarrhea and parasite infection in cats

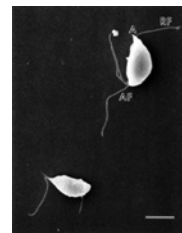


Distribution of gastrointestinal parasite findings

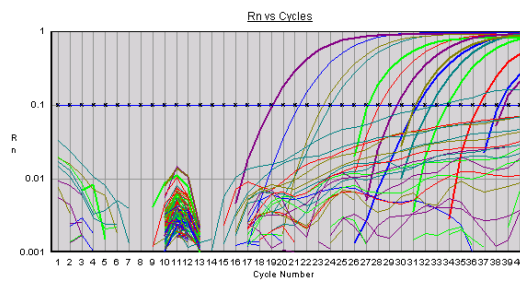


Ranges of GI parasite findings from all five shelters:

<i>Ancylostoma</i> sp.	0 to 3%
<i>Trichuris</i> sp.	0 to 18%
<i>Ascarid</i> sp.	0 to 41%
<i>Cestode</i> sp.	0 to 17%
<i>Coccidia</i> sp.	9 to 24%
<i>Giardia</i> sp.	0 to 7%



Scanning electron micrograph image of *Tritrichomonas foetus*³



Real-time PCR serial dilutions of *T. foetus* and unknown samples #1-33

Specific Aims

- Determine the prevalence of GI parasites in cats housed in Iowa animal shelters using fecal floatation methods
- Assess the prevalence of *T. foetus* in cats housed in Iowa animal shelters using real-time PCR
- Determine whether other factors are associated with GI parasitism

Methods

- A total of 100 samples of freshly voided feline feces were collected from five animal shelters in Iowa during June 2005
- Fecal samples were randomly collected from all cats regardless of health status
 - Samples were transported to ISU, analyzed using zinc sulfate and sugar solution fecal floatation methods for GI parasites, and frozen at -20°C
- DNA was extracted from 200 milligram samples of feces using the Qiagen QIAamp DNA stool minikit
- Real-time PCR was used to identify the presence of *T. foetus* in each sample

Results

- 37% of cats tested were positive for at least one species of a common GI parasite
- Fecal analysis revealed 46 positive findings. Of these:
 - 17 out of 46 (37%) were *Coccidia* sp.
 - 16 out of 46 (34.8%) were *Ascarid* sp.
 - 6 out of 46 (13%) were *Cestode* sp.
 - 4 out of 46 (8.7%) were *Giardia* sp.
 - 2 out of 46 (4.3%) were *Trichuris* sp.
 - 1 out of 46 (2.2%) were *Ancylostoma* sp.
- None of the 100 fecal samples collected and tested showed the presence of *T. foetus* by real-time PCR
 - *Cryptosporidium parvum* or *Escherichia coli* DNA were not amplified during negative control runs
 - A known negative sample spiked with *T. foetus* DNA did amplify
- Our designed PCR primers and probe could detect *T. foetus* DNA at a concentrations as low as 10 femtograms of DNA/μL

Conclusions

- Prevalence of GI parasitism in Iowa shelter cats (37%) is comparable to previous studies
- The designed PCR primers and probe do appear to be specific for *T. foetus*
- Findings of zero samples positive for *T. foetus* does not support *T. foetus* infection in this population. Alternatively, the zero findings could be due to degradation of the organism and DNA during storage
- More work needs to be done on the prevalence of *T. foetus*, including expanding the number of samples collected and improving *T. foetus* diagnostic assays

References

- Spain CV, Scalet JM, Wade SE, et al. Prevalence of enteric zoonotic agents in cats less than 1 year old in central New York State. *J Vet Intern Med* 2001;16:30-38
- Goodin JL, Foster DM, Poole MF, et al. Use of a commercially available culture system for diagnosis of *Tritrichomonas foetus* infection in cats. *J Am Vet Med Assoc* 2003;222:576-579
- Lavy MG, Goodin JL, Poole M, et al. *Tritrichomonas foetus* and not *Pentatrichomonas hominis* is the etiologic agent of feline trichomonad diarrhea. *J Parasitol* 2003;89:9-14
- Foster DM, Goodin JL, Poole MF, et al. Outcome of cats with diarrhea and *Tritrichomonas foetus* infection. *J Am Vet Med Assoc* 2004;225:888-892
- Goodin JL, Strickland AJ, Brinkhoffer ER, et al. Single-labor nested PCR for detection of *Tritrichomonas foetus* in feline feces. *J Clin Microbiol* 2002;40:4126-4130
- Tanakauchi S, Bentley R, Saitoh C. 2003 ISU Maddie's summer scholar research project.
- Carlson RE, Tobert MK. Prevalence of *Giardia lamblia* and gastrointestinal helminths in cats euthanized at animal control agencies in northwest Georgia. *Helv Parasitol* 2004;112:161-166
- Goodin JL, Lavy MG, Law JM, et al. Experimental infection of cats with *Tritrichomonas foetus*. *Am J Vet Res* 2001;62:1690-1697
- Goodin JL, Stebbins ME, Hunt E, et al. Prevalence of and risk factors for feline *Tritrichomonas foetus* and *Giardia* infection. *J Clin Microbiol* 2004;42:2707-2710
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