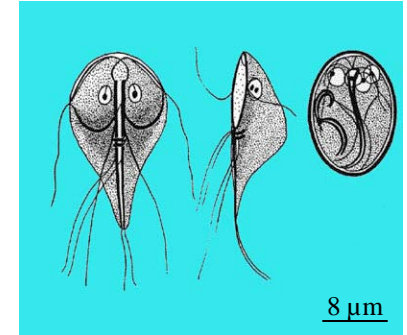


Zoonotic potential of *Giardia duodenalis* in fecal samples from dogs and cats in Ontario

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Giardia duodenalis

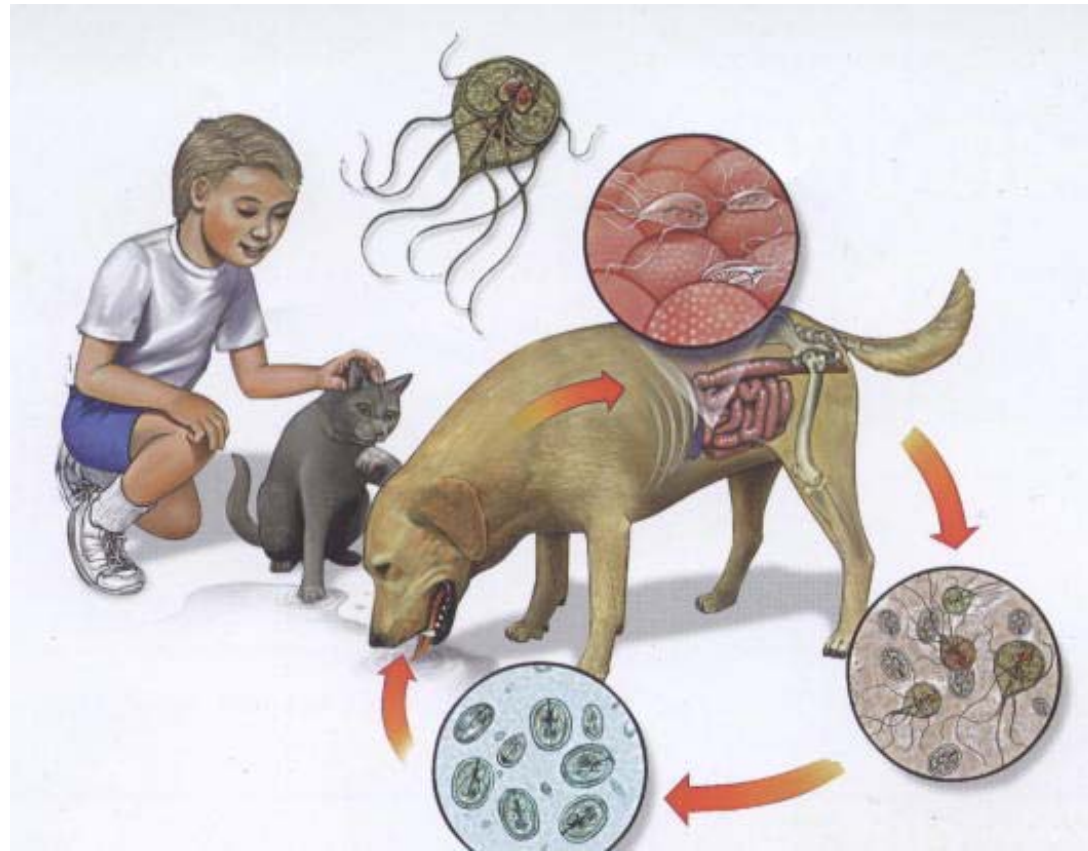


- *Giardia* spp.-flagellated protozoans
- *G. duodenalis* (*lamblia*) causes giardiasis in human and most mammals, therefore is zoonotic.
 - ~7% world's people infected (Bowman & Lynn 1999)
 - Up to ~60% in cattle, sheep, dogs and cats (Ballweber, 2010, Feng and Xiao, 2011)

How common is *Giardia* in dogs in Canada?

- 15 suburban veterinary practices across Canada:
7.2% (86/1,216) dogs positive (Jacobs et al 2001)
- Suburban veterinary practices in Ontario:
9.9% (10/101) dogs positive (Skubic-Vengust 2003)
- Hospital visitation programs in Ontario:
6.9% (7/102) dogs positive (Lefebvre et al 2006)

Are all Giardia duodenalis zoonotic?



<http://www.rhk9klub.ca/archives/1646>

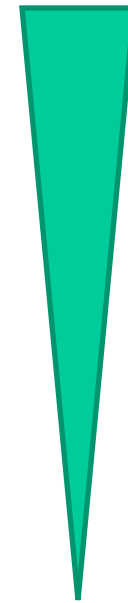
Giardia assemblages

Assemblage	Host specificity	Host range
A	Zoonotic	Humans, livestock, cats, dogs, beavers
B	Zoonotic	Humans, dogs, beavers, rats, chinchillas
C, D	Dog	Dogs
E	Livestock	Cattle, sheep, goats
F	Cat	Cats
G	Rat	Domestic rats
H	Seal	Seal, gull

(Read et al 2004; Feng and Xiao 2011)

Giardia assemblage typing: house keeping gene sequencing

- Small subunit rRNA (*ssu-rRNA*)
- β -giardin (*bg*)
- Glutamate dehydrogenase (*gdh*)
- Triose phosphate isomerase (*tpi*)
- Variant surface protein (*vsp*)
- Elongation factor 1-alpha (*ef1 α*)



popularity

Objectives

- To compare the sensitivity of four PCR-sequencing methods for *Giardia* typing.
- To determine the *Giardia* assemblage types (zoonotic potential) among dog and cat fecal samples in Ontario.

Materials and Methods

- Dog and cat fecal samples submitted to the AHL, University of Guelph, for *Giardia* testing (2008-2010).
- If *Giardia* positive with antigen-ELISA or sucrose wet mount, subjected to PCR-sequencing.
- 118 dog samples, 15 cat samples.
- All examined with four PCR-sequencing methods.

PCR-sequencing methods compared in this study

Gene	PCR product sequenced	Reference
small subunit rRNA (<i>ssu-rRNA</i>)	180 bp	Leonhard et al 2007
β -giardin (<i>bg</i>)	750 bp	Robertson et al 2007
glutamate dehydrogenase (<i>gdh</i>)	432 bp	Robertson et al 2007
triose phosphate isomerase (<i>tpi</i>)	450 bp	Lebbad et al 2010

Assemblage identification

Sequences compared to sequences in Genbank:

- assemblage ID = >99% similarity
 - if (a) different assemblages identified
by different typing methods
(b) mixed sequences
- } mixed
assemblages

Results for dogs

Gene sequenced	Samples tested	Samples typeable	<i>Giardia</i> assemblage type						
			A	B	C	D	E	F	G
<i>ssu-rRNA</i>	118	75 (64%)	-	1	23	51	-	-	-
<i>bg</i>	118	37 (31%)	-	-	3	33	-	1	-
<i>gdh</i>	118	20 (17%)	-	-	4	16	-	-	-
<i>tpi</i>	118	24 (5%)	-	-	4	20	-	-	-

- 9% (7/75) contained mixed types

Results for cats

Gene sequenced	Samples tested	Samples typeable	<i>Giardia</i> assemblage type						
			A	B	C	D	E	F	G
<i>ssu-rRNA</i>	15	13	12	1	-	-	-	-	-
<i>bg</i>	15	4	-	-	-	-	-	4	-
<i>gdh</i>	15	2	-	-	-	-	-	2	-
<i>tpi</i>	15	0	-	-	-	-	-	-	-

- 30% (4/13) contained mixed types

Results for method comparison

- ssu-rRNA + β -giardin PCR-sequencing methods combined identified all single and mixed infections.

Discussion

Infection of dogs with non-zoonotic assemblages

Proportion (n) samples types C/D	Place	Reference
99% (74/75)	Ontario	This study

Discussion

Infection of dogs with non-zoonotic assemblages

Proportion (n) samples types C/D	Place	Reference
99% (74/75)	Ontario	This study
100% (15/15)	Georgia, USA	Sulaiman et al 2003
68% (408/600)	Europe	Sprong et al 2009
31% (40/128)	Western USA	Covacin et al 2011
0% (0/13)	Saskatchewan, CA	Himsworth et al 2010

Association with - socioeconomic status ?

- clinical signs ? (Claerebout et al 2009)

Discussion

Infection of cats with zoonotic assemblages

Proportion (n) samples type A	Place	Reference
92% (12/13)	Ontario	This study

Discussion

Infection of cats with zoonotic assemblages

Proportion (n) samples type A	Place	Reference
92% (12/13)	Ontario	This study
100% (10/10)	Italy	Papini et al 2007
43% (68/158)	Europe	Sprong et al 2009
35% (6/17)	Mississippi/Alabama	Vasilopoulos et al 2007

True zoonotic risk?

Assemblage A divided into 4 subtypes:

- Human: $\frac{3}{4}$ AII; $\frac{1}{4}$ AI
- Animals: $\frac{3}{4}$ AI; $\frac{1}{4}$ AII, all AIII and AIV (Sprong et al 2009; Ballweber et al 2010)

Summary

- Method of choice for *Giardia* assemblage typing: ssu-rRNA + *bg* sequencing.
- Zoonotic potential of *Giardia* appeared to be low in clinically infected dogs in Ontario.

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Public Health
Agency of Canada

Agence de santé
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