The prevalence of intestinal parasites in dogs and cats in Calgary, Alberta

Daniel Joffe, Drew Van Niekerk, France Gagné, John Gilleard, Susan Kutz, Robert Lobingier

Abstract — The prevalence of endoparasites was evaluated in 619 dogs and 153 cats in the Calgary, Alberta region. Both homed and shelter-sourced pets were evaluated, and prevalence was assessed in various age groups. The overall endoparasite prevalence was 16.5% in canine samples and 7.2% in feline samples. The most common intestinal parasites in dogs were Giardia (8.1%) and ascarids (4.2%). The most common feline endoparasite was ascarids (6.5%). This study will help veterinarians to better plan diagnostic and preventative strategies with regard to companion animal intestinal parasites.

Résumé — Prévalence de parasites intestinaux chez les chiens et les chats à Calgary, en Alberta. La prévalence d’endoparasites a été évaluée chez 619 chiens et 153 chats dans la région de Calgary, en Alberta. Des animaux de compagnie provenant de domiciles et de refuges ont été examinés et la prévalence a été évaluée dans les divers groupes d’âge. La prévalence globale d’endoparasites était de 16,5 % dans les échantillons canins et de 7,2 % dans les échantillons félins. Les parasites intestinaux les plus communs chez les chiens étaient Giardia (8,1 %) et les ascarides (4,2 %). Les endoparasites félins les plus communs étaient les ascarides (6,5 %). Cette étude aidera les vétérinaires à mieux planifier les stratégies de diagnostic et de prévention en ce qui concerne les parasites intestinaux des animaux de compagnie.

Introduction

Veterinarians educate clients about parasite control and answer questions from clients concerning parasites and their pets daily. Information on the local prevalence of various endoparasites is valuable, and given the zoonotic potential of some companion animal endoparasites (1), such information is also important for human health care providers.

Several recent publications have documented parasite prevalence in various locations around the world (2–7). Three publications from the United States documented parasite prevalence in large numbers of animals (8–10) and provided regional prevalence data (9,10). Due to regional variations in parasite prevalence, such information is often of limited value outside the specific areas evaluated. In a country as large and environmentally diverse as Canada, data from one region may not be applicable to another area of the country. Relatively recent reports of parasite prevalence in central Canada (11,12) and off the coast of Atlantic Canada (13) are likely not transferable to western Canada. Older Canadian studies in eastern and Atlantic Canada (14,15) are similarly less valuable. Though possibly presenting more regionally relevant data (16–18), older studies in western Canada are likely not presently applicable due to changes in parasite prevention and pet husbandry practices. One recent study reports the parasite prevalence for over 100 dogs from 2 northwest Canadian communities and discusses some effects of husbandry on parasite prevalence (7).

The purpose of the current study was to determine the prevalence of intestinal parasites in a broad demographic spectrum of dogs and cats in Calgary, Alberta in 2009. Samples from stray, surrendered, and currently homed pets of various ages were evaluated, and parasite prevalence was calculated. Data generated from this study will help veterinarians and physicians practicing in this region to better educate their clients and patients about the local prevalence of these parasites and help to guide parasite diagnostic and preventative programs.

Materials and methods

Sample selection

Fecal samples were collected from currently homed and shelter-sourced dogs and cats in the Calgary region between October 2008 and November 2009. Currently homed animals included animals sampled at 9 veterinary clinics. Shelter-sourced animals...
were already housed at the Calgary Humane Society (CHS). The gender and age of each animal was recorded based on dental examination and/or records from the veterinary clinics or the CHS.

All owners were informed of their participation in the survey and signed a waiver for release of patient information. Owners were then asked 3 questions relating to parasiticide use, travel outside the Alberta region, and the use of leash-free environments. Currently homed animals were excluded if they were receiving injectable endoparasite preventive products or had been treated orally or topically with parasiticides within the 6 mo prior to sampling. All currently homed animals were returned to their owner’s care immediately following sampling. The animals sampled at the CHS had not been treated for endoparasites at the shelter. Previous deworming history prior to shelter admission was not available for all animals.

**Sample collection and processing**

A minimum of 2 g of feces was collected from each animal, immediately placed into a plastic container, and stored at 4°C. Samples were picked up for analysis from each clinic daily and were kept refrigerated until they were examined. Fecal specimen processing and parasite identification were conducted at Antech Diagnostics (Irvine, California, USA).

Samples were examined grossly for adult parasites, which were removed and placed in a labeled Petri dish. Feces (2 to 3 g) were mixed thoroughly with 15 mL pre-made zinc sulfate solution (ZnSO₄, specific gravity 1.18) and transferred to a 15-mL conical tube. Additional ZnSO₄ was added to bring the volume up to 15 mL if required, and the solution was centrifuged in a Beckman TJ-6 swinging bucket centrifuge (Beckman, Palo Alto, California, USA) at 500 to 600 × g for 5 min. Following centrifugation, ZnSO₄ was added to form a positive meniscus, onto which a coverslip (22 mm × 22 mm) was placed and left for 5 min. The coverslip was removed, placed on a glass slide and examined by light microscopy. The entire coverslip area was examined using a 10× objective, and 5 fields were spot-checked using the 40× objective. The presence of ova, larvae and/or mites was recorded for each coverslip. When required

**Table 1. Demographics of dogs sampled in the Calgary region between October 2008 and November 2009**

<table>
<thead>
<tr>
<th>Source</th>
<th>Age</th>
<th>n</th>
<th>Mean Age (y)</th>
<th>Age (y) Minimum, Maximum</th>
<th>Gender (%)</th>
<th>Males, Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelter-sourced</td>
<td>&lt; 1 y</td>
<td>47</td>
<td>0.42</td>
<td>0.17, 0.92</td>
<td>53, 45</td>
<td></td>
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<tr>
<td>1 to 2 y</td>
<td>38</td>
<td></td>
<td>1.53</td>
<td>1.00, 2.00</td>
<td>45, 55</td>
<td></td>
</tr>
<tr>
<td>2 y</td>
<td>57</td>
<td></td>
<td>5.39</td>
<td>3.00, 12.00</td>
<td>60, 40</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>142</td>
<td></td>
<td>2.71</td>
<td>0.17, 12.00</td>
<td>54, 46</td>
<td></td>
</tr>
<tr>
<td>Currently homed</td>
<td>&lt; 1 y</td>
<td>144</td>
<td>0.37</td>
<td>0.04, 0.92</td>
<td>48, 51</td>
<td></td>
</tr>
<tr>
<td>1 to 2 y</td>
<td>92</td>
<td></td>
<td>1.51</td>
<td>1.00, 2.00</td>
<td>48, 51</td>
<td></td>
</tr>
<tr>
<td>2 y</td>
<td>241</td>
<td></td>
<td>6.95</td>
<td>2.50, 19.00</td>
<td>58, 41</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>477</td>
<td></td>
<td>3.92</td>
<td>0.04, 19.00</td>
<td>53, 46</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>619</td>
<td></td>
<td>3.64</td>
<td>0.04, 19.00</td>
<td>53, 46</td>
<td></td>
</tr>
</tbody>
</table>

*Not all values sum to 100% due to data not collected.

**Table 2. Demographics of cats sampled in the Calgary region between October 2008 and November 2009**

<table>
<thead>
<tr>
<th>Source</th>
<th>Age</th>
<th>n</th>
<th>Mean Age (y)</th>
<th>Age (y) Minimum, Maximum</th>
<th>Gender (%)</th>
<th>Males, Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelter-sourced</td>
<td>&lt; 1 y</td>
<td>39</td>
<td>0.47</td>
<td>0.17, 0.83</td>
<td>49, 44</td>
<td></td>
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<tr>
<td>1 to 2 y</td>
<td>32</td>
<td></td>
<td>1.50</td>
<td>1.00, 2.00</td>
<td>38, 56</td>
<td></td>
</tr>
<tr>
<td>2 y</td>
<td>14</td>
<td></td>
<td>3.50</td>
<td>3.00, 5.00</td>
<td>57, 29</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>85</td>
<td></td>
<td>1.36</td>
<td>0.17, 5.00</td>
<td>46, 46</td>
<td></td>
</tr>
<tr>
<td>Currently homed</td>
<td>&lt; 1 y</td>
<td>19</td>
<td>0.39</td>
<td>0.17, 0.92</td>
<td>53, 47</td>
<td></td>
</tr>
<tr>
<td>1 to 2 y</td>
<td>8</td>
<td></td>
<td>1.38</td>
<td>1.00, 2.00</td>
<td>13, 88</td>
<td></td>
</tr>
<tr>
<td>2 y</td>
<td>41</td>
<td></td>
<td>8.12</td>
<td>2.50, 17.00</td>
<td>51, 49</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>68</td>
<td></td>
<td>5.17</td>
<td>0.17, 17.00</td>
<td>47, 53</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>153</td>
<td></td>
<td>3.05</td>
<td>0.17, 17.00</td>
<td>46, 49</td>
<td></td>
</tr>
</tbody>
</table>

*Not all values sum to 100% due to data not collected.

**Figure 1.** Age distribution of parasite-positive dogs and cats within each source. ss — shelter-sourced; ch — currently homed.
Statistical analyses
Two datasets were constructed: 1 for dogs and 1 for cats. Each dataset was subdivided into multiple subsets: shelter or currently homed; age < 1 y, between 1 and 2 y, and > 2 y; and combinations of the first 2 subsets. The overall prevalence of infection and the prevalence for each parasite species found were both calculated for the entire dataset and for each data subset. Prevalence (p) was the number of positive samples/total number of samples. A 95% confidence interval was calculated using the formula for a binomial distribution. When there was at least 1 positive sample in the data subset, both the upper and lower confidence limits were nonzero. When there was no single positive sample, only the lower confidence limit was equal to zero, whereas the upper confidence limit was nonzero; this upper confidence limit increased as the sample size decreased. All analyses were carried out using SAS®, Version 9.1.3 (Cary, North Carolina, USA).

Results
Sample demographics
A total of 619 fecal samples were analyzed from shelter-sourced and currently homed dogs (Table 1). Forty percent of the shelter-sourced dogs and 50% of currently homed dogs were older than 2 y of age. Most of the canine samples (77%) were collected from currently homed pets. Samples were evenly distributed between genders, with 53% of samples originating from male dogs.

Most of the feline fecal samples (55%) were from shelter-sourced cats (Table 2). Of these shelter-sourced cats, 84% were 2 y of age or younger. From the fecal samples obtained from all of the cats during the study, only 36% were from cats older than 2 y of age, and most of these samples (75%) from older animals came from currently homed cats. The distribution of samples was comparatively even between genders (46% males, 54% female).

Parasite prevalence in dogs
Gross examination and fecal flotation revealed that 16.5% of canine fecal samples were positive for at least 1 species of parasite. Figure 1 shows the age distribution of dogs with parasite infection. The overall parasite prevalence was 21.1% in shelter-sourced dogs and 15.5% in currently homed dogs. This difference was not significant. In shelter-sourced dogs, parasite prevalence was highest in young dogs, with more than 80% (24/30) of positive samples coming from dogs 2 y of age or younger. A similar pattern was noted with samples from currently homed dogs, with 81% (58/72) of positive samples obtained from dogs 2 years of age or younger.
The most commonly identified parasite in canine feces was *Giardia*, which accounted for almost half of the parasite-positive samples identified. Prevalence of *Giardia* was 9.2% in currently homed dogs compared to 4.2% for shelter-sourced dogs (Table 3); this difference was not significant. *Giardia* was more prevalent in dogs less than 1 y old than in 1- to 2-year-old dogs (P = 0.02) and dogs older than 2 y (P < 0.0001).

Ascarids (*Toxocara canis* and *Toxascaris leonina*) also featured prominently in canine fecal samples (Table 4). For all age-groups, ascariasis infection prevalences were higher in shelter-sourced animals (12%) than in currently homed animals (1.9%, P < 0.0001). Combined *T. canis* and *T. leonina* prevalence was higher in young dogs than in dogs older than 2 y of age. Analyzing samples from shelter-sourced and currently homed dogs together showed that 72.2% of the *T. canis*-positive samples were from dogs less than 1 y old. This age-related prevalence pattern was also true for *T. leonina*-infected currently homed dogs. However, the shelter-sourced dogs most commonly infected with *T. leonina* were 1 to 2 y old.

Only 5 of the 619 dogs were positive for hookworm (*Ancylostoma caninum* or *Uncinaria Stenocephala*) eggs, resulting in a prevalence of 0.81%. No *Trichuris* eggs were identified. Other than *Giardia*, overall gastrointestinal protozoan parasite prevalence in dogs was low (0.048%).

### Parasite prevalence in cats

The overall prevalence of parasite infections in cats in this study was 7.19%. Figure 1 shows the age distribution of parasite-positive cats. *Toxocara cati* was the most commonly recorded parasite in feline samples, being present in 10.5% of shelter-sourced cats and 1.5% of currently homed cats (Table 5). A single shelter-sourced cat was positive for coccidian oocysts, resulting in an overall prevalence of 0.65%. *Giardia* was not detected in any of the feline fecal samples.

### Discussion

This study evaluated the presence of gastrointestinal parasites in 619 dogs and 153 cats, representing a wide demographic range (Table 1). Although the number of fecal samples evaluated was small in comparison to those in recent American studies (8–10), this study represents the largest companion animal parasite prevalence study ever performed in Canada. As endoparasite intensity would be expected to vary based on the degree and type of previous veterinary care (9), it is important to evaluate stray and surrendered animal populations as well as currently homed pets. Additionally, studies have shown variation in parasite prevalence based on age (with younger pets having higher parasite burdens than older pets) (8,9,14), making it valuable to evaluate pets of various ages.

The overall parasite prevalence in dogs in this study was 16.5% and in cats was 7.2%. A comparison of these data with those from prior studies is shown in Table 6. Similar to other studies (5), the overall parasite prevalence in shelter-sourced pets (21.1%) was higher than in homed pets (15.1%). Homed pets are expected to be in better overall health and be better cared for than shelter-sourced pets. It is surprising that the parasite prevalence in the “best-cared-for group” (homed animals over 2 y of age) was still 5.9%.

The most common canine parasites were *Giardia* (8.1% positive samples) and ascarids (4.2% positive samples). The prevalence of hookworm was low (0.81%), no cases of whipworm infection were detected, and low coccidian oocyst prevalence was found. These results are similar to those from the United States, Australia, and the United Kingdom (5,6,8,9) in which ascarids were common, but the prevalence of both hookworms and whipworms was lower in the present study than in several others (5,6,8,). Similar results were found in a small study from Colorado, a geographic locale with environmental similarities to the Calgary area (19). However, a higher prevalence of *Uncinaria* was found (30%) in a study of adult dogs in northern Canada (7).

Ascarids isolated from canine samples included *T. canis* (2.9% prevalence) and *T. leonina* (2.1% prevalence). A recent large American study did not report any *T. leonina* infections (10). Two large surveys (5,8) reported a much higher prevalence of *T. canis* (2.0% and 1.2%, respectively) than *T. leonina* (0.2% and 0.1%, respectively). It has been reported (20) that coyotes (*Canis latrans*) in Alberta are commonly infected with *T. leonina* (95.7%). Much of the parklands in the Calgary region are shared habitats in which dogs and coyotes comingle; this interaction may explain the presence of *T. leonina* in dogs. A study of dogs in northern Canada also showed a high prevalence of *T. leonina* (7).

*Toxocara canis* is of special concern to both veterinarians and medical doctors due to its zoonotic potential (1). We found an overall prevalence of *T. canis* of 2.9% in dogs. This result is higher than the 1.2% prevalence in Australia (5) and lower than...
the 5.0% prevalence in the United States (10). The prevalence of *T. canis* infection in Calgary is significant given that canine infection with this parasite can lead to marked environmental contamination (21). *Toxocara canis* infection was much higher in shelter-sourced animals of all ages (9% in all ages; 19% in <1 y). These findings are consistent with the findings of Little et al (9) and Palmer et al (5), which showed that infection rates in homed animals were less than those of pets from shelters. The present study may have underestimated the true prevalence of *T. canis* in the homed-pet population, as more than half of the dogs evaluated were older than 2 y of age. Overall, consideration of parasite prevalence for each age group may be more useful for the practicing veterinarian.

*Giardia* is also potentially zoonotic. Of all dogs, 8.1% were infected with *Giardia*. Another Canadian study reported a similar prevalence of 7.2% (22), and a prevalence of 9.3% was reported in Australia (5) and Belgium (23). One study conducted in northern Canada (7) reported 0% to 33% prevalence, depending on age group. The zoonotic potential of canine *Giardia* has been debated. Several studies have now shown that dogs can carry both the zoonotic (A assemblage) and the canine-specific (C and D assemblages) subtypes of *Giardia intestinalis* (24–26). Assemblage A has also been isolated from dogs in northern Canada (7). Further investigation to evaluate the strains of *Giardia* in dogs to assess zoonotic potential would be valuable.

*Toxocara cati* eggs were present in 10.6% of shelter-sourced cats and 1.5% of homed cats. This difference may be partly explained by demographics. Most shelter-sourced cats (82%) were younger than 2 y of age, whereas only 40% of homed cats were <2 y old. Shelter-sourced cats maintained a high prevalence for *T. cati* as they aged, with the 1- to 2-y age cohort having a higher rate of infection (12.5%) than the younger age group (10.3%).

The 10.6% *T. cati* prevalence in shelter cats reported here is equal to that reported in a study conducted in Ontario and Quebec (11). Older studies documented higher prevalences than those reported here for shelter cats in Saskatoon (17.3%) (16) and Halifax (25.1%) (14). A study of homed cats from veterinary clinics in the Niagara region of Ontario (12) reported a higher prevalence of *T. cati* 12.2% than that reported in homed cats in the current report. The fact that the cohort of homed cats was skewed towards older animals may have led to the lower overall *Toxocara* prevalence. An increased number of feline fecal samples would also have strengthened these data.

*Giardia* was the most common canine parasite identified in this study, yet no cases of feline *Giardia* were identified. A study in the Niagara region of Ontario evaluating cats brought into veterinary clinics (12) identified *Giardia* in 2.4% of the cats. Another report (11) that examined stray cats in Ontario and Quebec failed to report any instances of feline *Giardia*. Zinc sulfate centrifugation was used to identify the parasite population in fecal samples in the present study; perhaps a higher prevalence of *Giardia* would have been detected had a *Giardia* antigen test been performed (27).

Testing of fecal samples submitted to laboratories (8), samples collected in a general practice setting (10), and samples collected in a shelter setting (11,14,16) would all be expected to yield different results that are difficult to compare. Studies using various methodologies to detect parasites [postmortem evaluation of the intestinal tract (16), simple fecal floatation (9,12,14), and fecal centrifugation (5,8,11)] will yield results that are also difficult to compare. The centrifugation technique used herein has been shown to be a much more sensitive test than the simple floatation method (28). Except for *Giardia*, shelter-sourced dogs and cats had higher parasite burdens than did homed animals. Currently homed animals were not dewormed for a 6-month period prior to sampling, and shelter-sourced animals were not dewormed while at the shelter prior to fecal sampling. However, deworming history prior to shelter admission was not known for all shelter-sourced animals. Prior deworming of these animals may have contributed to underestimation of parasite prevalence in this group. Pet husbandry practices would also be expected to vary among pet owners and are certain to affect parasite burdens. However, no study has critically evaluated the influence of urban pet husbandry practices on endoparasite prevalence (strictly indoor versus indoor/outdoor cats; dogs confined to a backyard versus dogs that frequent “off leash” park areas). For these reasons, it is important that each study documenting parasite prevalence be interpreted only within context of the parameters that were evaluated.

Nevertheless, such studies do provide valuable generalities for veterinary and human health care professionals as to the likely prevalence of various parasitic diseases in the region in which the study was performed. This study is the first to evaluate canine and feline endoparasite prevalence in the Calgary, Alberta region. More companion animal samples were evaluated herein than any Canadian parasite prevalence study previously performed. The findings that *Giardia* and ascarid infections are common in pets in the Calgary region will help veterinarians and physicians to better plan diagnostic and preventative strategies.

References


