Article

A survey of intestinal parasites in dogs from Saskatoon, Saskatchewan

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Abstract — Fresh fecal samples from 124 apparently healthy dogs and 333 random source canine fecal samples from dog walking areas were analyzed by centrifuged flotation in Sheather's solution to determine the prevalence of gastrointestinal parasites in dogs from Saskatoon, Saskatchewan. Fecal flotation was positive in 4.4% of samples. Roundworm species were found in 1.5% of samples, hookworm species were found in 0.4% of samples, whipworm species were found in 0.7%, *Strongyloides* spp. were found in 0.6%, *Giardia* spp., *Cystoisospora* spp., and *Alaria* spp. were found in 0.4% of samples.

Résumé — Enquête sur les parasites intestinaux chez les chiens de Saskatoon, en Saskatchewan. Des échantillons fécaux frais provenant de 124 chiens paraissant en santé ont été analysés par flottaison centrifuge dans une solution de Sheather afin de déterminer la prévalence de parasites gastro-intestinaux chez les chiens de Saskatoon, en Saskatchewan. La flottaison fécale a été positive dans 4,4 % des échantillons. Des espèces de vers ronds ont été trouvées dans 1,5 % des échantillons, des espèces d'ankylostomes ont été trouvées dans 0,4 % des échantillons, des espèces de trichocéphales ont été trouvé dans 0,7 % des échantillons, *Strongyloides* spp. a été trouvé dans 0,6 % des échantillons, tandis que *Giardia* spp., *Cystoisospora* spp. et *Alaria* spp. ont été trouvés dans 0,4 % des échantillons.

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Introduction

There have been no recent surveys to determine the prevalence of intestinal parasites in dogs in western Canada. Studies investigating prevalence in western native communities, Halifax, Nova Scotia, and Kuujjuaq, Quebec were performed in the 1970s and 1980s and a 2007 study by Blagburn et al (1) evaluated fecal samples from shelter dogs and cats in Ontario and Quebec, but did not include client-owned animals (1–4). A necropsy survey of cats from 1999 and a survey of 3370 canine fecal samples from 1971 are the only previously published evaluations of intestinal parasitism in Saskatchewan (5,6).

Comparable studies with published reports have been performed in various locations throughout the continental United States and the rest of the world. Two large recent nationwide studies in the United States include information from northern states bordering western Canadian provinces; these serve as the most representative data for intestinal parasitism prevalence in this region (7,8).

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Given the lack of current and reliable knowledge about the prevalence of intestinal helminths, it has been difficult for veterinarians to develop logical deworming recommendations for patients under their care. These protocols are important not only for the health of animals, but also for humans who come into contact with dogs or their feces. Several intestinal helminths of dogs including *Toxocara canis, Ancylostoma braziliense,* and *Ancylostoma caninum* are important causes of zoonotic disease, including cutaneous, visceral, and ocular larva migrans and eosinophilic enteritis (9,10).

Materials and methods

Fecal samples were collected during routine annual examination of 124 apparently healthy patients during rectal palpation or by utilizing samples less than 3 h old brought in by the owner at the time of examination. Patients with underlying immunosuppressive or gastrointestinal diseases and patients dewormed within 6 mo of sampling were excluded. Owners were asked to complete a survey investigating risk factors for parasitism including origin of the dog, housing status, medical history, and activity level.

A total of 333 fecal samples were collected randomly from free-standing or bagged samples removed from garbage cans in parks, walking trails, and off-leash dog parks throughout Saskatoon. Random samples were collected between 9:00 am and noon in order to obtain fresh samples. Fecal samples from the 124 client-owned dogs and the 333 random fecal samples were all collected between May and October 2008–2009.

Fecal samples were submitted to Prairie Diagnostic Services Laboratory (PDS) for preparation and evaluation. A tongue depressor was used to place approximately 5 g of feces into

Table 1. Prevalence of intestinal parasites in fecal samples from dogs in Saskatoon

	Total	Client-owned	Random
Total (%) (95% confidence interval)	4.4 (0.025–0.063)	7.2 (0.021–0.108)	3.6 (0.016–0.056)
Roundworm (total, %)	1.5 (0.004–0.027)	2.4 (-0.003–0.052)	1.2 (0.000–0.024)
Toxocara canis	0.2 (-0.002–0.006)	0.8 (-0.008–0.024)	0
Toxascaris leonine	0.65 (-0.001–0.014)	1.6 (-0.006–0.039)	0.3 (-0.003–0.009)
Unidentified ascarid spp.	0.65 (-0.001–0.014)	0	0.9 (-0.001–0.019)
Hookworm	0.4 (-0.002–0.010)	1.6 (-0.006–0.039)	0
Whipworm	0.7 (-0.001–0.014)	0.8 (-0.008–0.024)	0.6 (-0.002–0.014)
Strongyloides spp.	0.6 (-0.001–0.014)	0	0.9 (-0.001–0.019)
Giardia sp.	0.4 (-0.002–0.010)	0	0.3 (-0.002–0.014)
Cystoisospora spp.	0.4 (-0.002–0.010)	0.8 (-0.008–0.024)	0.3 (-0.003–0.009)
Alaria spp.	0.4 (-0.002–0.010)	1.6 (-0.006–0.039)	

a paper cup. Sheather's solution (40 mL) was added to each sample and mixed well. (Sheather's solution is prepared by PDS using 39.66 mL formaldehyde, 3000 g white sugar, and 2346 mL distilled water to create a solution with a specific gravity of 1.26.) The mixture was filtered through cheesecloth into a second cup, and then poured into a 16 × 125 mm test tube until it was 0.5 cm from the top. Sheather's solution was used to fill the tube until a convex meniscus formed. A 22 × 22 mm cover slip was then placed over the top of the tube. The samples were then centrifuged at 300 × *g* for 10 min. After centrifugation, the cover slips were lifted vertically off the tube and placed on a glass slide. The slides were examined using a standard light microscope (100× magnification). Quality control was ensured by strict adherence to standard operating procedures and laboratory hygiene.

A computer program was used for statistical anaylsis (STATA; StataCorp, College Station, Texas, USA) utilizing the chi-squared test to assess risk factor significance and to compare the samples from client-owned dogs and the random samples. Significance was assigned to $P < 0.05$.

Results

The overall prevalence of intestinal parasites was 4.4% (Table 1). Roundworm species [*Toxocara canis* (0.2%), *Toxascaris leonina* (0.65%), and undetermined ascarid species (0.65%)] were found in 1.5% of samples; hookworm species *(Uncinaria stenocephala)* in 0.4% of samples; whipworm *(Trichuris vulpis)* in 0.7% of samples; *Strongyloides* spp. in 0.6% of samples; and *Giardia, Cystoisospora* spp., and *Alaria* spp. in 0.4% of samples. Positive samples were identified in every month of the study, May through October.

The prevalence of intestinal parasites within the client-owned dogs was 7.2% (Table 1). Roundworm species were identified in 2.4% of samples, with *Toxocara canis* accounting for 0.8% and *Toxascaris leonina* accounting for 1.6%. Hookworm species were identified in 1.6% of samples, whipworm species were found in 0.8% of samples, *Cystoisospora* spp. were found in 0.8% of samples and *Alaria* spp. were found in 1.6% of samples.

The prevalence of intestinal parasites within the random sample population was 3.6% (Table 1). Roundworm species were identified in 1.2% of samples, with *Toxascaris leonina* accounting for 0.3% and unidentified ascarid species accounting for 0.9%. Whipworm species were found in 0.6% of samples, *Strongyloides* spp. were found in 0.9%, *Giardia* sp. were found in 0.6% of samples, and *Cystoisospora* spp. were found in 0.3% of samples. No hookworm species were identified in the random samples.

No significant difference was found between the 2 groups with respect to parasitology results. Age, sex, castration status, leash use, dog park visitation, the presence of other dogs in the household, and vomiting or diarrhea within 1 mo of sampling were evaluated as risk factors for parasitism. No significant correlation was found between any of the proposed risk factors and a positive fecal flotation.

Discussion

This study establishes prevalence data for intestinal parasitism in dogs from Saskatoon. Given that prevalences established with a single fecal floatation underestimate true prevalence, our data should be considered the minimal level of parasite infestation (11). The overall prevalence of 4.4% identified here is notably lower than the prevalences identified in the Midwest (14.9%) and western United States (14.0%) in a 2009 study

by Little et al (7). These regions contain states that border western Canada and offer the closest geographic data available for comparison. The prevalence of ascarid eggs in that study (7) was 2.2%, matching the prevalence for ascarids found herein. Hookworm and whipworm eggs were identified less frequently in the current study (7). Direct comparison of these data and the current study results is complicated by the use of different fecal flotation methodologies. Little et al (7) used 33% zinc sulfate, which may increase the identification of *Giardia* sp. and *Cystoisospora* spp. when compared with the sugar flotation solution used in the current study.

A study completed between 2003 and 2006 examined fecal samples from different geographic regions defined by the United States Center for Disease Control, with the West-North region being most closely comparable to western Canada (8). *Toxocara* spp. were found in 4.53% of samples, *Ancylostoma* spp. were found in 2.32% of samples, and *Trichuris* spp. were found in 1.12% of samples (8). Though these results are similar in distribution to the results reported here, they indicate a slightly higher prevalence.

The prevalence of *Giardia* spp. in this study is comparable to that reported in West and Midwest divisions of the United States in 1996; however, Blagburn et al (12) used a sucrose solution for their flotation procedure, which has been shown to be unreliable for the identification of *Giardia* spp. Both the 1996 study and the current study found a much lower prevalence of *Giardia* spp. than that identified by Little et al (7) in the Midwest and western US in 2009. Little et al (7) described a prevalence of giardiasis of 4.0% in the United States as a whole and 3.9% and 6.4% in the Midwest and western regions, respectively.

Of note in the current study is the 0.9% prevalence of *Alaria* spp., a species that is rarely documented in dogs in North America (1,5). Dogs and wild mammals typically become infested by ingesting the second intermediate host, a frog or tadpole (5). A survey of 3370 dog fecal samples from Saskatchewan between 1966 and 1969 concluded that while *Alaria arisaemoides* infestation is rare in other regions, it is relatively common in Saskatchewan, with 7% of samples being positive on flotation (6). One report from 1973 identified *Alaria* spp. in 27% to 29% of canine fecal samples around Loon Lake, Saskatchewan and to a lesser extent in Alberta and the Northwest territories (1). A more recent report identified *A. arisaemoides* during exploratory laparotomy of a 4-month-old Labrador retriever pup with a history of vomiting and poor weight gain (13).

Studies examining intestinal parasitism in Saskatchewan performed in 1971 and 1973 determined significantly higher prevalence of all of the parasites identified in the current study (1,6). *Toxocara canis* was found in 27% to 30% of samples, hookworm species in 12% to 46%, whipworms in 3% to 9%, and *Alaria* spp. in 7% to 29% (1,6). The decrease in prevalence rates may be related to the introduction of highly effective and broad-spectrum deworming medications as well as the more widespread use of these products.

Risk factors previously reported to be associated with endoparasitism in dogs include age, sex, reproductive status, median household income, breed size, population, and geographic location (7,8,14). No significant risk factors for parasitism were identified in the current study. The number of samples with known patient history did not allow detection of potentially significant risk factors. A larger sample size from animals with documented histories would likely allow for identification of risk factors for endoparasitism as noted in other studies.

Small sample size, limited geographical sampling area, and a high proportion of patients over the age of 6 mo likely contribute to the relatively low prevalence of parasitism identified. The fact that shelter dogs were not included in this study may also contribute to the low prevalence when compared with other studies. Furthermore, to achieve a more representative picture of endoparasitism in Saskatoon, samples should be collected year round.

A recent survey suggested that many western Canadian veterinarians believe that intestinal parasites are prevalent in this region. When asked to rank prevalence (1 uncommon to 5 very common) of parasites such as roundworms in their patients, the median score was 3.6 (15). This score, in light of the low prevalence identified in the current study, suggests that veterinarians in western Canada have an adequate suspicion of endoparasitism in dogs.

The data presented here indicate that endoparasitism is present in dogs in Saskatoon between the months of May and October. The wide variety of species identified indicates that broad-spectrum anthelmintics should be used for management of endoparasitism in this region. The data presented here do not allow for valid clinical recommendations to be made with respect to prophylactic management.

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Answers to Quiz Corner
Les réponses du test éclair

1. **d)** Mares may show estrual behavior when in anestrus, when pregnant, or when a new horse is added.
d) Les juments montrent un comportement de chaleur lorsqu'elles sont en anœstrus, ou en gestation ou lorsqu'un nouveau cheval est introduit.

2. **d)** Cows in proestrus mount estrous cows.
d) Les vaches qui sont en pro-œstrus montent les vaches qui sont en œstrus.

3. **d)** The black tarry stools suggest gastrointestinal bleeding, such as from an ulcer. Pancreatitis rarely causes gastric or duodenal ulceration.
d) Les fèces noires goudronneuses suggèrent un saignement gastro-intestinal, comme celui provenant d'un ulcère. La pancréatite cause rarement des ulcères gastriques ou duodénaux.

4. **d)** A hepatoma arising from the right side of the liver would displace the pylorus caudomedially as described. Lymphosarcoma is a possibility but is often multicentric and unlikely to cause a solitary large mass in the right cranial abdominal quadrant. Hemangiosarcoma is possible but most likely to affect the spleen on the other side of the abdomen. A linear foreign body may displace the intestine but it is doubtful that it would displace the pylorus as described.
d) Un hépatome provenant du côté droit du foie va déplacer le pylore caudomédialement comme il est décrit. Le lymphosarcome est une possibilité mais il est souvent multicentrique et ne causerait vraisemblablement pas une seule grosse masse dans le gradient crânial droit de l'abdomen. L'hémangiosarcome est possible mais affectera plus probablement la rate située de l'autre côté de l'abdomen. Un corps étranger linéaire peut déplacer l'intestin mais il est douteux qu'il puisse déplacer le pylore comme il est décrit.

5. **c)** Although corticosteroids (e.g., triamcinolone) may cause some gastric disease, nonsteroidal anti-inflammatory drugs (i.e., ibuprofen) are the most consistent cause of severe ulceration.
c) Bien que les corticostéroïdes (p. ex., triamcinolone) puissent causer certaines maladies gastriques, les anti-inflammatoires non stéroïdiens (p. ex., ibuprofène) sont la cause la plus compatible d'ulcération sévère.

6. **d)** Digitoxin has a half-life of over 100 hours in cats. It undergoes extensive hepatic metabolism. It should not be used in cats.
d) La digitoxine possède une demi-vie de plus de 100 heures chez les chats. Elle subit un métabolisme hépatique important. Elle ne doit pas être utilisée chez les chats.

7. **b)** The urine of animals with chronic renal failure is typically more dilute than normal (lower specific gravity).
b) L'urine des animaux souffrant d'insuffisance rénale chronique est caractéristiquement plus diluée que la normale (densité plus faible).

8. **a)** Most mares pass their placenta within 3 hours after foaling. If it has not been expelled by this time it is considered retained.
a) La plupart des juments éliminent le placenta dans les trois heures suivant le poulinage. S'il n'est pas éliminé durant cette période, on le considère retenu.

9. **e)** Selenium-vitamin E deficiency affects other species and ages of animals.
e) La carence en sélénium-vitamine E affecte d'autres espèces et d'autres groupes d'âge.

10 **b)** Although the other signs listed could be consistent with septicemia, antemortem confirmation of septicemia should be based upon blood culture.
b) Bien que les autres signes énumérés puissent être compatibles avec une septicémie, la confirmation antémortem de septicémie doit s'appuyer sur la culture du sang.