Research Article

Presence and Associated Factors of *Ancylostoma* spp. in Domestic Cats from Mexico City, Mexico Associated Factors of *Ancylostoma* spp. in Domestic Cats

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Abstract | Infections caused by nematodes of the genus *Ancylostoma* represent a concern in feline medicine and public health because of their clinical impact and zoonotic potential. This study assessed *Ancylostoma* spp. positivity and associated factors in fecal samples from domestic cats in Mexico City, Mexico. A cross-sectional study was conducted over 24 months at a feline-specialized private veterinary hospital using convenience sampling. Eligibility required residence in Mexico City, signed owner informed consent, and availability of fecal samples; cats not meeting these criteria were excluded. The collection procedure comprised three consecutive samples per animal, processed separately immediately on laboratory receipt without storage, and examined within 24 h of collection using Mini-FLOTAC®. Epidemiological information was obtained through owner questionnaires. Of 111 fecal samples examined, 49 were positive (44.1%). Exploratory chi-square tests and unadjusted odds ratios examined cohabitation, bathing and brushing, hunting, insect predation, and neutering status. The male-versus-female confidence interval included the null value (OR = 2.17; 95% CI: 0.99–4.72), providing inconclusive evidence of an association. Age, outdoor access, FeLV/FIV status, raw meat consumption, and recent deworming were not statistically significant at the specified threshold. Findings are exploratory and describe sample positivity rather than animal-level prevalence. Convenience sampling, owner-reported exposures, repeated sampling, and absence of multivariable adjustment limit generalizability and preclude causal interpretation or identification of independent risk factors.

Keywords | Nematodes, Cats, Diagnosis, Mini-FLOTAC®

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INTRODUCTION

Infections caused by nematodes of the genus *Ancylostoma* (hookworms) represent a major concern in feline medicine and public health worldwide (Taylor *et al.*, 2016; Bowman, 2021). These hematophagous helminths inhabit the small intestine of their hosts and may cause enteritis, weight loss, malnutrition, and anemia, particularly in kittens and immunocompromised animals (Bowman, 2021; Bowman *et al.*, 2002; Traversa, 2012).

In cats, *Ancylostoma* tubaeforme and *Ancylostoma braziliense* are important hookworms. The former is a principal feline hookworm, whereas the latter is associated with cutaneous larva migrans (CLM) in humans (Traversa, 2012; Bowman *et al*., 2010). *Ancylostoma ceylanicum* also has zoonotic importance, reinforcing the need to distinguish genus-level detection from species identification (Traub, 2013).

Cutaneous larva migrans occurs when infective larvae actively penetrate human skin following contact with soil or sand contaminated with feces from infected animals, a scenario commonly observed in warm and humid environments (Heukelbach and Feldmeier, 2008). Consequently, hookworm infections in companion animals represent a significant public health concern in urban and peri-urban areas with high densities of dogs and cats (Robertson *et al*., 2000; Traversa, 2012).

Epidemiological studies have documented the presence of *Ancylostoma* spp. in feline populations worldwide, with differences related to study populations and diagnostic methods (Zajac and Conboy, 2012; Traversa, 2012). In Mexico, Rodríguez-Vivas *et al*. (2001) reported *Ancylostoma* in feline fecal samples submitted to a diagnostic laboratory in Yucatán, whereas Cantó *et al*. (2013) examined free-roaming cats in Querétaro using postmortem parasitological examination. More recently, Segura-Tinoco *et al*. (2025) examined feline parasitism across Mexico and assessed associated factors using multivariable analysis. In Mexico City, Iturbe Cossío *et al*. (2021) previously examined intestinal parasites and owner-reported factors in cats attending a feline medical center. The present investigation therefore does not address an absence of feline clinical studies in the city; its contribution is an *Ancylostoma*-focused assessment using Mini-FLOTAC in the sampled hospital setting.

Additionally, individual factors such as age, outdoor access, contact with other animals, and management practices may increase the risk of infection in domestic cats (Beugnet *et al.,* 2014; Traversa, 2012).

In this context, epidemiological surveillance of enteroparasites in cats is essential for both veterinary practice and zoonotic disease prevention (Robertson *et al*., 2000; Beugnet *et al*., 2014). Coproparasitological diagnosis remains the standard method for detecting hookworm eggs; however, its performance depends on the concentration technique, parasite burden, and operator expertise (Dryden *et al*., 2005).

The Mini-FLOTAC® technique permits qualitative detection and quantitative evaluation of parasitic elements in feces without the centrifugation required by the original FLOTAC procedure (Cringoli *et al*., 2017; Cringoli *et al*., 2010; Barda *et al*., 2013). Its standardized procedure facilitates reproducible coproparasitological examination. Therefore, the aim of this study was to determine the frequency of *Ancylostoma* spp. positivity and explore associated demographic, behavioral, and management factors in fecal samples from domestic cats attending this hospital. The study addresses a defined clinical setting rather than estimating prevalence in the general feline population of Mexico City.

MATERIALS AND METHODS

A cross-sectional study was conducted over 24 months at a private veterinary hospital specialized in feline medicine in Mexico City, Mexico. Non-probability convenience sampling was used. Eligible cats resided in Mexico City, had signed owner informed consent, and had fecal samples available. Cats residing outside Mexico City, those whose owners did not sign informed consent, and those without fecal samples were excluded. No a priori sample-size calculation was performed; the study size was determined by the eligible samples available during the study period, yielding an analytical total of 111 fecal samples.

Owners were instructed to collect three consecutive fecal samples per animal, each weighing at least 50 g, in sterile plastic containers while avoiding soil or litter contamination. Samples were transported in insulated coolers at approximately 4 °C and processed separately immediately upon laboratory receipt, without storage. Analysis was completed within 24 h after collection. The 50-g collection quantity was distinct from the 2-g aliquot used for Mini-FLOTAC. Positivity was calculated per fecal sample.

Epidemiological information was obtained using a structured owner questionnaire based on the instrument previously used in the Mexican CEME Gatos study by Iturbe Cossío *et al*. (2021). This published antecedent provided the methodological basis for the questionnaire used in the present investigation. All owners signed informed consent, and the same veterinarian administered the questionnaire to all participants, providing consistency in interview administration. The questionnaire covered demographic characteristics, health status, and behavioral and management practices. Sex was categorized as female/male; animal contact and outdoor access were recorded as yes/no; owner-performed brushing was recorded as daily, weekly, monthly, or never. Additional variables included bathing, cohabitation with dogs, raw meat consumption, hunting, insect predation, sleeping in the owners' room, neutering, FeLV/FIV status, vaccination, deworming, and fecal testing. Brushing refers to an owner management practice rather than feline self-grooming. The questionnaire domains and administration are described in

Supplementary Description S1.

All samples were analyzed by personnel experienced in the detection of feline parasitic forms at the laboratory of Hospital Veterinario Dermavet. Fecal samples were processed using Mini-FLOTAC®, following the published procedure for fresh cat and dog feces (Cringoli *et al*., 2017), which expands the general description cited by Capuozzo *et al*. (2024). A 2-g aliquot was homogenized with 18 mL of sodium chloride flotation solution (FS2; NaCl; specific gravity 1.20), giving a 1:10 dilution. The suspension was mixed in Fill-FLOTAC, filtered through its integrated filter, and used to fill both 1-mL chambers. After 10 min of flotation without centrifugation, the reading disc was rotated approximately 90° and both chamber grids were examined microscopically. At this dilution and 2-mL examination volume, the multiplication factor is 5, corresponding to a theoretical analytical detection limit of 5 eggs per gram. Results were used qualitatively to identify positive samples; egg counts are not reported. Egg detection was reported as *Ancylostoma* spp.; species-level identification was not performed.

Statistical analysis

Categorical variables were examined using chi-square tests and unadjusted odds ratios (ORs), with $p \leq 0.05$ as the significance threshold. Analyses were performed using JMP 8.0. These univariable analyses explored associations with *Ancylostoma* spp. sample positivity; no multivariable adjustment was performed. ORs were interpreted in relation to their reference categories and confidence intervals. For sex, the 95% confidence interval included 1, so the evidence was considered inconclusive despite the originally reported p value. Potential confounding, multiple comparisons, and correlation between consecutive samples from the same animal were considered when interpreting the findings.

RESULTS

Ancylostoma spp. eggs were detected in 49 of 111 fecal samples (44.1%). Age was not significantly associated with positivity (p = 0.20). The reported comparison for kittens yielded OR = 2.10 (95% CI: 0.82–5.35). The male-versus-female comparison yielded OR = 2.17 (95% CI: 0.99–4.72; p = 0.04). The 95% confidence interval includes the null value of 1; sex is therefore not classified as an established association. The reported p value and confidence interval differ in their threshold classification; interpretation is therefore conservative.

Outdoor access was not significantly associated with positivity (p = 0.08). Cohabitation with dogs (p = 0.0001) and cohabitation with other cats (p = 0.0001) were associated with sample positivity in the reported univariable comparisons.

Regarding management practices, bathing status (p = 0.0009) and owner-performed brushing status (p = 0.04) were associated with sample positivity. Consumption of raw meat was not significantly associated (p = 0.64). These comparisons do not establish that bathing or grooming prevents infection.

Hunting behavior showed a significant association (p = 0.0003), as did insect predation (p = 0.0001), identifying exploratory associations. Sleeping in the same room as the owners was not significantly associated (p = 0.39).

Neutering status was associated with sample positivity (p = 0.0001). FeLV status (p = 0.20), FIV status (p = 0.25), and up-to-date vaccination status (p = 0.056) did not meet the significance threshold. Time since last deworming and routine coproparasitological testing were reported as nonsignificant. These findings concern unadjusted comparisons and do not establish absence of a biological relationship.

DISCUSSION

This study confirms that *Ancylostoma* spp. is present in domestic cats treated at a specialized veterinary hospital in Mexico City, indicating that feline ancylostomiasis remains a relevant issue in small animal clinical practice and public health. According to Taylor *et al*. (2016), hookworms are among the most important gastrointestinal nematodes in domestic carnivores, while Bowman (2021) highlights their clinical impact, particularly in kittens and immunocompromised individuals, in whom infection may lead to hemorrhagic enteritis, anemia, and deterioration of body condition. The zoonotic relevance, especially of *Ancylostoma braziliense*, has been widely documented by Traversa (2012), who describes its role in the etiology of cutaneous larva migrans (CLM). Thus, although hookworm infections have traditionally been associated with rural environments, urban settings have increasingly highlighted their epidemiological importance. The observed 44.1% is a frequency among fecal samples rather than an estimate of the proportion of unique cats infected. This distinction is necessary because consecutive samples were collected from each animal.

Mexican studies illustrate differences in the populations and diagnostic methods used to investigate feline parasites. Rodríguez-Vivas *et al*. (2001) examined diagnostic submissions in Yucatán, and Cantó *et al*. (2013) investigated cats from an animal control center in Querétaro. The broader survey by Segura-Tinoco *et al*. (2025) provides national evidence on parasitism and associated factors. Differences from the present results cannot be attributed

to climate, indoor conditions, or diagnostic sensitivity alone because the studies differ in recruitment, diagnostic procedures, and denominators. The earlier Mexico City clinical study by Iturbe Cossío *et al*. (2021) is also a relevant comparator, but findings across studies cannot be treated as interchangeable because the parasites examined and diagnostic approaches differ.

Regarding demographic factors, age was not significantly associated with positivity, although the point estimate for kittens exceeded 2. Young animals can be particularly susceptible to the clinical effects of hookworms (Taylor *et al*., 2016; Bowman, 2021), but this does not establish an age effect in the present sample. The reported male-versus-female OR was 2.17, with p = 0.04 and a 95% CI of 0.99–4.72. The interval includes the null value of 1 and does not provide conclusive evidence of an association at the 95% confidence level. Behavioral differences are possible explanations, but roaming and contact patterns were not directly tested as mediators, and sex cannot be identified as an independent risk factor.

Cohabitation with dogs and other cats was associated with sample positivity. Shared environmental exposure is a plausible explanation in view of the hookworm life cycle, which includes development of infective larvae in suitable environments (Taylor *et al*., 2016; Traversa, 2012). However, environmental contamination and infection in cohabiting animals were not measured. The associations therefore do not demonstrate transmission between animals or identify the direction of transmission.

Outdoor access did not reach statistical significance, which does not establish that indoor transmission is equally or more important than outdoor exposure. Hunting and insect predation were associated with positivity. Although some hookworms may use paratenic hosts (Bowman, 2021), this study did not examine prey or insects and cannot demonstrate the acquisition route. Hunting may also be correlated with other exposure and management variables, which were not jointly evaluated.

Hygiene-related variables were associated with sample positivity. Bathing and grooming could reflect broader differences in management or exposure, but the study did not test their preventive effects or measure contamination of the hair coat. Owner-reported behaviors are also susceptible to recall and reporting error. These results should not be interpreted as evidence that bathing or grooming independently prevents intestinal hookworm infection. The questionnaire was based on the published CEME Gatos instrument (Iturbe Cossío *et al*., 2021), and all interviews were conducted by the same veterinarian.

Neutering status was associated with sample positivity. Neutering is relevant to feline population management, and the reproductive potential of free-roaming cats has been documented (Levy and Crawford, 2004; Nutter *et al*., 2004). These publications do not establish that neutering prevents hookworm infection. In this study, the observed association may be confounded by sex, age, hunting, or other management factors. Without multivariable analysis, an independent or protective effect of neutering cannot be inferred.

Regarding clinical factors, FeLV and FIV were not significantly associated with sample positivity. The clinical consequences of retroviral infection are well recognized (Little *et al*., 2020), but the present comparisons do not measure immune function or establish equivalence between viral-status groups.

Time since last deworming was not significantly associated with sample positivity. Reinfection, treatment selection, dosing, and adherence are possible considerations in parasite control (Taylor *et al*., 2016; ESCCAP, 2021), but these mechanisms were not evaluated here. Consequently, the findings do not demonstrate treatment failure or establish the effectiveness of any deworming regimen.

Up-to-date vaccination status did not meet the significance threshold (p = 0.056). Vaccination and regular health checks form part of preventive veterinary care (Day *et al*., 2016), but this does not validate vaccination status as a proxy for comprehensive care or establish a relationship with hookworm prevention in this sample.

The use of Mini-FLOTAC® provides a standardized approach to coproparasitological examination (Cringoli *et al*., 2017). Capuozzo *et al*. (2024) discuss the FLOTAC family in the context of automated egg detection; their study does not establish the diagnostic sensitivity achieved in these feline samples. No direct comparison with another technique was performed here, so the observed frequency should not be described as a more accurate estimate than those from earlier Mexican studies.

The presence of *Ancylostoma* spp. eggs supports the relevance of parasite surveillance and owner education within a One Health framework (Robertson *et al*., 2000; Traversa, 2012). However, genus-level detection does not identify a zoonotic species, and this study did not examine humans or quantify human infection risk.

The convenience sample from a single private hospital limits generalizability. The cross-sectional design does not establish temporality or causation. Although all interviews were conducted by the same veterinarian, owner-reported behaviors remain susceptible to recall and reporting error. Univariable analyses do not control for confounding, and

multiple comparisons increase the possibility of chance findings. Consecutive specimens from the same animal may be correlated. The reported frequency therefore describes sample positivity, and the associations should be considered exploratory.

CONCLUSIONS

Ancylostoma spp. eggs were detected in 49 of 111 fecal samples (44.1%) from domestic cats attending a private veterinary hospital in Mexico City. Univariable analyses reported associations with cohabitation, hunting, insect predation, hygiene-related variables, and neutering status. The confidence interval for sex included 1; this comparison was inconclusive. These results describe sample positivity and exploratory associations; they do not establish animal-level prevalence, independent risk factors, or causal mechanisms. Convenience recruitment, owner-reported exposures, repeated sampling, and lack of multivariable adjustment limit generalizability and should guide the design of future studies.

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NOVELTY STATEMENT

This study provides evidence on the occurrence of Ancylostoma spp. infection in cats attending a feline veterinary hospital in Mexico City and its association with demographic characteristics and management practices. These findings contribute local epidemiological information to support parasite prevention and zoonotic risk reduction.

AUTHOR'S CONTRIBUTION

Camilo Romero contributed to the study design. Laura Reyes Clímaco and Ana Quetzalli Marín-Ventura collected and processed the samples. Rafael Heredia performed the statistical analysis. Ariadna Flores and Camilo Romero drafted and revised the manuscript.

Generative AI and AI assisted technology statement

The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

Conflict of interest

The authors have declared no conflict of interest.

REFERENCES

Barda BD, Rinaldi L, Ianniello D, Zepherine H, Salvo F, Sadutshang T, Cringoli G, Clementi M, Albonico M (2013). Mini-FLOTAC, an innovative direct diagnostic technique for intestinal parasitic infections: Experience from the field. PLoS Negl. Trop. Dis., 7(8): e2344.

Beugnet F, Bourdeau P, Chalvet-Monfray K, Cozma V, Farkas R, Guillot J, Halos L, Joachim A, Losson B, Miró G, Otranto D, Renaud M, Rinaldi L (2014). Parasites of domestic owned cats in Europe: co-infestations and risk factors. Parasit. Vectors, 7: 291.

Bowman DD, Hendrix CM, Lindsay DS, Barr SC (2002). Feline clinical parasitology. Ames: Iowa State University Press; 2002. ISBN:9780813820333.

Bowman DD, Montgomery SP, Zajac AM, Eberhard ML, Kazacos KR (2010). Hookworms of dogs and cats as agents of cutaneous larva migrans. Trends Parasitol., 26(4): 162–167.

Bowman DD (2021). Georgis parasitology for veterinarians. 11th ed. St. Louis: Elsevier; 2021. ISBN:9780323543965.

Cantó GJ, Guerrero RI, Olvera-Ramírez AM, Milián F, Mosqueda J, Aguilar-Tipacamú G (2013). Prevalence of fleas and gastrointestinal parasites in free-roaming cats in central Mexico. PLoS One, 8(4): e60744.

Capuozzo S, Marrone S, Gravina M, Cringoli G, Rinaldi L, Maurelli MP, Bosco A, Orrù G, Marcialis GL, Ghiani L, Bini S, Saggese A, Vento M, Sansone C (2024). Automating parasite egg detection: Insights from the first AI-KFM challenge. *Front. Artif. Intell.*, 7: 1325219.

Cringoli G, Maurelli MP, Levecke B, Bosco A, Vercruysse J, Utzinger J, Rinaldi L (2017). The Mini-FLOTAC technique for the diagnosis of helminth and protozoan infections in humans and animals. Nat. Protoc., 12(9): 1723–1732.

Cringoli G, Rinaldi L, Maurelli MP, Utzinger J (2010). FLOTAC: New multivalent techniques for qualitative and quantitative copromicroscopic diagnosis of parasites in animals and humans. Nat. Protoc., 5(3): 503–515.

Day MJ, Horzinek MC, Schultz RD, Squires RA (2016). Guidelines for the vaccination of dogs and cats compiled by the vaccination guidelines group (VGG) of the world small animal veterinary association (WSAVA). J. Small Anim Pract. 2016;57(1): E1–E45.

Dryden MW, Payne PA, Ridley R, Smith V (2005). Comparison of common fecal flotation techniques for the recovery of parasite eggs and oocysts. Vet. Ther., 6(1): 15–28.

European Scientific Counsel Companion Animal Parasites (ESCCAP) (2021). Worm control in dogs and cats. ESCCAP Guideline 01. 6th ed. May 2021. https://www.esccap.org/guidelines/gl1/.

Heukelbach J, Feldmeier H (2008). Epidemiological and clinical characteristics of hookworm-related cutaneous larva migrans. Lancet Infect. Dis., 8(5): 302–309.

Iturbe Cossío TL, Montes Luna AD, Ruiz Mejia M, Flores Ortega A, Heredia Cárdenas R, Romero Núñez C (2021). Risk factors associated with cat parasites in a feline medical center. J. Feline Med. Surg. Open Rep., 7(2): 20551169211033183.

Levy JK, Crawford PC (2004). Humane strategies for controlling feral cat populations. J. Am. Vet. Med. Assoc., 225(9): 1354–1360.

Little S, Levy J, Hartmann K, Hofmann-Lehmann R, Hosie M, Olah G, St Denis K (2020). 2020 AAFP feline retrovirus

testing and management guidelines. J. Feline Med. Surg., 22(1): 5–30.

Nutter FB, Levine JF, Stoskopf MK (2004). Reproductive capacity of free-roaming domestic cats and kitten survival rate. J. Am. Vet. Med. Assoc., 225(9): 1399–1402.

Robertson ID, Irwin PJ, Lymbery AJ, Thompson RCA (2000). The role of companion animals in the emergence of parasitic zoonoses. Int. J. Parasitol., 30(12–13): 1369–1377.

Rodríguez-Vivas RI, Cob-Galera LA, Domínguez-Alpizar JL (2001). Frecuencia de parásitos gastrointestinales en animales domésticos diagnosticados en Yucatán, México. *Rev. Biomed*., 12(1): 19–25.

Segura-Tinoco JC, Morales-Guerrero RE, Pérez-Rivero JJ, Rico-Chávez O, Del Río-Araiza VH, Alcala-Canto Y (2025). Feline parasitic infections, risk factors, and their association with parasitic treatment in Mexico. Parasitologia, 5(3): 48.

Taylor MA, Coop RL, Wall RL (2016). Veterinary parasitology. 4th ed. Chichester: Wiley-Blackwell; ISBN:9780470671627.

Traub RJ (2013). *Ancylostoma* ceylanicum, a re-emerging but neglected parasitic zoonosis. Int. J. Parasitol., 43(12–13): 1009–1015.

Traversa D (2012). Pet roundworms and hookworms: a continuing need for global worming. Parasit. Vectors, 5: 91.

Zajac AM, Conboy GA (2012). Veterinary clinical parasitology. 8th ed. Chichester: Wiley-Blackwell; ISBN: 9780813820538.