

Intestinal Helminth Infections among Domesticated Cats in Malate, Manila, Philippines

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Abstract

Intestinal helminthiasis is a public health issue in developing nations particularly those which have insufficient access to clean water, sanitary infrastructures, and lacks public health education. Due to the zoonotic potential of some intestinal helminths, cats, and other mammalian species with direct contact to humans may act as reservoir hosts and provide a medium for the transmission of zoonotic infections. This study aimed to determine the prevalence of intestinal helminths among domesticated cats in Malate, Manila, Philippines. A total of 25 cat stools were collected, processed using Formol-Ether Concentration Technique (FECT) and were microscopically examined. The overall prevalence of intestinal helminths was 76% (19/25). The intestinal helminths identified include roundworms of phylum Nematoda: *Toxocara cati* (44%) and *Ascaris* spp. (20%), whipworm: *Trichuris* spp. (24%), and hookworm (12%). All of the identified intestinal parasites have zoonotic potential and domestic cats are significant reservoirs of zoonotic intestinal parasites that can facilitate the transmission of infection to humans. Therefore, an innovative one-health approach strategy which includes constant monitoring and control of stray and feral cats, access to potable water, public health education, and more sanitary infrastructures, can help resolve intestinal helminthiasis crisis in the Philippines.

Keywords: Intestinal helminthiasis; cats; zoonosis; prevalence; Philippines

Introduction

Intestinal helminthiasis is a poverty-related disease considered as one of the world's most neglected tropical diseases. Intestinal helminthiasis affects approximately 1.7 billion people globally, primarily in the Caribbean, China, East Asia, and Sub-Saharan Africa. It primarily afflicts around 267 million preschoolers aged 4 to 7 and 568 million school-age children of less than 20 years old (WHO, 2020). Since Asia is one of the most populous continents, it accounts for more than 60% of the global prevalence of intestinal helminths. Philippines, China, and India have the highest prevalence rates among Asian countries (Pullan and Brooker, 2010). In the Philippines, intestinal helminth infections remain as a public health concern due to poverty, cultural and open defecation practices, poor basic

hygiene, limited sanitary infrastructures, deficient nutrition, and a lack of disease awareness (Belizario *et al.*, 2013).

Many intestinal helminths, including *Toxocara* spp. and *Ancylostoma* spp., have been documented to have zoonotic potential, suggestive that they may transmit infectious parasitic diseases from animals to humans. Owing to their exposure to a contaminated environment like soils and water bodies, oral ingestion of raw, undercooked, or contaminated food and water, transmission of zoonotic diseases becomes feasible (Hölzel and Bauer, 2008). The direct proximity and cohabitation between humans and animals including cats, carabaos, dogs, and rats also offers a pathway for zoonotic transmission of these intestinal parasites (Santarém *et al.*, 2011).



A cat may serve as a reservoir host for several helminths and has been demonstrated to play an essential role in the transmission of intestinal helminth infections, particularly considering the vulnerability of children and adults who live with cats who serve as reservoir hosts (Sato *et al.*, 2014). The complex epidemiology and zoonoses of these intestinal parasites contribute to the scarcity of information in the Philippines. The elimination of these parasitic diseases in the country has been extensively impeded by the increased poverty, fragmented health system, inadequate information and research. Low disease awareness among vulnerable populations, as well as the inconsistencies on the implementation of the control, prevention, and treatment programs such as school-based mass drug administration (MDA), care and rehabilitation, vector control, and water, sanitation, and hygiene (WASH) (DOH, 2015).

This study aimed to determine the prevalence of soil-transmitted helminths (STH) among domesticated cats in Manila City and to evaluate the public health importance of zoonotic parasitic diseases. Establishing the correlation between cats, humans, and the environments in which they live can achieve the development of long-term approaches for better preventing, controlling, and consequently eliminating parasitic zoonotic diseases in the country.

Methods

2.1 Collection of Stool Samples

25 stool samples were collected from domesticated cats in urban residences of Malate, Manila (14°33'54"N 120°59'26"E) in May 2022. Collected stool samples immediately placed in pre-labeled stool cups with 10% formalin before they transferred to DLSU Science and Technology Research Center (STRC) Zoology and Parasitology Laboratory for analysis.

2.2 Formol-Ether Concentration Technique (FECT) and Data Analysis

Approximately 1 gram of each cat stool sample transferred in a pre-labelled conical centrifuge tubes (15 ml) and mixed in a 10ml of 10% formalin for 30 minutes for fixation. The 5ml of the suspension strained through a small funnel containing two layers of wet gauze into a 15 ml centrifuge tube. Then 0.9% normal saline solution added to within ½ inch of the top of the conical tube. The solution placed in a centrifuge for 10 minutes at 2000rpm. The supernatant was decanted to leave the 0.5 - 1.5 ml of sedimented material. The sediment resuspended with 10ml of 10% formalin and mixed using wooden stick and about 2 to 4 ml of ethyl acetate added. The screw

cap inserted, and the solution inverted and shaken vigorously for a minimum of 30 seconds. The solution was once more centrifugated at 2000 rpm for 10 minutes to produce four layers. The first three layers removed, and the remaining layer observed for the presence of parasite eggs under the light microscope (WHO, 2019). Non-parametric statistical analysis utilized to determine the prevalence rates of STH in domesticated cats. Data expressed and presented using a table and figure.

2.3 Ethics, Biosafety and Quality Assurance of Samples

Prior to the sample collection, pet owners informed about the methodology and their consent and approval obtained. All animal experiments in this study carried out in full compliance with De La Salle University's Research Ethics Office's (REO) ethical standards. Quality measures used to ensure the reliability and accuracy of the parasitological assessment. These include proper sample collection, utilization of appropriate and uncontaminated reagents, and use of acceptable laboratory techniques. The identification of STH eggs was confirmed by a parasitologist's cross examination. To prevent mistakes and assure data correctness, data encoded in Microsoft Excel software.

Results and Discussion

Overall, four intestinal helminths species detected in domesticated cat feces collected from residences in Malate, Manila. The four intestinal helminths identified in fecal samples were two kinds of nematodes identified as *T. cati* and *Ascaris* spp. (roundworms) and *Trichuris* spp. (whipworm) as well as hookworm (**Figure. 1**).

T. cati roundworm species was the most prevalent intestinal helminth identified in cats. *T. cati* eggs were golden, sub-spherical, and had a thick, rough pitted shell. The detected eggs were roughly 65 by 75 µm in size (Fig. 1A). *Ascaris* spp. is the second most prevalent nematode identified among domesticated cats. Their eggs were round to oval with a thick shell and an external mamillated layer. *Ascaris* spp. eggs measured approximately 40 to 80 µm in length (Figure 1B). The *Trichuris* spp. eggs isolated appeared elongated or barrel-shaped, with a polar plugs at both ends. These eggs were thick-shelled and very resistant to environmental conditions (Fig. 1C). The identified hookworm eggs were transparent thin-shelled bodies with an internal clustered layer which measures about 55 to 75 µm in length and 35 to 42 µm in width (Fig. 1D).

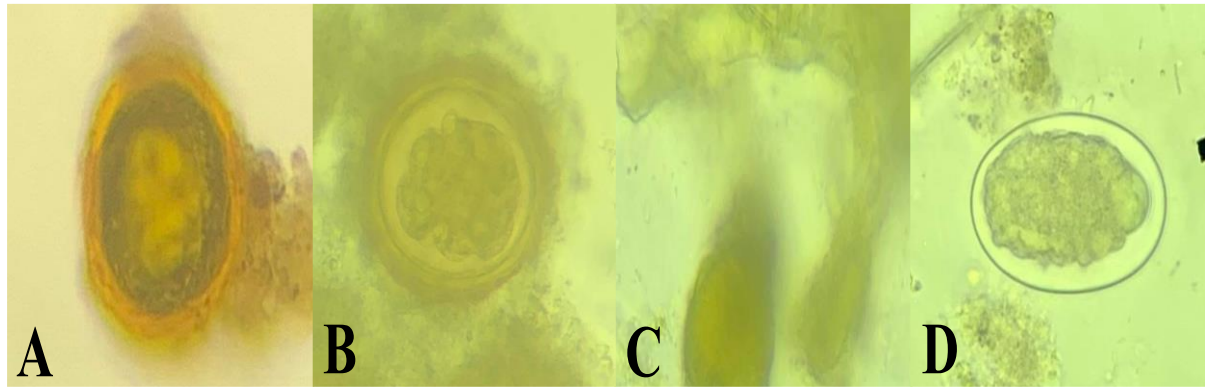


Figure 1. Intestinal helminths identified from cat stool samples using (FECT) under 40x magnification. A.) *Toxocara cati*, B.) *Ascaris* spp., C.) *Trichuris* spp., and D.) hookworm.

Table 1. Prevalence of Intestinal Helminths Among Domesticated Cats in Manila City, Philippines Detected Using Formol-Ether Concentration Technique (FECT)

Intestinal Helminths	Domesticated cats (n=25) No. of infected (%)
<i>Toxocara cati</i>	11 (44.0)
<i>Ascaris</i> spp.	8 (32.0)
<i>Trichuris</i> spp.	6 (24.0)
hookworm	3 (12.0)

Discussion

Intestinal helminths are parasitic worms of several species that cause infectious parasitic diseases in approximately 40 mammalian species, including humans. Intestinal helminthiasis often transmitted in humid, moist environments that are optimal for their growth and development. Human, animal, and environmental transmission commences when infected people or animals contaminate the soil and water with parasite eggs in their feces (Ciddio *et al.*, 2017). Depending on the species, these intestinal helminths transmitted by the accidental ingestion of infective eggs or through the skin penetration of larvae (Ziegelbauer *et al.*, 2012).

Intestinal helminth infections induce greater burden in developing countries, attributable to inadequate sanitation and a lack of access to water (Belizario *et al.*, 2009). Intestinal helminthiasis are highly prevalent in all provinces of the Philippines, covering the three island groups of Luzon, Visayas, and Mindanao, with an overall prevalence of more than 50%, predominantly among school-age children (Soares-Magalhes *et al.*, 2015). Age, sex, occupation, poor hygiene, open defecation practices and children's play behaviors in endemic areas are among the demographic variables that are closely linked to the spread of

these parasitic diseases and the susceptibility of individuals to contracting them (Gordon *et al.*, 2015). Affected individuals may suffer from malnutrition, anemia, stunted growth and development, decreased fitness, delayed cognitive function, severe organ damage or even mortality (Miguel and Kremer, 2004). Furthermore, there is a clear correlation between the number of worms and the morbidity of intestinal helminth diseases. As a result, the severity of the infection increases with the number of parasites present in an infected person (Gordon *et al.*, 2015).

Most contagious diseases that impact people thought to have zoonotic potential (WHO, 2018). Threats to human health posed by zoonoses, which mostly found in felines and other wild animals (Cleaveland *et al.*, 2001). Domesticated cats can serve as reservoir hosts for a diversity of zoonotic intestinal parasites that may infect humans. All four intestinal parasites identified in the study, such as *Toxocara* spp., *Ascaris* spp., whipworm, and hookworm, have been reported to possess zoonotic capabilities which allow the transmission of these parasites from animals to humans. Ascariasis, whipworm infections, and hookworm infections caused by *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm), and *Ancylostoma duodenale* or *Necator americanus* (hookworm) are the most prevalent types of soil-transmitted helminthiasis in humans. These intestinal helminths have also been revealed to be capable of surviving for years in the gastrointestinal tract and producing thousands of eggs every day (Strunz *et al.*, 2014).

Reports of zoonotic parasites in animal feces, which typically utilized as agricultural fertilizer, are rapidly increasing (Paller and Babia-Abion, 2019). Domestic animals, which account for more than 42% of mammals and over 1,700 species, such as cats, dogs, rats, bubaline, sheep, and pigs, being studied for their potential involvement as

animal reservoir hosts in the spread of intestinal helminth infections (Jourdan *et al.*, 2018). These combined with the co-habitation and substantial crossover between people and animals, which would be regarded as the most important element for transmission given the massive amounts of infective parasite eggs released into the environment (Li *et al.*, 2010).

Recent studies have shown that parasitic zoonosis is becoming more common in several nations throughout the world, which is related to population growth, urbanization, habitat modification, and mass migration (WHO, 2019). Since they provide appropriate habitats for some wild animal species that have led to frequent increasing interaction with people, urban residential areas are of particular concern when considering the advent of zoonotic diseases (Luniak, 2004). Studies are also surfacing that highlight the importance of not paying enough attention to animal reservoirs in the development of intestinal helminthiases, indicating that MDA alone will not be able to eliminate these parasitic diseases (Belizario *et al.*, 2011).

An integrated one-health approach that targets animals, humans and the environment for surveillance, prevention, control, and treatment is essential for the successful management of these intestinal helminth infections. This long-term implementation of this strategy should involve responsible action to address the issue of the potential involvement of animals in the transmission of intestinal helminth infections by enhancing veterinary and public health in priority areas with the help and support of active research and boosting WASH and MDA program implementation (WHO, 2008).

Conclusion

In the Philippines, intestinal helminth infections caused by *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms are common and endemic in all provinces causing serious health problems. Toxocariasis has also a significant socioeconomic impact, especially on populations in poor rural regions. Despite the low overall mortality caused by intestinal helminth infections, significant morbidities have been reported, including a high impact on nutrition, growth and development, physical fitness, and even cognitive functions among infected individuals of all ages, which has contributed to the burden of these parasitic diseases. The local government implements national control plans to prevent transmission of intestinal helminthiases in the country. However, due to limited resources and after years of established

control measures, the prevalence rate of these parasitic infections continues to rise and remains a public health problem in the country. This is mostly due to the approaches not being sustained due to the insufficient funding allocated to efforts to eliminate these parasitic diseases.

The current national monitoring measures are insufficient to prevent intestinal helminth infections from spreading. To lower the occurrence of zoonotic parasitic diseases, the local government should prioritize public health education and deworming campaigns, particularly among school-age children living in endemic areas. The etiology and risk of zoonoses in reservoir hosts must also be investigated on a continuous basis, as it has a greater impact on people who are exposed to animals. Rationalized and reliable information on neglected tropical diseases was critical for establishing and strengthening national control programs. Moreover, government assistance for the long-term control strategy must be consistent since discontinued implementation of control programs can lead to major setbacks in program execution and infection resurgence. Developing more innovative control measures is required to broaden health awareness campaigns against NTDs, particularly intestinal helminthiases, beyond morbidity management and toward elimination.

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