Preliminary survey of feline intestinal parasites in Ghana

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ABSTRACT

Cats can host an array of parasite species. This is particularly evident in sub-Saharan Africa, where climatic conditions favour parasites and their vectors, and pets are given little medical attention. The presence of parasites in cats results in significant morbidity in these companion animals. Proximity of infected cats to humans also favours zoonotic transmissions. This study aimed at ascertaining the prevalence and diversity of parasites in cats. A total of 90 feline faecal samples were examined using floatation techniques. Overall, 75 cats (83.3%) were infected with at least one of six parasite species. Toxocara ova were found in 35 (38.9%), hookworm ova in 20 (22.2%), Isospora in 19 (21.1%), Capillaria in 17 (18.9%), pinworm eggs in 5 (5.6%) and flukes in 4 (4.4%) cats respectively. Sex of cats was a significant determinant of infections. This study demonstrates environmental contamination with feline parasites of zoonotic importance, thus necessitating a One-Health surveillance to minimize zoonotic risks from these companion animals. Cats play active roles in the transmission of multiple parasites of zoonotic importance in Ghana.

Contribution/Originality: This paper provides data for the first time on parasites of zoonotic importance in cats in Ghana, a developing country with a high population of stray cats.

1. INTRODUCTION

Cats are companion animals that are well adapted to human settlements worldwide. In addition to providing social and emotional benefits, cats serve as biological control agents of rodent pests in homes and important sources of animal proteins [1]. Despite these benefits, cats remain public health threats, as they can host infective stages of several parasite species that are naturally transmissible to humans and other domestic animals [2].

Endoparasites have been recovered from both feral and pet cats including Toxoplasma gondii, Dipylidium caninum, Ancylostoma spp., Toxocara cati, Giardia cysts, Cryptosporidium spp., and Strongyloides stercoralis, all of which are of zoonotic importance [3]. Endoparasitism in cats may cause mild or life-threatening disorders, depending on the species of the parasite and the parasite loads [4]. Zoonotic transmissions from cats to humans may occur through contact with animal fur/hair, excrement, or exposure to contaminated environmental matrices (including soil, water, and food) infested with feline parasite eggs, larvae or oocysts [5]. Some feline parasites have been reported to cause diseases of public health importance, including cutaneous and visceral larva migrans, dipylidiasis, and toxoplasmosis [6]. Cat ownership has been documented as a risk factor for Toxoplasma infections in pregnant women [7]. Studies on endoparasites of cats have reported a prevalence ranging from 20 to 46% in Europe [8].
Infection rates in the United States are estimated at 0.03 to 33% \[9\]. In Africa, the prevalence of parasites in cats can be as high as 91%. Significantly higher prevalence of parasitic infections has been reported in stray cats as compared to indoor cats \[10\]. Only a small population of cat owners provide their cats with litter boxes. However, the disposal of the litter in the open contributes to environmental contamination with parasite eggs and/or oocysts of zoonotic importance \[4\]. In Ghana, there exists a high population of stray animals, including cats and dogs. Pet keeping is a common practice in Ghana, yet these animals are rarely given medical treatment. So far, there is no study on feline parasites nor the role they play in zoonotic transmissions in Ghana. Knowledge of the diversity of parasite in cats is needed to inform public health interventions and limit zoonotic transmissions. This study aimed at providing data on the parasites of cats in Ghana.

2. MATERIALS AND METHOD

2.1. Study Area

The study was conducted in Mampong, the capital of the Mampong Municipal Assembly in the Ashanti region of Ghana. Geographically, it is located on latitude 7°05’42” N and longitude 1°24’49” W, approximately 60km northeast of the regional capital, Kumasi. It has an estimated population of 88,650 people, accounting for approximately half of the population of the entire municipality \[11\]. The town lies within a wet semi-equatorial forest zone and has rippling and picturesque landforms that range from escarpments and hills to tropical lowlands. Agricultural activities are predominantly the occupation of townships owing to their fertile soil \[12\].

2.2. Study Design

This study was a multi-site, cross-sectional field survey to provide current baseline on endoparasites of cats in Ashanti-Mampong, Ghana. The study area was divided into seven groups according to the names in the study area (Tunsuom, Site, Awaiso, Locust, Tataforoso, Adiembra, Zongo). Figure 1 shows the study area on the map of Ghana.

![Figure 1. Map of Ashanti region showing the study area.](image)

2.3. Study Animals

Cats of varying age and sex were sampled from the study community. Random house to house sampling was done for cats who owners were available and consented to have their animal sampled. A total of 90 cat stool samples
were collected from 72 households. Cats were classified according to age as kittens (0–6 months), young cats (>6 months to 12 months), or adults (>12 months).

2.4. Sample Collection and Faecal Examination

Samples were randomly collected from households in containers containing formalin to protect eggs from destruction. Briefly, 3 grams of stool samples were emulsified in 50ml sodium chloride floatation fluid. The mixture was filtered using fabric gauge into the test tube, then a floating liquid is added to achieve meniscus. After 15 minutes, the test tube was covered with a cover slip and gently placed on the microscope slide for parasite identification [13]. Each sample was examined under 10x and 40x magnifications of the microscope. Following microscopy, parasite ova or oocysts were identified according to existing keys and descriptions [14].

2.5. Data Analysis

Data was analyzed to determine frequencies and percentages using RStudio (2022.02.3 Build 492) statistical tool. Test for associations was conducted with the Chi-square ($\chi^2$) test at 5% significance level.

2.6. Ethical Approval and Consent to Owners

Individual consent from cat owners was obtained prior to collection of faecal samples.

3. RESULTS

3.1. Characteristics of Sampled Cats

A total of 90 cats, including 47 males (52.2%), were drawn from the study community. Of these, 23 (25.6%) were kittens, 37 (41.1%) were aged between 6 – 12 months and 30 (33.3%) above 12 months of age. Most of the cats (71.1%) were allowed to roam about freely in the communities. A total of 47 males and 43 female cats were examined, 43 (91.5%) and 32 (74.4%) were infected respectively.

3.2. Prevalence of Parasites in Cats

Out of the 90 samples examined, 75 (83.3%) were found to be positive with at least one of six parasite eggs/oocysts. *Toxocara* ova were found in 35 (38.9%), hookworm ova in 20 (22.2%), *Isospora* in 19 (21.1%), *Capillaria* in 17 (18.9%), pinworm ova in 5 (5.6%) and flukes in 4 (4.4%) cats respectively. Figure 2 shows the prevalence of the parasites recovered from the cats.

![Figure 2. Parasitic prevalence in cats sampled.](image-url)
Table 1. Prevalence and distribution of parasites species in relation to age.

<table>
<thead>
<tr>
<th>Age</th>
<th>No. examined</th>
<th>Toxocara</th>
<th>Hookworm</th>
<th>Isospora</th>
<th>Capillaria</th>
<th>Pinworms</th>
<th>Flukes</th>
<th>Overall prevalence</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6m</td>
<td>23</td>
<td>9(39.1%)</td>
<td>8(34.8%)</td>
<td>5(21.7%)</td>
<td>4(17.4%)</td>
<td>1(4.3%)</td>
<td>0(0%)</td>
<td>17(73.9%)</td>
<td>0.003</td>
</tr>
<tr>
<td>7-12m</td>
<td>37</td>
<td>12(32.4%)</td>
<td>7(18.9%)</td>
<td>9(24.3%)</td>
<td>12(32.4%)</td>
<td>1(2.7%)</td>
<td>2(5.4%)</td>
<td>32(86.5%)</td>
<td>0.001</td>
</tr>
<tr>
<td>&gt;12m</td>
<td>30</td>
<td>14(46.7%)</td>
<td>5(16.7%)</td>
<td>5(16.7%)</td>
<td>1(3.3%)</td>
<td>3(10%)</td>
<td>2(6.7%)</td>
<td>26(86.6%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
<td>35 (38.9%)</td>
<td>20(22.2%)</td>
<td>19(21.1%)</td>
<td>17(18.9%)</td>
<td>5(5.6%)</td>
<td>4(4.4%)</td>
<td>75(83.3%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 2. Prevalence and distribution of parasites species in relation to sex single and multiple infections in cats.

<table>
<thead>
<tr>
<th>Sex</th>
<th>No. examined</th>
<th>Toxocara</th>
<th>Hookworm</th>
<th>Isospora</th>
<th>Capillaria</th>
<th>Pinworms</th>
<th>Flukes</th>
<th>Overall prevalence</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>47</td>
<td>19(40.4%)</td>
<td>12(25.5%)</td>
<td>9(19.1%)</td>
<td>12(25.5%)</td>
<td>3(6.4%)</td>
<td>3(6.4%)</td>
<td>43(91.5%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Female</td>
<td>43</td>
<td>16(37.2%)</td>
<td>8(18.6%)</td>
<td>10(23.3%)</td>
<td>5(11.6%)</td>
<td>2(4.7%)</td>
<td>1(2.3%)</td>
<td>32(74.4%)</td>
<td>&lt;0.001</td>
</tr>
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<td>5(5.6%)</td>
<td>4(4.4%)</td>
<td>75(83.3%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
3.3. Parasitic Infections in Relation to Age and Sex of Cats.

Significantly higher prevalence was seen in male cats (91.5%) as compared to female cats (74.4%) \( (\chi^2 = 4.7115, p= 0.02996) \). The overall age-specific prevalence was 73.9% for kittens, 86.5% for young cats and 86.6% for older cats \( (p < 0.05) \). Overall, sex, but not age, was a determinant of parasitic infections in cats. Tables 1 and 2 describe the distribution of parasites in relation to age and sex respectively.

Single infections were found in 52 cats (57.8%), with 18 (20.0%) double infections, 3(3.3%) triple infections and 2 (2.2%) quadruple infections. Out of the 23 cats with multiple infections, 10 (43.5%) had combined *Toxocara* and hookworm infections. Table 3 shows types of multiple infections in cats.

### Table 3. Poly-parasitism in cats.

<table>
<thead>
<tr>
<th>Mixed parasitism</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Double infections</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Toxocara</em> + Hookworm</td>
<td>5</td>
<td>5.6</td>
</tr>
<tr>
<td><em>Toxocara</em> + Capillaria</td>
<td>4</td>
<td>4.4</td>
</tr>
<tr>
<td><em>Toxocara</em> + Isospora</td>
<td>3</td>
<td>3.3</td>
</tr>
<tr>
<td><em>Capillaria</em> + Hookworm</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td><em>Isospora</em> + Hookworm</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td><em>Toxocara</em> + Pinworm</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td><em>Toxocara</em> + Fluke</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Triple infections</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Toxocara</em> + Capillaria + Hookworm</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td><em>Toxocara</em> + Isospora + Hookworm</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Quadruple infections</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Toxocara</em> + Isospora + Capillaria + Hookworm</td>
<td>2</td>
<td>2.2</td>
</tr>
</tbody>
</table>


4. DISCUSSION

This study provides an overview of gastrointestinal parasites in cats in Mampong. In total, cat parasitic infections accounted for 83.3% (75/90). This is comparable to reports in India (85%; 77.2%) [15, 16], Nigeria
The widespread distribution, particularly in children, of toxocara canis, a well-known zoonotic parasite, can infect people and cause visceral and ocular enteritis, particularly in the upper respiratory tract of cats and other carnivores. Human exposure to these parasites may result in cutaneous larval migrans, anaemia and eosinophilic gastroenteritis. For toxocara spp., pre- and perinatal transmission, age immunity, and exposure to paratenic hosts and highly resistant eggs contaminating the environment are all well-established. The warmer climatic conditions in the study area likely increase the presence and persistence of infective stages of the parasite.

Hookworms were the second most prevalent parasites in this study (22.2%), which is similar to published data. Infection of cats with hookworms may occur via ingestion of free larvae from the soil or paratenic hosts, maternal milk and transcutaneous penetration by infective larvae. Species of hookworms identified in cats include Anclylostoma spp. and Uncinaria stenocephala. Human exposure to these parasites may result in cutaneous larval migrans, anaemia and eosinophilic gastroenteritis. Considering hookworm larvae can persist in the soil for several months, the habit of burying faeces by cats is of public health concern.

Isospora are the commonest coccidian parasites found in cats. They inhabit the gastrointestinal tract of cats and can cause diarrhoea. Species of Isospora recovered from cats include Isospora felis and Isospora rivolta. Unlike, Cryptosporidium parvum and Toxoplasma gondii, Isospora is not contagious to humans, but is transmissible from cat to cat. The prevalence of 21.1% reported in this study is higher than previous reports in Iraq (13.3%) [35], (6.61%) [34], Switzerland (8.1%) [35]. Given that Isospora oocysts are highly resistant to environmental conditions and disinfectants, improved hygiene and proper disposal of cat feaces are important in cat-to-cat infections.

Another nematode recovered from 18.9% of the cats was Capillaria spp. Capillaria aerophila, (syn. Eucoleus aerophilus) is a zoonotic trichuroid nematode parasite that inhabits the upper respiratory tract cats and other carnivores. Infections in cats with lung nematodes result from ingestion of paratenic hosts, including rodents, soricromorphs, and birds. Lung nematodes are considered the most important causes of parasite-induced respiratory infection in felids. Due to their high pathogenicity, pulmonary nematodes have received increased attention in recent years, particularly in Europe, where there is apparent emergence. There are sporadic cases of human infections, with zoonotic transmission often reported in areas with high prevalence.

Pinworm ova were also recovered from 5.6% of the fecal samples examined. Pinworms are considered atypical cat parasites given that these nematodes are host-specific. Pinworm ova in cats may stem from consumption of rodents, such as mice and rats which are known to harbour pinworms. Two species of pinworms commonly reported in rodents include Syphacia obvelata and Aspiculuris tetraptera. The role of cats in the transmission of pinworm infections needs to be elucidated. In addition to pinworms, unknown flukes were recovered from 4.4% of the cats. Several species of flukes have been recovered from cats, including species of zoonotic importance.

Parasites of both veterinary and public health importance were recovered from the cats sampled. In the current study, Toxocara spp. was the most prevalent parasite (38.9%), which is in line with reports from other parts of the world (20.3%) [23], (44.4%) [27] and (44.6%) [25] that Toxocara spp. is the most commonly encountered endoparasite of cats. Toxocara cati, a well-known zoonotic parasite, can infect people and cause visceral and ocular larva migrans, especially in children [22, 25]. The danger of human infection is raised since Toxocara cati eggs are known to stay and remain viable in the environment for a long time. The widespread distribution of this ascarid is mostly attributable to the eggs' strong tolerance to harsh environmental conditions. Additionally, infestation among young cats is increased by transmammary transmission [25]. In our study both age groups of cats had a prevalence of this parasite over 30%. Information about the high prevalence of these zoonotic parasites is important for public health concerns. The high prevalence of T. cati in cats may be due to the high consumption of paratenic hosts, such as rodents and birds [27]. For toxocara spp., pre- and perinatal transmission, age immunity, and exposure to paratenic hosts and highly resistant eggs contaminating the environment are all well-established. The warmer climatic conditions in the study area likely increase the presence and persistence of infective stages of the parasite.

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Sex of cat was identified as risk factors of infection in this study. Significantly higher prevalence in male cats compared to females could be attributed to the greater propensity by the former to roam about.

5. CONCLUSION

The prevalence of parasites in the cats was 83.3%. Presence of the zoonotic helminths, hookworms, Toxocara, and Capillaria suggest cats are potential zoonotic agents in the area. Sex of cat was a significant determinant of infections. Presence of zoonotic parasites in cats with poor deworming history is of public health concern. A One-Health surveillance is recommended to limit zoonotic transmissions from cats.

Funding: This study received no specific financial support.

Competing Interests: The authors declare that they have no competing interests.

Authors’ Contributions: Both authors contributed equally to the conception and design of the study.

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