A survey on environmental contamination of suburban parks and playgrounds in Harare, Zimbabwe, with canine helminths of zoonotic significance

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ABSTRACT

In an attempt to assess the possible risk to humans of soil-transmitted canine helminths of of zoonotic significance, 161 faecal samples and 81 soil samples were collected from 6 public parks and playgrounds in Harare between March and June 1998 and examined for nematode ova. Of the 161 faecal samples collected, 17.4 % were positive for *Ancylostoma* sp. ova and 5.6 % were positive for *T. canis* ova. No other nematode species ova were found. Over 50 % of the faecal samples positive for *Ancylostoma* sp. ova were 'moist', and this suggests that the moisture content of faeces contributes to the development and survival of this parasite in the environment. Only 3 of the 81 soil samples collected were positive for *T. canis.* The low levels of contamination of public playgrounds and parks with *T. canis* ova suggests that environmental contamination might not be important in the aetiology of human toxocarosis in Harare.

Key words: dog, soil, suburban parks and play grounds, Zimbabwe, zoonotic nematodes.

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INTRODUCTION

The ever-growing population of dogs in cities of developing countries has increased the risk of zoonotic diseases in humans associated with nematode parasitism of dogs[5]. The majority of these dogs have access to the outdoor environment and are likely to contaminate public areas with their faeces[11]. Direct contact with dogs is unlikely to give rise to infection in humans because the ova must undergo development in the environment before they can become infective[8]. Public parks, particularly playgrounds that are heavily fouled by dogs, may be an important source of infection for humans[7].

Over 12 species of helminths are capable of being transmitted from dogs to humans[17]. Among the zoonotic helminths transmitted by dogs, *Toxocara canis* is particularly important as the cause of visceral larva migrans in humans[12], and embryonated ova of this parasite species remain viable for a considerable length of time in soil[16]. Human infection with the dog hookworm *Ancylostoma* sp. can result in cutaneous larva migrans[3]. Human enteritis characterised by abdominal pain and eosinophilia associated with *A. caninum* infection has also been reported[4,14]. *Ancylostoma* larvae are present in contaminated environments, and humans are infected when the infective larvae penetrate the skin.

The purpose of this survey was to establish the prevalence of helminth ova in dog faecal samples and soil collected from public playgrounds and parks in suburban areas of Harare, Zimbabwe, and to determine the risk of zoonotic disease in humans exposed to the this environment.

MATERIALS AND METHODS

The study was carried out over a period of 4 months from March 1998 to June 1998. One hundred and sixty-one dog faecal samples and 81 soil samples were collected from 2 public parks and 4 suburban playgrounds in Harare (Mbare, Botanic Gardens, Epworth, Warren Park, Rugare and Waterfalls), which are maintained by the Harare City Council.

Details regarding the location and availability of parks and playgrounds was obtained from the City Health Department of the Harare City Council.

Polyethylene bags were used to collect the faecal samples by randomly selecting suitable areas in the parks and playgrounds frequented by dogs and humans. Dog faeces on the soil surface could readily be identified as such by their appearance and smell or by the presence of hairs. Faecal material was considered 'moist' when the consistency was of damp or humid nature and 'dry' when the consistency was dry with a powdery texture[13].

A plastic pipe 6 cm in diameter was used for the collection of soil samples. The pipe was thrust into the soil and a sample of 150–200 g per 4 m^2 was collected into polyethylene bags. The samples were a mixture of the superficial and intermediate layer soil (approximately 15 cm deep). Soil samples from Warren Park and Rugare consisted of gravel and the samples were discarded as they were not suitable for analysis of *T. canis* ova.

The presence of helminth ova in faeces was determined by a modified McMaster technique[1]. The recovery of *T. canis* ova from the soil samples was performed using the flotation method[13] where an average recovery rate of 69.8 ± 7.9 % has been recorded. No attempt was made to recover *Ancylostoma* sp. ova or larvae from soil samples, as there are no documented standard techniques for their recovery from soil. As they are susceptible to environmental factors such as high temperatures and desiccation, their recovery from soil in Harare was in any case unlikely. Helminth ova were identified to genus/species level[16]. Faecal egg counts were transformed to logarithm (count + 1) because of the overdispersed distribution of the number of eggs in the faecal samples. Using the Statistix version 1.0 statistical computer package, an Chi-square test was performed with regard to differences in positivity of ova in faeces according to the moisture content of the sample at 5 % significance level.

RESULTS

The only helminth ova found in the faeces collected from the different study areas were those of *T. canis* and *Ancylostoma* sp. Of a total of 161 faecal samples

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Table 1: **Prevalence of *Ancylostoma* sp. ova in dog faeces collected from public playgrounds and parks in suburban Harare.**

Site	*n*	Positive (*n*)	% Positive
Mbare	25	3	12.0
Botanic Gardens	36	8	22.2
Epworth	40	6	15.0
Warren Park	14	2	14.3
Rugare	21	0	0.0
Waterfalls	25	9	36.0
Total	161	28	17.4

Table 2: **Prevalence of *Toxocara* sp. ova in dog faeces collected from public playgrounds and parks in suburban Harare.**

Site	*n*	Positive (*n*)	% Positive
Mbare	25	5	20.0
Botanic Gardens	36	0	0.0
Epworth	40	2	5.0
Warren Park	14	0	0.0
Rugare	21	1	4.8
Waterfalls	25	1	4.0
Total	161	9	5.6

collected from the different study sites, 28 (17.4 %) were positive for *Ancylostoma* sp., ova. The percentage of positive samples varied considerably between the sites (range 0–36 %) (Table 1).

Although the prevalence of *T. canis* ova was 5.6 % (range 0–20 %), 2 study areas (Botanic Gardens and Warren Park) were not positive for this parasite (Table 2).

Of the 4 study areas where 81 soil samples were collected, only 2 areas (Mbare and Epworth) were contaminated with *T. canis* ova, with a prevalence of 5 % and 13.3 % respectively (Table 3).

The prevalence of *Ancylostoma* sp. and *T. canis* ova in faecal samples according to classification as either 'moist' or 'dry' is shown in Table 4. The difference between the number of positive samples for *Ancylostoma* sp. ova classified as 'moist' or 'dry' was found to be significant (χ^2 = 39.58; $df = 1$; $P < 0.01$), with higher number of positives in the 'moist'. samples than the 'dry'. samples. For *T. canis* ova the difference was not significant ($\chi^2 = 0.20$; $df = 1$; $P > 0.60$).

Table 3: **Prevalence of *T. canis* ova in soil samples collected from public parks and playgrounds in suburban Harare.**

Site	Number of samples	Number with eggs	% Positive
Mbare	20	1	5.0
Botanic Gardens	26	0	0
Epworth	15	2	13.3
Waterfalls	20	0	0
Total	81	3	3.7

Table 4: **Prevalence of ova of *Ancylostoma* sp. and *Toxocara* sp. ova in faecal samples that were classified as either 'dry' or 'moist'.**

Sample class	*n*	Positive (*n*)	% Positive
Dry (*Ancylostoma* sp.)	134	12	9.0
Moist (*Ancylostoma* sp.)	27	16	59.3
Dry (*Toxocara* sp.)	134	7	5.2
Moist (*Toxocara* sp.)	27	2	7.4

DISCUSSION

It is evident that public parks and playgrounds in Harare are contaminated with low levels of *T. canis* ova and moderate levels of *Ancylostoma* sp. ova. Since playgrounds are more often frequented by stray dogs than parks, high levels of contamination were expected in the playgrounds. However, the level of contamination by *T. canis* and *Ancylostoma* sp. ova in faecal samples and *T. canis* ova from soil collected from public parks and playgrounds did not show any trend.

The absence of other helminth ova is interesting. At least 4 helminth genera of zoonotic importance (*Ancylostoma, Toxocara, Taenia* and *Dipylidium*) have been reported in stray dogs in Zimbabwe[11]. The fact that faecal samples were not fresh might explain the failure in this study to find ova belonging to these helminths. The more common tapeworms of dogs (*Taenia* sp., *Echinococcus* sp. and *Dipylidium caninum*) usually shed detached proglottids[2]. Unless proglottids are damaged during transit through the bowel or macerated during the flotation procedure, eggs are generally not seen.

Observations have shown that mainly adult dogs frequent public playgrounds and parks. The prevalence of *T. canis* in adult dogs is much lower than in puppies[9,10], and this might explain the low incidence of *T. canis* in the faecal and soil samples.

The samples were collected during the cooler and drier part of the year in Harare. This period is likely to be favourable for the survival of *T. canis* ova[6] but detrimental to the survival of *Ancylostoma* sp. infective larvae, which depend on a conducive microclimate, with optimum conditions being moist soil in a warm and shaded setting[15].

There was a clear distinction between the prevalence of *Ancylostoma* sp. ova in moist and dry faecal samples. Moist faecal samples had a higher prevalence of *Ancylostoma* sp. ova than dry samples. It is possible that ova were destroyed in 'dry' samples by desiccation. This finding indicates that free-living *Ancylostoma* sp. stages survive in moist samples. This study suggests that there is a significant risk of humans being infected by *Ancylostoma* sp. during the wet season when conditions are ideal for the development and survival of the infective larvae in contaminated environments.

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