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Occurrence of *Giardia* sp. cysts and *Cryptosporidium* sp. oocysts in faeces from public parks in the west of Scotland

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SUMMARY

One hundred faecal specimens, randomly collected from various locations within seven public parks in the west of Scotland, were examined for the presence of *Giardia* sp. cysts and *Cryptosporidium* sp. oocysts. Eleven percent of samples contained *Giardia* sp. cysts and 1% contained *Cryptosporidium* sp. oocysts. Occurrence data from individual parks varied from 0 to 40% for *Giardia* and 0 to 2·4% for *Cryptosporidium*. The occurrence of parasitic organisms in public parks, especially in the vicinity of children's playing areas is a matter of concern for public health officials and regulators of leisure and recreation amenities.

INTRODUCTION

In the United Kingdom, *Giardia intestinalis* and *Cryptosporidium parvum* are two of the five most common causes of diarrhoeal illness in man, with a preponderance of cases associated with children. Epidemiological data from United Kingdom communicable disease surveillance centres indicate that sporadic cases of human disease are reported continuously throughout the year. In 1989, these pathogens were identified as the aetiological agents responsible for 15% of laboratory confirmed gastrointestinal infections in England and Wales and 17% of gastrointestinal infections in Scotland [1]. Concern has been expressed over the risks that companion animals, and their faeces, present to the immunocompromised community [2–4]. Here we report the occurrence of *Giardia* and *Cryptosporidium* in faeces from seven public parks in the west of Scotland.

MATERIALS AND METHODS

One hundred faecal samples were randomly collected from seven public parks located within two Scottish district councils, in central Lanarkshire, Scotland, between December 1989 and March 1990. Protozoan parasites were concentrated by emulsifying 5 g of faecal material in 45 ml 10% formalin in a 50 ml centrifuge

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Table 1. *Criteria for the detection of* Giardia intestinalis *cysts and* Cryptosporidium parvum *oocysts in faecal samples by immunofluorescence antibody techniques*

Cryptosporidium parvum oocysts	*Giardia intestinalis* cysts
(1) Characteristic apple-green fluorescence specifically around the oocyst wall	(1) Characteristic apple-green fluorescence specifically around the cyst wall
(2) Shape (spherical to ovoid)	(2) Shape (oval to round)
(3) Size (4–6 μm in diameter)	(3) Size (6–12 μm wide by 8–15 μm long)
(4) Identification of internal structures (nuclei, sporozoites)	(4) Identification of internal structures (nuclei, median body, axonemes)

Table 2. *Occurrence of* Giardia *sp. cysts and* Cryptosporidium *sp. oocysts in faeces collected from public parks in districts A and B*

District: park	Number sampled	Number (percentage) of faecal samples positive for *Giardia*	Number (percentage) of faecal samples positive for *Cryptosporidium*
A: Park I	5	2 (40)	0 (0)
A: Park II	14	2 (14·3)	0 (0)
A: Park III	10	1 (10)	0 (0)
A: Park IV	9	1 (11·1)	0 (0)
A: Park V	10	0 (0)	0 (0)
B: Park VI	41	4 (9·7)	1 (2·4)
B: Park VII	11	1 (9·1)	0 (0)
Total	100	11 (11)	1 (1)

tube, washed twice by centrifugation (1050 **g**, 5 min), and the final pellet resuspended in 45 ml reverse osmosis (RO) water. After the addition of 5 ml diethyl-ether, the sample was vortexed, centrifuged (1050 **g**, 5 min), the supernatant aspirated to waste, and the resuspended pellet washed a further two times with RO water. Finally, the supernatant was aspirated to waste and the pellet resuspended to between 2·5 and 5 ml. An aliquot (4×25 μl) of faecal concentrate was placed onto four-welled multispot slides (Hendley, Essex), air dried and fixed in methanol (5 min). *Giardia* sp. cysts and *Cryptosporidium* sp. oocysts were identified by an immunofluorescent antibody technique [5, 6]. The criteria for the identification of *Giardia* sp. cysts and *Cryptosporidium* sp. oocysts are outlined in Table 1.

(Oo)cyst recovery efficiency from control contaminated dog faeces

The mean percentage (oo)cyst recovery efficiency of the method employed for the concentration and detection of 4×10^3 *Giardia* cysts and *Cryptosporidium* oocysts added to 5 g dog faeces (previously found to be negative for *Giardia* and *Cryptosporidium*) was similar ($n = 8$); the mean percentage cyst recovery efficiency was $86·7 \pm 10·3$ %, the mean oocyst recovery efficiency was $83·6 \pm 7·2$ %.

Survey of faeces from public parks

Table 2 illustrates the breakdown of the findings on faecal samples examined from district council parks in the study area. *Giardia* and/or *Cryptosporidium* oocysts were detected in faeces from 6 of 7 public parks examined. Of a total of 100 samples collected from various locations within 7 public parks, 11 were positive for *Giardia* and 1 positive for *Cryptosporidium*. In district A, *Giardia* were detected in 6 of 48 (12·5%) faecal samples collected from 4 out of the 5 public parks examined. Whereas in park I, 2 of 5 (40%) faecal samples were positive for *Giardia*, the number of positive faecal samples in parks II, III and IV was 2 of 14 (14·3%), 1 of 10 (10%), and 1 of 9 (11·1%), respectively. No *Cryptosporidium* oocysts were detected in any faecal samples collected from district A ($n = 48$). In district B, *Giardia* were detected in 5 of 52 (9·6%) and *Cryptosporidium* in 1 of 52 (1·9%) faecal samples. Whereas *Giardia* were detected in faecal samples from both parks VI and VII, *Cryptosporidium* were detected only in park VII. *Giardia* were detected in 4 of 41 (9·7%) faecal samples examined from park VI, and 1 or 11 (9·1%) from park VII.

DISCUSSION

In this study, faecal samples containing *Giardia* sp. cysts or *Cryptosporidium* sp. oocysts were detected in 6 of 7 public parks surrounded by urban housing estates with high human population densities. The geographical location of the various parks would suggest that domestic, rather than wild animals were responsible for this contamination. Although definitive identification of the species responsible for the faecal contamination in the public parks in this study was not possible, dogs, because of their habits, were most likely to be the main contributor. Faecal contamination of public parks and footpaths by domestic pets and stray dogs, is a common public health problem in many urban towns and inner cities. The movement of infected animals within and between parks may account for the dispersal of *Giardia* positive faecal samples detected at different locations within public parks and districts. It is possible that faecal samples found to contain *Giardia*, collected from different locations within the same park, may have originated from the same or a few infected animals.

Little published information is available on the occurrence of *Giardia* and *Cryptosporidium* in the United Kingdom domestic and indigenous animal population. The prevalence of canine giardiasis in the east of Scotland has been reported to range from 4 to 9·9% [7, 8]. Two studies from the south-east of England found between 14·5 and 20% of dogs infected [9, 10]. In a survey of 101 healthy dogs in the east of Scotland, Simpson and colleagues [8] found no *Cryptosporidium* oocysts in faecal samples. In a previous study, Tzipori and Campbell [11] detected antibodies against *Cryptosporidium* in 16 of 20 dogs examined from the same part of the country, indicating that the dogs had previously been infected by *Cryptosporidium*.

The number of *Giardia* cysts detected in this study ranged from 8×10^2 to 4×10^3 cysts per gram of faecal material, whereas the number of *Cryptosporidium* oocysts detected was $1·6 \times 10^2$ oocysts per gram. Such levels of potentially infective organisms ensure a high level of environmental contamination, and increases the risk of infection for other susceptible animals, and possibly human beings, if ingested. Whereas the minimum infectious dose of *Giardia* for man is 10–100 cysts [12], the minimum infectious dose of *Cryptosporidium* for man is unknown. However, as few as 10 oocysts can produce infection in non-human juvenile primates [13].

The major route of transmission between animals, including man, is thought to be faecal–oral. At the present time, it has not been demonstrated unequivocally that canine isolates of *Cryptosporidium* or *Giardia* are infectious to man. However, as dogs can be infected, experimentally, with (oo)cysts of human origin [14, 15], humans may acquire infection naturally from dogs. The close proximity in which animal owners and their pets reside, might increase the potential risk for both zooanthrponotic and anthropozoonotic transmission. Infection by both these routes of transmission may be responsible for sporadic unexplained incidences of human and animal illness [2–4], although definitive epidemiological information has not been forthcoming.

At present, it is not known how long *Cryptosporidium* or *Giardia* survive outside the host, although the transmissive stage of these parasites have been shown to survive for prolonged periods under favourable environmental conditions, but are susceptible to desiccation [16, 17]. Nevertheless, the occurrence of these pathogenic protozoa in animal faeces within public parks, especially in the vicinity of children's playing areas should be of concern to public health officials and regulators of leisure and recreation amenities. Further work is required to determine the occurrence of *Giardia* and *Cryptosporidium* in the indigenous urban animal population, especially companion animals, and to elucidate the public health significance of animal isolates to humans.

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