

# Contamination of public squares and parks with parasites in Erbil city, Iraq

Khder Nooraldeen<sup>1</sup>

<sup>1</sup> Department of Biology, College of Education, Salahaddin University – Erbil, Iraq

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## Abstract

**Introduction and objective.** The soil of public squares and parks may be contaminated with the infective stages of parasites because of the presence of stray animals in these parks. Many people take a rest in these places and they may be at risk of infection with parasites because the infective stages of parasites can survive for months, or even years, in spite of the factors of weather.

**Objective.** To evaluate contamination with the eggs of parasites in the soil of parks in Erbil city, Iraq.

**Material and methods.** Forty-eight soil samples were collected from 12 public parks and gardens from 11 different neighbourhoods (8 parks and 3 playgrounds) and one district in Erbil city. The zinc sulfate floatation method was used to recover the eggs of parasites from the samples.

**Results.** Eggs of parasites were identified in 91.6% of the parks. Eggs of *Hymenolepis diminuta* were found in 75%, *Toxocara* spp. in 50%, *Ascaris* spp. in 33.3%, *Taenia* spp. in 25%, hookworm in 25%, *Trichostrongylus* spp. in 16.7% and *Trichuris* spp. in 16.7% of the parks. Helminth eggs were found in 48% soil samples with a mean number of 1.1 per soil sample. The most contaminated soil sample was found in a park in neighbourhood number 325 with 6 eggs.

**Conclusions.** The presence of pathogenic parasites in the soil of parks in Erbil city constitutes a high risk to the people who use these parks for recreation, and requires the appropriate control for these parasites.

## Key words

public parks, parasites, eggs, soil, Iraq

## INTRODUCTION

The human can be infected with many diseases of zoonotic origins which can cause many health problems. These zoonotic diseases may be caused by many infectious agents, like parasites. There are many parasitic diseases of zoonotic origin and occur after the ingestion of parasite eggs. Soils are the most common source and reservoir of parasite eggs, which may continue their lifecycle or remain and survive in soils for months, or even years, until ingestion occurs [1].

It is very common to see animals (pets or stray animals), cats and dogs, in urban public areas in many cities around the world, and their numbers are increasing. Many studies have been performed to evaluate the contamination of soil with parasites in many cities, and they showed differences because of certain factors, such as characteristics of the human population, environmental conditions, type of urbanization and the density of the canine and feline population [2]. The main stray animals in Erbil city include canine and feline populations which can defecate in the public parks, and this will lead to the contamination of the soil of these parks with parasite eggs. People can be infected with these parasites through their contact with the soil when they rest in public parks. Contaminated soil play an important role in the spreading of the parasitic diseases in the conditions of Iraq. The contamination of public squares and parks with parasites has been demonstrated as a source of infection with the parasites and can cause significant health problems for human [3, 4], especially for small children.

This study was undertaken to determine the prevalence of parasites, especially those which represent a risk for human health, in public squares and parks in Erbil city in order to establish control measures and prevent human infection.

## MATERIALS AND METHOD

The survey was carried out and soil samples collected in urban areas of Erbil city, Iraq, between June 2013 – November 2013, with the agreement of the Directorate of Parks Engineering in the city. Twelve public parks and gardens from 11 different neighbourhood areas (8 parks and 3 playgrounds) and one district (one park) of Erbil city were studied for soil contamination with parasite eggs.

Each sample consisted of approximately 20 g of soil collected at a depth of (3–7 cm) in an area of 10 cm<sup>2</sup>, without vegetation, at 4 different points in each sampled park or garden. The samples were sealed in plastic bags and transported to a laboratory. The samples were analyzed by the modified zinc sulphate (ZnSO<sub>4</sub>) floatation technique previously described [5], with some modifications. Briefly, each soil sample was placed in a centrifuge tube, suspended in tap water and centrifuged at 1,500 rpm for 5 min. The supernatant was discarded and the sediment resuspended in ZnSO<sub>4</sub> solution with specific gravity 1.80. The tube was then centrifuged again at 1,500 rpm for 5 min. After that, the tube was transferred onto a stand, and the floatation fluid added to the tube with a pipette until the meniscus was well rounded over the top of the tube. A cover slip was superimposed onto the rounded meniscus and left for a minimum of 10 minutes. The cover slips were removed, placed on a slide, and examined microscopically. Statistical analysis was performed by means of Fisher's exact test.

Address for correspondence: Khder Nooraldeen, Department of Biology, College of Education, Salahaddin University – Erbil, Kirkuk Street, Erbil, Iraq  
E-mail: khderniazi@yahoo.com

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## RESULTS

Eggs of Intestinal parasitic helminths were found in 11 (91.6%) of the 12 parks analyzed. Out of 48 soil samples collected from the parks, 23 (48%) were found to be positive for helminth eggs; the mean number of helminth eggs was 1.1 per soil sample. Nematode eggs (*Ascaris* spp., *Toxocara* spp., *Trichuris* spp., *Trichostrongylus* spp. and hookworm), and 2 cestode eggs (*Hymenolepis diminuta* and *Taenia* spp.) were recovered.

Eggs of *H. diminuta* were the most prevalent helminth eggs and found in 9 (75%) parks, *Toxocara* spp. in 6 (50%) parks, *Ascaris* spp. in 4 (33.3%) parks, *Taenia* spp. and hookworm in 3 (25%) parks, respectively, and *Trichostrongylus* spp. and *Trichuris* spp. in 2 (16.7%) parks, respectively.

Out of 23 positive samples, 60.9% were contaminated with eggs of *H. diminuta*, 39.1% with *Toxocara* spp., 26.1% with *Ascaris* spp., 17.4% with hookworm, 13% with *Taenia* spp., 13% with *Trichostrongylus* spp. and 13% with *Trichuris* spp. From the positive soil samples for helminth eggs, (12) 52.1% contained eggs of more than one genus of helminths.

The largest total number of eggs in one soil sample was found in a park in neighbourhood number 325, where 6 eggs were found, but the statistical analysis did not show any significant difference between the numbers of the eggs in soil samples between the parks included in the study ( $p=0.05$ ).

There were statistically significant differences between the numbers of eggs for *H. diminuta* and each of *Trichostrongylus* spp., *Trichuris* spp., *Taenia* spp. and hookworm ( $p=0.01$ ) and *Ascaris* spp. ( $p=0.05$ ). There were also statistically significant differences between the number of eggs for *Toxocara* spp. and each of *Trichostrongylus* spp., *Trichuris* spp. and *Taenia* spp. ( $p=0.01$ ) and hookworm ( $p=0.05$ ). Statistical differences were not found between the numbers of eggs for other parasites.

The highest number of eggs for *Toxocara* spp. was found in soil samples from the park in neighbourhood number 331, and this number of eggs for one parasite per one park was statistically significantly higher than in the other parasites in each of the parks in neighbourhoods 401, 414, 202, 336, 302 and 333 ( $P=0.01$ ) and 425, 327, 314 and 345 ( $p=0.05$ ).

## DISCUSSION

The contamination rate of the soil in public squares and parks with parasites is an indicator of the potential prevalence of zoonotic parasites in the animals as sources for these parasites in this environment. The presented study revealed high levels of contamination of soil by parasites in 91.6% of the investigated parks in Erbil city. These results concerning the contamination of the soil in public parks are in agreement with studies in many cities worldwide which also showed that the soils in public parks are contaminated with eggs of helminth parasites.

The public parks' soil contamination rate with eggs of parasites found in the current study was higher than that reported in other studies. In Tenerife, Murcia and southeastern Madrid in Spain, 82.5%, 67% and 40.3%, respectively, of the parks were found to be contaminated with parasites [6, 7, 8].

In Iran, helminth eggs were recovered from 10.7% and 79.3% of soil samples from public places and children's playgrounds in Shiraz and Tehran, respectively [9, 10]. In a study of the sand in public squares and lawns of the city

of Maringá, southern Brazil, 69.2–95.4% of public squares contained protozoans and/or helminthes [11].

The most prevalent eggs of helminth parasites in the current study was *H. diminuta*, found in 75% of the parks. This high contamination of park soil samples may be due to the high presence of rodents infected with *H. diminuta*. The prevalence of *H. diminuta* was 14.3% in mice and 31.3% in rats in Erbil [12]. *H. diminuta* can be a health problem in human; it is noteworthy that *H. diminuta* had been previously reported in 0.2% of the patients attending a medical city teaching hospital in Baghdad [13].

The eggs of *Toxocara* spp. contaminated 50% of the parks in Erbil city, which was higher than that reported in Basrah, south of Iraq, where the contamination rates were 18.0% and 16.2% in urban public places and schools, respectively. The results of the present study were slightly lower than those reported in Khorram Abad in Iran where 63.3% of municipal squares were contaminated with the eggs of *Toxocara* spp. [14]. In Aydin, Turkey, and in Prague, Czech Republic, 18.9% and 20.4% of parks, respectively, were found to be positive for eggs of *Toxocara* spp. [15, 16].

The source of the contamination of soils from parks in Erbil city with the eggs of *Toxocara* spp. may be because of the presence of stray dogs and cats in the parks. The infected stray dogs and cats defecate in these parks causing the contamination with the eggs of *Toxocara* spp. Eggs of *Toxocara canis* and *Toxocara cati* can be found in the faeces of dogs and cats, respectively; the infection rate of stray cats with *T. cati* in Baghdad, Iraq, was 46% [17].

The presented study shows that eggs of *Ascaris* spp. were found in 33.3% of the parks; this may be related to *Ascaris lumbricoides* eggs, as many parks and household gardens use soils brought from river banks because of its high fertility. These soils may be contaminated with parasites, including *A. lumbricoides* from humans, because human sewage is discharged into the rivers without any treatment. Immigrant workers who used to sleep at night in the public parks of the city are another potential source which could contaminate the soil with the eggs of *A. lumbricoides*.

In a study of soils contamination in the public parks in Pula, Croatia, the number of positive samples for *A. lumbricoides* eggs ranged from 4.4% – 15.5% [5]. *Ascaris* spp. eggs were found as the most common soil contaminant (56.1%) of positive samples in a study in the Katmandu Valley in Nepal [18].

Eggs of *Taenia* spp. were detected in 25% of the parks; this may be due to the contamination of the soils with the faeces of stray animals (dogs and cats) and rodents. The infection rates with *Taenia* spp. were 78% in stray dogs of Kalar city in Sulaymaniyah province near Erbil, and 65% in stray cats in Baghdad, Iraq. Metacestodes of *Taenia taeniaeformis* were recorded in 6.7% of mice in Erbil [12]. *Taenia* spp. was detected in 0.2% of the patients' faeces in an investigation on the incidence of intestinal parasites in Baghdad [13].

Contamination of soil with hookworms is a global problem, and in the present study the contamination of parks may be due to the presence of *Ancylostoma* spp. in dogs and cats. In Canada, hookworm eggs were recovered from the soil in daycare centres in the Montreal and Quebec City areas [19]. Hookworm eggs were also found in 38% of soil samples from a university campus in the municipality of Pelotas, Rio Grande do Sul, Brazil [20].

Eggs of *Trichostrongylus* spp. were observed in 2 (16.7%) parks, the potential origin of which was untreated livestock

**Table 1.** Contamination of soil samples from public squares and parks with parasites in 12 neighbourhoods in Erbil city

Neighbourhood No.	No. of positive samples/No. of eggs							Total No. of eggs
	<i>Ascaris</i> spp.	<i>Trichostrongylus</i> spp.	<i>Toxocara</i> spp.	<i>Trichuris</i> spp.	<i>Hymenolepis diminuta</i>	<i>Taenia</i> spp.	Hookworm	
401	-	-	1/1	1/1	1/1	-	-	3
425	2/3	1/1	-	-	1/1	1/1	1/1	7
327	2/3	1/1	-	-	1/1	1/1	-	6
325	1/1	-	-	-	2/4	-	2/5	10
314	-	-	1/1	-	2/3	-	1/1	5
345	-	-	-	-	2/3	-	-	3
414*	-	-	2/2	2/2	2/2	-	-	6
202	-	-	2/2	-	1/1	-	-	3
336	-	-	-	-	-	-	-	0
302**	-	-	1/2	-	1/1	-	-	3
331**	1/1	-	2/6	-	-	-	-	7
333**	-	-	-	-	-	1/1	-	1
Total No.	6/8	2/2	9/14	3/3	13/18	3/3	4/7	55

\* District; \*\* Playground

manure used as a fertilizer. Eggs of *Trichostrongylus* spp. were also detected in sandy soil from the beaches of the municipality of Santos, located in the State of Sao Paulo, Brazil [21].

The cause of the presence of *Trichuris* spp. eggs in soil of parks is the infected human and dogs. Eggs of *Trichuris trichiura* can be found in the parks because of the tradition of using soils from the river banks for plantation in the parks and gardens. *T. trichiura* was found in 0.2% of faecal samples from patients in Baghdad [13]. *Trichuris vulpis* can be found in the faecal samples of dogs; dogs defecate in the parks, causing the contamination. Eggs of *Trichuris* spp. were also found in the soil samples from recreational areas in the Lublin Region, Poland [22].

## CONCLUSIONS

The results of the presented study indicate that there is a high contamination with parasitic agents of human and animal origin in the parks in Erbil city. This contamination can cause many health problems in people if they become infect with these parasites. Therefore, there is a need for preventive means of the contamination in the parks, it is also important to control stray animals, sterilize the livestock manure which is used as fertilizer before using it, and sterilize the soil brought from the river banks.

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