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Soil Contamination with Soil Transmitted Helminthes in Schools and Play Areas of Kermanshah City, West of Iran

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Abstract

Background: Geohelminth infections are common infections worldwide. These helminthes are parasitic nematodes, which could infect humans and animals by contact with eggs or infective larvae and in some cases cause serious disorders, especially in children.
Objectives: The present study was designed to evaluate the prevalence of geohelminth eggs in the soil of schools and play areas of Kermanshah city, western Iran.
Materials and Methods: One hundred and ninety-two soil samples were collected from 24 primary schools and 24 play areas from four different parts of each area. Diagnosis of geohelminth was confirmed by the recovery of their eggs by the flotation technique using sucrose solution and examined under light microscope using 10X and 40X objectives.
Results: Out of 192 soil samples, soil of play areas from four regions was contaminated with geohelminth eggs. The rate of soil contamination with Trichuris spp. eggs was 3.12% while this was 2.1% for hookworm eggs, yet no Ascaris eggs were found in the examined soil samples.
Conclusions: Based on the results of this study there is a risk of infection with soil transmitted helminthes among children of Kermanshah, Iran.

Keywords: Geohelminth, Soil Contamination, School, Play Area, Nematodes

1. Background

Geohelminth infections are major intestinal pathogens, which affect underprivileged communities with incomplete admission to innocent water and appropriate health facilities. Soil Transmitted Helminth (STH) such as *Ascaris lumbricoides*, Trichuris trichiura and hookworms are among the most important geohelminths, which have been estimated to infect approximately two billion humans all over the world (1). Infection with geohelminths effect feeding, growth and fitness and also cause chronic infections in the population of endemic areas (1, 2). Soil provides appropriate conditions for conversion of the eggs to the infective stage. Also presence of eggs in the superficial layers of the soil can be considered as a factor affecting their transition to humans in each region (3). One of the main pathways for human infection is ingestion of infective eggs by consumption of raw vegetables and fruits contaminated with soil containing eggs (2, 4). Thus, it seems that soil is the main resource for human infection and can be a direct indicator for the risk of infection among human populations, especially children. Evidences indicate that STH infections affect children in developing and developed countries and are directly associated with growth retardation, physical activity reduction and disorders in learning abilities (5, 6).

Basically, the endemicity of geohelminth depends on the presence of infected individuals, continuous contamination of the soil with feces and suitable soil condition and frequent contact between the soil and healthy individuals. Therefore, geohelminth infection rate is affected by both natural and cultural factors (3, 6, 7). Due to limited resources in most developing countries, prioretising the

control of such infections seems very difficult and it could be an important reason for the presence of the infection in these countries. These kinds of infections are considered as neglected diseases, which in case of suitable conditions can cause serious problems (4, 8).

2. Objectives

The present study aimed to determine the prevalence of soil contamination by geohelminth eggs in schools and play areas of Kermanshah city, West of Iran.

3. Materials and Methods

3.1. Study Area

Kermanshah city is located in the center of Kermanshah province in the West of Iran, and the city is divided to six regions. Its' population is estimated around 850000, where most of its population are engaged in agricultural activities. Kermanshah is one of the western agricultural centers of Iran that produces grain, rice, vegetable, fruits and oilseeds. Kermanshah has cold winters and usually has rainfalls in fall and spring.

3.2. Sample Collection

During the period from September to December 2014, a total of 192 soil samples were collected from 24 primary school and 24 play areas in Kermanshah city. In each of the six regions, the samples were collected from four play areas and four primary schools. The samples were collected from four different parts of each area, including northern, eastern, western and southern part. Samples were collected from loose soil, mainly from [U+FB02]owerbeds. Approximately 200 grams of soil was obtained from an approximate depth of 3 cm, and all samples were then placed in plastic containers, labeled with a number and were exposed to air to dry.

3.3. Parasitological Procedures

Two grams of each sample was isolated using 150 μm mesh sieves and transferred into the test tubes. Next 10-mL Tween-80 with 0.05% concentration was added to the mixture and shook vigorously. The tubes were centrifuged at 1500 rpm for five minutes. In the next step, the supernatants were discarded and the tubes containing the sediments were filled with approximately 1 cm from the top with sucrose solution (1.2 g/cm^3) and the sediments were suspended. The tubes were then centrifuged for 15 minutes at 1500 rpm. Finally, the tubes were filled with sucrose solution and a cover slip was placed on each tube and left stationary for 30 minutes and then the cover slips were placed on the microscopic slides and examined under a light microscope using 10X and 40X objectives.

4. Results

A total of 192 soil samples were examined and low rate of geohelminth egg contamination was observed. Although, the prevalence of free-living nematodes was considerably high in the studied areas (Table 1), Trichuris spp. eggs were not observed in any of the studied schools, but were found in three play areas (3.12%). Additionally, no Ascaris eggs were found in the examined soil samples.

5. Discussion

Public sites such as schools and play areas are considered an important source for human infection, especially for children. The places where children play are important for public health (9). In many studies, it has been demonstrated that parasitic infections have a considerable negative influence on health factors such as weight and height (10, 11).

Recent studies evaluated STH prevalence in the soil from parks, playgrounds, schools, etc. (12, 13). Reports of soil contamination with geohelminth eggs have been published in Iran and other countries, as summarized in Table 2. According to the results of the present study, soil contamination with geohelminth eggs (2.6%) is low in Kermanshah compared to the other studied areas in Iran and other countries. Environmental factors such as soil type, preprocessing sieving, suspension of sediment, washing and flotation and specific gravity of flotation solution seem to influence the recovery of geohelminth eggs in the soil (14, 15). Furhtermore, some factors like climate, herbage and presence of animals could affect soil contamination (16). Increase in the number of stray dogs and cats plays an important role in soil contamination with hook worm eggs, one of the main causes of cutaneous larva migrans in humans, which were found in two play areas in separate regions of Kermanshah. The eggs are excreted by infected host to the soil and develop to third stage larva (L3), which is infective and can infect children by direct contact with contaminated soil in schools and play areas (17). During childhood, infection with hookworms plays an important role in moderate to severe anemia in preschool and school-aged children (18-20).

Trichuris spp. is another STH, which were found in another region in Kermanshah. Human infections with this parasite are associated with some clinical disorders, which are similar to that of inflammatory bowel disease, such as chronic abdominal pain, diarrhea and other disorders such as impaired growth, anemia and finger clubbing (21).

The results of the present cross-sectional study indicate that the current status of contamination of soil with

Table 1. Soil Contamination With Geohelminth Eggs in Different Parts of Kermanshah[a]

Region	Collected Soil Samples		Free Living Nematodes		*Trichuris* Spp.		Hook Worms	
	School	Play Areas	School	Play Areas	School	Play Areas	School	Play Areas
1	16	16	2 (12.5)	13 (81.25)	0	0	0	1 (6.25)
2	16	16	0	14 (87.5)	0	1 (6.25)	0	0
3	16	16	2 (12.5)	9 (56.25)	0	0	0	1 (6.25)
4	16	16	3 (18.75)	14 (87.5)	0	0	0	0
5	16	16	3 (18.75)	8 (50)	0	0	0	0
6	16	16	7 (43.75)	6 (37.5)	0	2 (12.5)	0	0
Total	96	96	17 (17.7)	64 (66.6)	0	3 (3.12)	0	2 (2.1)

[a] Values are expressed as No. (%).

Table 2. Reports of Soil Contamination With Geohelminth Eggs Have Been Published in Iran and Other Countries

Country/city	Location of Study	Sample. No. (%)
Poland/Lodz	Park playground	168 (7.7)
	School sports fields	216 (15.7)
Poland/Lublin	Beach	215 (18.6)
Egypt/Sharkyia	Rural and urban areas	120 (28.3)
Philippines/Barangay Bayog	Rural areas	120 (54)
India/Titagarh	Soil of wastewater-irrigated areas	35 (68.6)
Nigeria/Abuja	Public parks	764 (67.5)
Iran/Tehran	Public places	150 (6.7)
Iran/shiraz	Public places	112 (10.7)
Iran/Kermanshah	School/play areas	192 (2.6)

soil transmitted helminth is fairly good, but some preventive measures such as controlling stray dogs and cats and preventing their entry into public places to keep schools and play areas and other public places uncontaminated seems necessary.

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Footnote

Authors' Contribution: Mohammad Ali Mohaghegh, Mohsen Ghomashlooyan and Mehdi Azami were responsible for the experimental design of the study. Mohammad Ali Mohaghegh, Mohsen Ghomashlooyan, Mohammad Reza Vafaei, Nooshin Hashemi and Mohammad Falahati were responsible for the execution techniques and parasitological examination of soils. Farzaneh Mirzaei, Hamed Kalani, Somayeh Jahani and Seyed Hossein Hejazi were responsible for the statistical analysis and Mohammad Reza Vafaei for the collection of the samples. All authors reviewed and contributed to the writing of this manuscript.

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