

Soil Contamination with Intestinal Helminthic Parasites in Children's Play Areas in Soran City, Kurdistan Region, Iraq

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Abstract— Parasitic diseases caused by soil-transmitted helminths are significant diseases of humans and livestock, that only about the human population, affect about one third of the world's people. These parasites passing some parts of their life cycle in the soil and then transfer from soil to new host. The primary goal of current study was to determine the rate of soil contamination by intestinal helminthic parasites in soil samples gathered from children play areas in Soran city and suburbs. Sixty soil samples were collected randomly and examined by floatation technique. By applying NaNO₃ solution, helminth forms were found in (40%) of urban samples while (33.3%) of them were positive by using sugar solution. Flotation by NaNO₃ solution and sugar solution showed that (73.3%) and (53.3%) of rural samples were contaminated respectively. The predominant parasite species detected in the examined soil samples were *Taenia* spp. and *Ascaris* spp. This study demonstrated high level of soil contamination in both urban and rural play areas thus there is a serious threat and risk for acquiring helminth infection for children who use these areas.

Index Terms— Helminthic parasites, Soil contamination, Play areas, Flotation technique, Soran.

I. INTRODUCTION

More than one fourth of infectious diseases in humans are induced by parasitic worms and protozoa. Among these, intestinal parasites as an important group of human pathogens, infected humans from prehistoric times and they have inhabited in human body and evolved with them throughout history [1]. Geohelminths also called (soil-transmitted helminths) belonging to phylum nematoda, are intestinal parasitic helminth of both humans and animals affecting over than 2 billion people worldwide [2, 3] [4];[5]. Soil-transmitted helminths regarded as one of the most prevalent groups of infectious agents and they are cause of terrible universal health problems. They considered as the main source of environmental contamination [6].

Most geohelminth parasites live in the digestive system (gastrointestinal tract) of human and mature there and then produce eggs then excrete those eggs in to the outside of the human body via the stool. There are some differences in infection pathways and migration in the body of their host. Exited eggs from host, transmit to soil, vegetation and water. The stability and viability of the eggs in the soil is depending on the humidity of soil and temperature. Helminths eggs can't survive in low humidity and high temperature. Also many microorganisms that present in soil may attack helminths eggs

and destroying them, but they can survive at high PH range [7, 8].

Among those nematode parasites, the most commonest and prevalent species in soil that transmit to humans and cause disease are whipworm (*Trichuris trichiura*), roundworm (*Ascaris lumbricoides*) and two hookworms (*Necator americanus* and *Ancylostoma duodenale*) [8]. Many reports show that (*A.lumbricoides*) with (*T.trichiura*) are the most prevalent intestinal parasites in humans [9].

Childrens, however are more susceptible to geohelminths parasites and they are at the highest risk to infection. Therefore infections in childrens can lead to anemia, iron deficiency, vomiting, diarrhea, abdominal pain, fever, impair mental and physical growth cause growth retardation. [10] [9] [8] [11].

The most important route for transmission of infection, especially in humans, is direct contact with contaminated soil, water, vegetables and fruits that are not carefully washed. Contaminated children's play area are one of the important source of infection in children. Invasive larval stage in soil, (active penetration in to the skin) in some other nematodes particularly in hookworms is another way of contamination [12] [13].

Nowadays, STHs are significant public health issues in various parts of the world specially in tropical and subtropical region, particularly in places where hygiene is poor and lack of sanitation but some also occur in poorly nourished children in developing countries [6] but they are rarely fatal [11]. As of our current knowledge, there are limited investigations on the possible contamination of soil in children's play areas with intestinal nematodes in Kurdistan and based to the available scientific literature, no prior surveys have been carried out to assess the presence of parasitic contamination in children's play area in soran. Therefore the main aim of this project is to appraise the sanitary state of soil (rate of soil contamination with intestinal helminthic parasites) in children's play areas in Soran city and suburbs.

II. MATERIALS AND METHODS

A. Study area

The present survey was conducted from September 2021 to January 2022 in Soran city and suburbs. Soran city or Diana is

located in the northeast of Kurdistan region – Iraq, an area with a semi arid continental climate. It is a city of the province Erbil, which is located in the north of Iraq. Turkey and Iran are located at the north and east sides of the Soran city, respectively. [14]

B. Sample collection

At first, the city was divided into five areas: the north, south, east, west, and center. Five villages around the Soran city were also considered. The study focused on children's play areas, thus for each part, a children's playground was chosen at random. A total of sixty soil samples were randomly collected from specified areas (6 samples for each site).

Due to the limited penetration ability of helminthic parasite eggs into the solid profile and their prolonged retention near the surface, soil samples (approximately 250 g in total weight for each) were picked from an approximate depth of 3 cm [15]. Soil samples were placed into plastic bags, labeled by number and description, then transferred to the biology laboratories in the biology department at Soran university.

C. Parasitological Procedures

All samples dried immediately at room temperature for 2-3 days and were separately sifted through sieve to remove solid objects. A total of sixty soil samples were finally collected and prepared: of these, 30 samples were from urban areas that divided in to two groups. First group (15 samples consist of 3 samples for each site) was examined by saturated sodium nitrate solution. The second group (15 sample, for each site 3 samples) was investigated by sheather's sugar solution. These process were also repeated for rural samples.

1. Saturated sodium nitrate flotation technique

A previously described procedure was followed in order to retrieve parasite forms from the gathered samples. In summary, a 40 g portion of the sample was weighed and transferred into a 250 ml Erlenmeyer flask. Then 60 ml of 5% sodium hydroxide (NaOH) added into the sample and left for 1 h. In the next step, the sample was shaken for 20 minutes and poured into a falcon tube. Then the sample was centrifuged for 3 minutes with 1500 rotations per minute. Supernatant solution discarded and centrifugation was repeated three times by 60 ml of distilled water. After being suspended in 60 milliliters of saturated flotation solution (NaNO₃) with a specific gravity of 1.30, the sediment was centrifuged for ten minutes at 1500 rpm. A cover slip was eventually placed on the surface of the fluid and left for ten minutes. In the final stage, the cover slip was put on the glass slide and observed under optical microscope.

2. Sheather's sugar flotation technique

The whole process was similar to the previous stage, but instead of saturated sodium nitrate fluid, the samples were analyzed by the Sheather's sugar solution and in the final stage, after 15 min the cover slip was placed on a glass slide, and inspected under light microscope. Detected parasites were identified and classified according to [17, 18].

III. RESULTS

The current study involved the analysis of 60 soil samples gathered from 10 children's playgrounds in the five urban areas (30 samples) and five rural areas (30 samples). By using two

different solutions in floatation technique, the following results were obtained: Experiments performed by applying saturated NaNO₃ indicated that (40%) of urban samples are infected with intestinal nematodes while by using the sugar solution, the rate of contamination was (33.3 %). About rural samples, conducted tests by saturated NaNO₃ solution showed that (73.3%) of samples are contaminated with parasites, but (53.3%) of samples were positive by using sugar solution. (Tables 1&2) The most prevalent parasites identified in urban samples, were *Taenia spp*, while in rural samples, *Ascaris spp* were dominant parasites. (Fig 1)

Table 1. Prevalence and types of intestinal helminthic parasites in soil samples examined by NaNO₃

Type of sample	No. Examined	No. Contaminated %	Type of parasite	No. positive Sample	%
Rural samples	15	11(73.3%)	<i>Ascaris spp.</i>	5	33.3
			<i>Hymenolepis spp.</i>	3	20
			<i>Taenia spp.</i>	6	40
			Larva of worm	1	6.6
Urban samples	15	6(40%)	<i>Taenia spp.</i>	3	20
			<i>Ascaris spp.</i>	1	6.6
			Larva of worm	1	6.6
			<i>Trichuris spp.</i>	3	20

Table 2. Prevalence and types of intestinal helminthic parasites in soil samples examined by sugar solution.

Type of sample	No. Examined	No. Contaminated %	Types of parasite	No. positive Sample	%
Rural samples	15	8(53.3%)	<i>Ascaris spp.</i>	5	33.3
			<i>Taenia spp.</i>	3	20
			<i>Toxocara spp.</i>	1	6.6
			<i>Hymenolepis spp.</i>	1	6.6
Urban samples	15	5(33.3%)	<i>Taenia spp.</i>	3	20
			<i>Ascaris spp.</i>	3	20
			<i>Hymenolepis spp.</i>	1	6.6

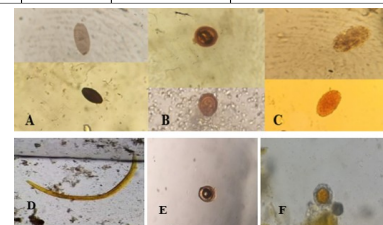


Fig 1. *Trichuris spp* eggs (A). *Taenia spp* eggs (B). *Ascaris spp* eggs (C) Larva of worm (D) *Hymenolepis spp* (E) *Toxocara spp* (F)

DISCUSSION

Transmission of parasites to humans and domestic animals through contaminated soil is one of the main causes of diseases and economic losses in human societies. On the other hand, the main cause of contaminated soil is infected humans and animals, whose excrement spread a variety of parasite species into the ecosystem [19] [6]. Geohelminths parasites include a group of intestinal parasitic helminthic which can infect humans through direct contact with their infective stages such as eggs or larvae, that are usually present in the soil and on the

surface of fruit and vegetables. Therefore, presence of the infective stages of these organisms in the soil is a possible risk to public health. Furthermore, the public sites suchlike play areas are determined as main source for human infection, particularly for children [20]. According to many studies, parasitic infections in children, have harmful effects on health factors such as weight and height [21].

Due to their similarities, the majority of common parasite species' eggs in soil cannot be distinguished based solely on morphology therefore, molecular methods are necessary for accurate differentiation. Additionally, it should be noted that there is lack of standardization in the methods used to isolate parasite eggs from soil [22] thus, in present study, in order to increase the accuracy and achieve the better results, two floating solutions were used. Our study about the soil contamination with intestinal helminthic parasites indicated that the rate of contamination in selected areas of Soran city (specially children play areas) is dramatically high which constitutes a serious health and epidemiological problem. By using the NaNO₃ solution, the rate of contamination in rural and urban play areas was (73.3%) and (40%) respectively that is greater than those reported by Azian, et al (2008) who confirmed (26.7%) of urban soil samples and (4.9%) of rural samples in Kuala Lumpur, Malaysia are contaminated with helminths parasites. In the other study, (78.6%) of soil samples collected from public parks and play areas in Kirkuk city, Iraq were contaminated by parasites [23]. Nooraldeen (2015) reported that (48%) of soil samples collected from parks in Erbil city Iraq are contaminated by helminths parasites. He also showed that more than (90%) of investigated parks are infected with parasitic eggs. In addition, our findings indicate that the dominant parasites in the soil samples are *Ascaris* spp and *Taenia* spp and their eggs were identified in many samples taken from rural and urban play areas in Soran city.

The recovery of helminthic eggs in the soil samples appears to be influenced by environmental factors such as different climate conditions, soil type, different sampling and detection methods, flotation and specific gravity of flotation solutions and these could be the reasons for the difference of results in various studies.

CONCLUSION AND RECOMMENDATION

In conclusions, the results of our study indicate a high rate of soil contamination with helminths parasites in Soran city and its suburbs specially in children play areas. In addition, it has been found that these helminthic can transmit to human and animals then may cause diseases and produce many health problems for them. This is the first survey on intestinal helminthic parasites in soil in Soran city and the results of this survey provide useful information for further studies in future.

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