DOI: 10.2478/cipms-2022-0025 Curr. Issues Pharm. Med. Sci., Vol. 35, No. 3, Pages 133-136

Current Issues in Pharmacy and Medical Sciences
Formerly ANNALES UNIVERSITATIS MARIAE CURIE-SKLODOWSKA, SECTIO DDD, PHARMACIA

journal homepage: http://www.curipms.umlub.pl/

Testing sand and soil from selected playgrounds in Lublin for eggs of nematodes of the genus: *Ascaris*, *Toxocara*, *Trichuris*

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ARTICLE INFO

Received 18 July 2022
Accepted 04 August 2022

Keywords:
children,
sand,
Toxocara,
Trichuris,
Ascaris,
health.

ABSTRACT

Children need to play outdoors. It is a natural tendency for young children to put everything in their mouths. Hygienic condition of playgrounds is important for maintaining their health. Companion animals (dogs and cats) as well as wild animals can transmit parasites that cause zoonoses in humans. Such infections often affects children playing in sandpits and playgrounds. Sand samples taken from specific locations (sandboxes, playgrounds) can be tested for the presence of parasite eggs specific to humans and animals (*Ascaris*, *Toxocara*, *Trichuris*). They cause ascariasis, toxocarosis, trichurosis. Invasive eggs of the parasites due to the very thick, multi-layered egg shells are very resistant to the influence of climatic factors and to chemicals present in the environment. The only way to get rid of parasite eggs from locations where they endanger human health is to remove the top layer of sand or soil or completely replace the sand. However, this is a laborious and costly procedure.

The aim of the project was to examine samples from selected playgrounds in Lublin (Polnad) in terms of the presence of *Ascaris*, *Toxocara*, and *Trichuris* eggs.

Thirty five samples of sand and soil obtained from 7 playgrounds in Lublin were obtained in May 2022 and tested for the presence of *Ascaris*, *Toxocara*, and *Trichuris* eggs with flotation method. In none of the examined samples the parasite eggs were found. The tested playgrounds in Lublin are hygienic and safe from eggs of *Ascaris*, *Toxocara*, and *Trichuris*.

INTRODUCTION

Children need to play outdoors, but it is a natural tendency for young children to put everything in their mouths. Thus, hygienic condition of playgrounds is important for maintaining their health.

Companion animals (dogs and cats), as well as wild animals can transmit parasites that cause zoonoses in humans. Such infections often affect children playing in sandpits and playgrounds. Sand or soil samples taken from specific locations (sandboxes, playgrounds, outdoor gyms, barbecue areas) can be tested for the presence of parasite eggs specific to humans and animals (nematodes or geohelminths of the genus: *Ascaris*, *Toxocara*, *Trichuris*) [1]. It is estimated that 72% of all homeless dogs and 10.5-30% of all cats are infected with *Toxocara canis* or *Toxocara cati*, respectively [2]. In the population of foxes living in Poland the incidence of *Toxocara canis* infection is 13-43% [3].

The geohelminths cause serious human diseases (ascariasis, toxocarosis, trichurosis). Invasive eggs of theses parasites (especially from the genera *Ascaris*, *Toxocara*, *Trichuris*) due to the very thick, multi-layered egg shells are very resistant to the influence of climatic factors and to chemicals present in the environment (Fig. 1). The only way to get rid of parasite eggs from locations where they endanger human health is to remove the top layer of sand or soil (in the case of large areas) or completely replace the sand (in sandboxes). However, this is a laborious and costly procedure.

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Figure 1. Immature *Toxocara canis* eggs obtained from a female parasite in the laboratory (Photo Anna Borecka – Military Institute of Hygiene and Epidemiology, Warsaw, Poland. Published with permission of the Author. Microscope Eclipse E200, Nikon, magnification 100×)

AIM

The aim of the study was to examine samples from selected playgrounds in Lublin (Poland) in terms of the presence of *Ascaris*, *Toxocara*, and *Trichuris* eggs.

METHOD

Thirty five samples of sand and soil from 7 playgrounds in Lublin were obtained (Tab. 1). In order to detect the presence of *Toxocara*, *Ascaris* and *Trichiuris* eggs, a modified flotation method was used. These tests are based on the Polish Standard and PN-Z-19000-4/2001. Sand samples were obtained from the top layer of the substrate, *i.e.* to a depth of 2-3 cm (sandbox, playground, recreation area) using a clean spoon or spatula. In sandbox tests, the envelope method was used, *i.e.* sampling from five places (one from each corner and one from the central area).

Table 1. The playgrounds selected for testing in Lublin

No	Address	Link to google maps	Fence	Neighborhood
1	Wspólna 1-23, 20-344 Lublin	https://goo.gl/maps/ci2qsdq8g9yKBVCCA	Yes	by the river Czerniejówka
2	Elektryczna 12, 20-349 Lublin	https://goo.gl/maps/BaTFtTKRgCtfq6qS6	Yes	next to a kindergarten and blocks of flats
3	Wierzbowa 13, 20-353 Lublin	https://goo.gl/maps/nborxm5pZz7pUS278	Yes	next to a kindergarten and blocks of flats
4	Bronowicka, 20-300 Lublin	https://goo.gl/maps/sRFZKdxGfegC87FE7	No	Bronowice Park 100-years old next to a kindergarten and blocks of flats
5	Piłsudskiego 9-27, 20-011 Lublin	https://goo.gl/maps/YTrJvjkZvVr2Yysx7	No	Park Ludowy-revitalized in 2020; playgraoud for children under 7 years of age; by the river Bystrzyca; 300 m from the dormitory for refugees
6	Piłsudskiego 9-27, 20-011 Lublin	https://goo.gl/maps/ZVwLv3e5wAjatdGa6	No	Park Ludowy, revitalized in 2020; playground; by the river Bystrzyca; 300 m from the dormitory for refugees
7	Piłsudskiego 9-27, 20-011 Lublin	https://goo.gl/maps/WHJqzU9CeHq3JGKc9	Yes	Park Ludowy revitalized in 2020; playground for dogs; by the river Bystrzyca

The weight of a single sample was at least 100 g. The samples collected in this way were poured into clean plastic containers (like for urinalysis).

The container was precisely described (address, place of collection, e.g. sandbox, playground, etc., number of the sandbox – with several tests, date of collection). The samples were collected in May 2022. The test were performed at the Independent Parasitology Laboratory of the Military Institute of Hygiene and Epidemiology, Kozielska 4 Street, 01-163 Warsaw, Poland.

RESULTS AND DISCUSSION

Parasite eggs were found in none of the examined samples, which shows that the examined spaces for play and recreation in Lublin are hygienic and safe for children. In comparison, in Warsaw where as much as 11.8%, in Bytom – 17.9%, in Poznan – 27% and in Cracow – 61.9% of all samples obtained from playgrounds were contaminated with eggs of *Toxocara spp*. [4-7]. This is a surprising result. According to Borecka in 2005, 22% of all lawns and 31.6% of all sandpits in Lublin were contaminated with the eggs of *Toxocara* spp.[2]. As a side-note, anti-*Toxocara* antibodies (detected with ELISA method IgG antibodies) are detected in 2-7% of the human population of Denmark and Sweden, 14% in the United States of America, 14% in Malesia, 22% in Iran, and 81% in Nepal [1].

Ascariasis is considered the most common parasitosis in the world. The highest number of people infected with this ubiquitous parasite live in Asia (75%), 12% in Africa and 8% in South America. Trichurosis is most common in Vietnam (it affects 80% of the local population). The World Health Organization reports 800 million infections in the world, with 35 million among schoolchildren [1].

In 1954, Zembrzuski conducted a large parasitology study in kindergarten and schoolchildren under 18 in Poland and recorded 11100 cases of children infected with intestinal parasites, where 54% had *Enterobius vermicularis*, 31.3% – *Toxocara canis* or *Toxocara cati*, 14.1% – *Ascaris lumbricoides* and 0.6% had tapeworms [8]. He examined directly samples of feces. In 1996, another study was conducted and it showed that 18.7% of all children under 15 in Lublin voivodship had anti-*Toxocara* antibodies [9]. In 2014, trichurosis was estimated to affect 2.3-25% of the entire Polish population, and ascariasis – 1-18% [10].

Playgrounds, including those with sandboxes, are considered to be small architecture objects in Poland, which means that they are subject to construction law. In the light of building regulations, they are in the same category as chapels, roadside crosses, figures, statues, fountains, garden architecture structures and garbage cans [11]. The qualification of playgrounds as objects of small architecture implies the obligations of managers in the field of periodic inspection of their technical condition [12]. The purpose of these inspections is to ensure the use of the facility in accordance with its intended use, while maintaining appropriate technical efficiency and aesthetic values [13].

Separate regulations regulate the location of playgrounds, insolation and their distance from other buildings [14]. The compilation of guidelines for the organization and

maintenance of playgrounds, in particular, in terms of safe use, has been formulated by the Office of Competition and Consumer Protection, which, in addition to the conditions relating to the safety of use (understood as preventing accidents), also outlines epidemic safety conditions, such as installing fences that prevent animals from accessing the playgrounds, assembly of rubbish bins and placing dog walks away from children's playgrounds [15].

An issue bordering on accident prevention and epidemic safety is the determination of the acceptable surface of the playground. According to the regulations, it is to be a surface aimed at reducing the risk of injury during a fall. Synthetic surfaces, as well as natural surfaces, such as turf, soil, sand, gravel, shavings or bark, are acceptable. It is worth noting that various surfaces, due to their nature, may be more or less difficult to maintain in terms of maintaining cleanliness and constant control for the appearance of contamination [16]. At the same time, it should be indicated that the biological active surface of the playground surface should not be less than 30% of the total area [17]. The technical conditions of playground equipment described above also have a direct impact on their epidemiological safety.

The entity managing the playground is obliged to periodically inspect its equipment, including paths, sidewalks and other surfaces. The regulations require three types of inspections: periodic visual inspection (once a week), equipment wear inspection (once every 1-3 months), and main-specialist inspection (once a year). The applicable standards place emphasis on preventing accidents understood as mechanical injuries resulting from damage, wear or improper condition of playground equipment. However, as part of periodic inspections, it is also required to assess the cleanliness of surfaces and equipment. During periodic inspections, possible contamination of loose substrates should be taken into account, as well as temporary removal of contaminants [18]. It should also be pointed out that playgrounds, as real estate, are also subject to sanitary rules. And so, the owner of the property, regardless of its nature or destination, is obliged to maintain it in a proper hygienic and sanitary condition, including, inter alia, the removal of waste, rodents and insects, fallen animals and animal excrements from the property. The aim of this action is to prevent infections and infectious diseases [19].

A sandbox is a special element of the playground equipment. Like swings or benches, it is classified as an object of small architecture, but for sanitary and hygienic reasons it is subject to more stringent regulations. The primary responsibility of the owner or manager of a sandbox is to secure it, for example, by fencing it off or covering it during periods of non-use. At the same time, a necessary element of sanitary and hygienic prevention is the replacement of sand in sandboxes after the winter season and during the summer season. This means that the sand has to be replaced twice a year and each time when waste, in particular, animal excrements, is detected in it. The implementation of these regulations is monitored by sanitary supervision authorities [20]. It should be noted that the above-mentioned regulations apply to entities from the public and service sphere, *i.e.* owners, holders and managers of real estate on which playgrounds are located. The catalog of these entities is extremely wide and includes both public entities such as local self-governments, organizational units of these self-governments, areas under the control of state authorities, as well as private housing cooperatives, communities of residents, developers, real estate management companies, holiday centers. In practice, persons operating on their own property are not subject to any regulations, and the condition of private playgrounds and sandboxes on their own premises depends only on sanitary and hygienic awareness.

The results obtained in our study indicate that homeless dogs and cats care in Lublin is good enough to limit the population, and that the accompanying animals (cats and dogs) are treated for intestinal parasites according to the current indications approximately 4 times a year.

CONCLUSION

The tested playgrounds in Lublin are hygienic and safe for children.

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