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## Intestinal parasitic infections in Ukrainian war refugee children living in Poland

### Zarażenia pasożytami jelitowymi wśród ukraińskich dzieci (uchodźców wojennych) mieszkających w Polsce

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#### Abstract

**Introduction:** The armed aggression of the Russian Federation against Ukraine in February 2022 forced millions of Ukrainian citizens to flee their country and seek refuge mainly in the European Union. Many of them found shelter in Poland. There are now over one million Ukrainian war refugees living in Poland, including 500,000 children. The attention of Polish medical services has been recently drawn to the previously unknown epidemiological status of infectious and invasive diseases in the paediatric population of Ukrainian refugees. The aim of this study was to assess the prevalence of intestinal parasitic infections in the group of Ukrainian children living in Poland. **Materials and methods:** The study involved performing parasitological examination of stool samples collected in May 2023 from 37 Ukrainian refugee children aged 3–7 years, who were living in Szczecin (Poland) and were attending a preschool set up to address the needs of the local Ukrainian community. Stool samples were tested by light microscopy using three different methods (direct smear, decantation, flotation) at the Department of Epidemiology and Tropical Medicine at the Military Institute of Medicine – National Research Institute. **Results:** Intestinal parasites were detected in 3 out of 37 children (8.1% of the study group; there was one case of infection with *Ascaris lumbricoides* and two cases of infection with *Blastocystis* spp.). The infected children's parents or guardians did not observe any diarrhoeas or other gastrointestinal symptoms within 6 months prior to the examination. **Conclusions:** The presence of intestinal parasites among Ukrainian war refugee children living in Poland justifies the screening for parasitic diseases in this population. The obtained results will allow to take appropriate preventive and therapeutic actions.

**Keywords:** intestinal parasites, children, Ukrainian war refugees, Poland

#### Streszczenie

**Wprowadzenie:** Zbrojna agresja Rosji na Ukrainę w lutym 2022 roku spowodowała ucieczkę milionów Ukraińców poza granice swojego kraju, głównie do krajów Unii Europejskiej. Wielu z nich znalazło schronienie w Polsce. W chwili obecnej na terenie Polski mieszka ponad milion ukraińskich uchodźców wojennych, w tym 500 tys. dzieci. Uwagę polskich służb medycznych zwrócił nieznan status epidemiologiczny populacji dziecięcej w aspekcie chorób infekcyjnych i inwazyjnych. Celem pracy była ocena występowania zarażeń pasożytami jelitowymi w grupie ukraińskich dzieci mieszkających w Polsce. **Materiał i metody:** W badaniach parazytologicznych przeprowadzonych w maju 2023 roku wzięło udział 37 ukraińskich dzieci, uchodźców wojennych w wieku 3–7 lat, mieszkających w Szczecinie i uczęszczających do przedszkola zorganizowanego na potrzeby społeczności ukraińskiej. Badania kału w kierunku pasożytów jelitowych wykonano trzema metodami w mikroskopii świetlnej (preparat bezpośredni, dekantacja, flotacja) w Zakładzie Epidemiologii i Medycyny Tropikalnej Wojskowego Instytutu Medycznego – Państwowego Instytutu Badawczego. **Wyniki:** Pasożyty jelitowe wykryto u 3 z 37 dzieci (8,1% zarażonych, w tym jeden przypadek inwazji *Ascaris lumbricoides* i dwa przypadki zarażenia *Blastocystis* spp.). Według relacji rodziców lub opiekunów zarażonych dzieci nie obserwowano występowania biegunek ani innych objawów żołądkowo-jelitowych w ciągu 6 miesięcy przed badaniem. **Wnioski:** Zarażenia pasożytami jelitowymi wśród ukraińskich dzieci, uchodźców wojennych mieszkających w Polsce, uzasadniają realizację badań przesiewowych w kierunku występowania chorób pasożytniczych w tej populacji. Uzyskane wyniki badań pozwolą na podejmowanie odpowiednich działań profilaktycznych i leczniczych.

**Słowa kluczowe:** pasożyty jelitowe, dzieci, ukraińscy uchodźcy wojenni, Polska

## INTRODUCTION

The armed aggression of the Russian Federation in February 2022 forced millions of Ukrainian citizens to flee their country and seek refuge mainly in the European Union. Most refugees found shelter in Poland. There are currently over one million Ukrainian war refugees living in Poland, including more than 500,000 children<sup>(1,2)</sup>. The attention of Polish medical services has been recently drawn to the previously unknown epidemiological status of infectious and invasive diseases in the paediatric population of Ukrainians. Given the fact that many Ukrainian refugees experienced poor sanitation while fleeing their country, it seems reasonable to implement a health programme aimed at monitoring their health status, especially in terms of controlling the spread of intestinal parasitic diseases. Such programmes are also extremely important since the epidemiological status of parasitic infections in Poland is uncertain. The absence of reliable epidemiological data is the consequence of the introduction of the *Act on Prevention and Combating Infections and Infectious Diseases in Humans* on 5 December 2008. Under this law, as many as 19 items were removed from the national list of notifiable diseases, including all roundworm infections (e.g. ascariasis, enterobiasis), tapeworm infections (taeniasis) and some protozoan infections (e.g. amoebiasis)<sup>(3)</sup>. The Department for Preventing and Combating Infections and Infectious Diseases in Humans at the Chief Sanitary Inspectorate lack sufficient data to reliably determine the prevalence rates of food and waterborne parasitic infections in Poland. Furthermore, Polish sanitary and epidemiological stations are not legally bound to monitor parasitic infections in local communities. As there is no legal obligation to report cases of intestinal parasitoses (except for giardiasis and cryptosporidiosis) or cases of food/waterborne parasitoses (cysticercosis and echinococcosis), the epidemiological status of intestinal parasitic diseases in Poland remains uncertain<sup>(4)</sup>. The aim of this study was to assess the prevalence rates of intestinal parasitic infections among Ukrainian war refugee children living in Poland.

## MATERIALS AND METHODS

The study involved performing parasitological examination of stool samples collected in May 2023 from 37 Ukrainian war refugee children aged 3–7 years, living in Szczecin (Poland) and attending a privately-owned preschool Tiny Land. The preschool, which is run by a charity organization YOUkraine, was opened in October 2022 in response to the needs of the local Ukrainian community. Three stool samples were collected from each study participant at 2–3 day intervals. The biological material was collected in labelled stool containers, fixed in SAF (sodium acetate acetic acid formalin)<sup>(5)</sup>, and then transported to the Department of Epidemiology and Tropical Medicine of the Military Institute of Medicine – National Research Institute in Gdynia (Poland) for parasitological examination.

## Laboratory procedures

Stool samples were tested by light microscopy using three different testing methods (direct smear, decantation, flotation)<sup>(6,7)</sup>.

### Direct smear in Lugol's solution

Approximately 2 mg of stool was collected with a glass rod and applied onto a slide, a drop of Lugol's solution was added, and the material was smeared over a 4 cm<sup>2</sup> surface. Next, a cover slide was placed on top of the preparation and the specimen was examined microscopically at ×20 magnification.

### Decantation in distilled water

Approximately 2 mL of stool sample was mixed thoroughly with a small amount of water in a test tube. Next, water was added to the top of the tube and mixed again. After 30 minutes the supernatant was decanted, and another portion of water was added. This procedure was repeated until clear supernatant was obtained, usually three to four times. The sediment was then placed on a slide, stained with Lugol's solution, and examined microscopically at ×40 magnification.

### Fülleborn's flotation

Approximately 2 mL of stool specimen was mixed with saturated NaCl solution in a test tube. Next, NaCl solution was added to the top of the tube. A cover slide was placed on the top of the tube and in contact with the suspension. After 30 minutes, the cover slide was gently removed with tweezers and placed with the wet side down on a slide. The preparation was ready for microscopic examination at ×10 magnification.

## Ethical considerations

The research project entitled *Screening of Ukrainian war refugee children for intestinal parasites with the aim of controlling the spread of parasitic infections* was approved by the Committee on Bioethics at the Pomeranian Medical University, Szczecin, Poland (Decision No. KB-006/28/2023 of 19 April 2023). Each parent/legal guardian submitted informed written consent for their child to participate in the study and to be screened for intestinal parasites by researchers from the Department of Epidemiology and Tropical Medicine of the Military Institute of Medicine – National Research Institute in Gdynia, Poland. Children's parents/legal guardians were also required to provide their child's personal details and were asked about a child's medical history (any gastrointestinal symptoms occurring within 6 months prior to the study).

## RESULTS

Intestinal parasitic infections were diagnosed in 3 out of 37 Ukrainian children attending a privately-owned preschool in Szczecin, Poland (8.1% of the study group; there

Ukrainian preschoolers			Gastrointestinal symptoms				Sex				Age			
			Yes		No		Female		Male		3–5		6–7	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Total	37	100.0	10	27.0	27	73.0	18	48.6	19	51.4	27	73.0	10	27.0
Positive (+)	3	8.1	0	0.0	3	8.1	1	2.7	2	5.4	2	5.4	1	2.7
Negative (–)	34	91.9	10	27.0	24	64.9	17	45.9	17	45.9	25	67.6	9	24.3
<i>Ascaris lumbricoides</i>	1	2.7	0	0.0	1	2.7	0	0.0	1	2.7	0	0.0	1	2.7
<i>Blastocystis</i> spp.	2	5.4	0	0.0	1	2.7	1	2.7	1	2.7	2	5.4	0	0.0

Tab. 1. Intestinal parasitic infections in Ukrainian children attending preschool in Poland (N = 37)

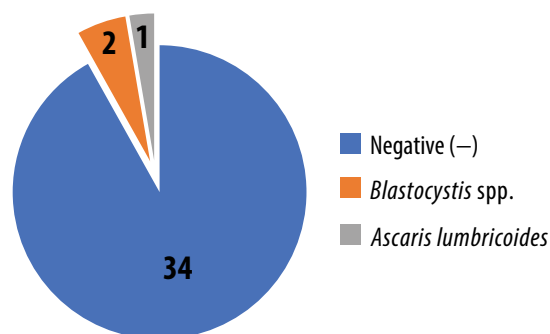


Fig. 1. Intestinal parasite infections in Ukrainian preschoolers in Poland (N = 37)

was one case of infection with *Ascaris lumbricoides* and two cases with *Blastocystis* spp.) (Tab. 1, Fig. 1). The infected children's parents/legal guardians did not observe any diarrhoea or other gastrointestinal symptoms within 6 months prior to the examination. Parasitological diagnosis was performed in all children enrolled in the study, regardless of their current health status.

In addition, microscopic examination of the samples of 6 children (16.2% of the study group, both among girls and boys) revealed the presence of multiple yeast cells in the fields of view. The presence of intense yeast colonization may be indicative of a frequent use of antibiotics without probiotics.

## DISCUSSION

In Ukraine, similarly as in Poland, there is no legal obligation to monitor and report cases of most intestinal parasitic diseases, except for giardiasis and cryptosporidiosis. A total of 1,334 cases of giardiasis and 19 cases of cryptosporidiosis were reported in Poland in 2022<sup>(8)</sup>, whereas there were 3,480 cases of giardiasis and 10 cases of cryptosporidiosis in the same year in Ukraine<sup>(9)</sup>. The epidemiological situation of most parasitic infections is not known in Poland. As recently as 15–20 years ago, Polish population was regularly screened for parasitic infections (especially the paediatric population). As an example, medical services screened 1,052 preschool-age children and 859 children from orphanages in the Warmian-Masurian Voivodship between 2003 and 2006. Parasitic infections were detected in

11% of preschoolers and 46% of orphans (*Enterobius vermicularis* was the most commonly detected pathogen). The study also showed that parasitic infections were more common in rural (17%) than urban preschoolers (10%)<sup>(10)</sup>. In his study in 2016 in a group of 1,823 children attending 31 different preschools in Warsaw, Korzeniewski confirmed a low prevalence of parasitic infections in children living in big Polish cities<sup>(11)</sup>. The study demonstrated that only 1.3% of children were infected with pathogenic (*Giardia intestinalis*, *Enterobius vermicularis*) or potentially pathogenic (*Blastocystis* spp.) intestinal parasites. *Giardia intestinalis* is one of the very few parasitic diseases that are still notifiable in Poland. The number of *Giardia intestinalis* cases reported in Poland has been falling since 2009 (3,182 in 2008 vs. 1,334 in 2022)<sup>(8)</sup>. This may be attributed to a decreasing prevalence of *Giardia intestinalis* infections in the general population or, on the other hand, physicians' failure to notify the authorities of the newly diagnosed cases of giardiasis. A survey conducted among Polish primary care physicians on the barriers limiting reporting of notifiable diseases to sanitary inspectors demonstrated that 30–50% of the surveyed physicians do not know which diseases are notifiable in Poland and have never sent any notification documents to competent sanitary inspectors<sup>(12)</sup>.

Laboratory diagnosis based on the accepted research methodology is a key element in the assessment of the epidemiological situation of parasitic infections. The analysis of the information from research papers published in Poland before 2007 clearly shows that coproscopic examination of stool samples was a common diagnostic procedure at that time. Currently, coproscopic methods are being replaced with other diagnostic methods such as immunoenzymatic or immunochromatographic assays. The latter two are designed to detect specific antigens of certain pathogens in stool samples, but they should only be used in patients manifesting clinical symptoms when microscopic examination of stool samples failed to reveal the etiological agent of infection<sup>(11)</sup>. Microscopic examination of stool samples is still considered the best available diagnostic method as it allows to identify multiple parasitic species at various developmental stages. Coproscopic diagnosis requires the collection of 3 stool samples taken at 2–3-day intervals. The basic types of specimens for microscopic examination include: a direct smear

mixed with saline or stained with Lugol's solution or a specimen concentrated using the methods of flotation or decantation<sup>(13)</sup>. Specimens should be prepared from fresh stool; however, if it is impossible to examine the stool within 24 hours of collection, the samples can be fixed with 10% formalin or SAF fixative and examined later. Microscopic methods are quick and easy to use, they allow to determine the developmental stage of the parasite as well as the severity of infection. It is important that coproscopic tests are performed by knowledgeable and experienced laboratory personnel. If differentiation between parasitic species is not possible with microscopic methods (e.g. *Entamoeba histolytica* vs. *Entamoeba dispar*, *Ancylostoma duodenale* vs. *Necator americanus*), it is recommended to use molecular biology techniques<sup>(13)</sup>.

The lack of legal obligation to report most parasitic diseases in Poland results in a decline in interest in parasitology and parasitological research. Currently, only a few health centres in Poland perform parasitological tests using different methods of light microscopy. Most Polish laboratories only use the direct smear method for the detection and identification of parasites in stool samples. This method, however, is not always reliable and may sometimes give false negative results. Another problem may be the lack of experience of the laboratory staff. This is not surprising as medical schools do not normally offer courses on parasitological diagnosis and the specialist course on laboratory methods in medical parasitology was removed from the curriculum of medical schools in Poland many years ago<sup>(11)</sup>. Since the obligation to monitor and report parasitic infections was lifted 15 years ago, and because there is very little data available on the prevalence of parasitic diseases (most data are obtained from screening programmes involving selected occupational groups or selected groups of patients), it is currently impossible to determine the rates, the risk of transmission and the extensiveness of parasitic infections in Poland. Another worrying fact is the discontinuation of screening programmes aimed to analyse the prevalence of parasitic infections in the paediatric population. In the past, such screening was conducted every 5 years and its results helped assess the epidemiological situation of parasitic infections in Poland<sup>(14,15)</sup>. Unfortunately, the lack of surveillance of parasitic diseases in Poland contributes to the spread of misinformation. Online papers by the so-called "experts" who claim that up to 80–90% of Polish children are infected with parasites and that the severity of symptoms of parasitic diseases is related to different moon phases can be easily found. This may sound unbelievable, but this is the current state of knowledge on parasitic infections in Central Europe<sup>(11)</sup>.

## CONCLUSIONS

The prevalence of intestinal parasites among Ukrainian war refugee children living in Poland justifies the screening for parasitic diseases in this population. The obtained results will allow to take appropriate preventive and therapeutic actions.

## Conflict of interest

The authors do not report any financial or personal connections with other persons or organisations which might negatively affect the content of this publication and/or claim authorship rights to this publication.

## Author contribution

Original concept of study: KK. Collection, recording and/or compilation of data: WR, MMM. Analysis and interpretation of data: WR. Writing of manuscript: KK. Critical review of manuscript: KK. Final approval of manuscript: KK.

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