

# Intestinal parasite infections among internal war refugees and inhabitants of the Ternopil region, Western Ukraine

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## ABSTRACT

**Background:** The armed aggression of the Russian Federation against Ukraine resulted in the destruction of the country's infrastructure and a decline in the standard of living for many citizens (e.g. shortages of electricity and safe drinking water, limited access to healthcare, living in unsuitable cold basements). A lot of Ukrainians living in the eastern, southern and central parts of the country were forced to flee their homes. The aim of this study was to assess the prevalence of intestinal parasite infections among internal war refugees and residents of Ternopil, a city in Western Ukraine, in response to the worsening of the epidemiological situation in the country.

**Materials and methods:** Parasitological diagnostics was carried out in June 2023 and involved 127 adult Ukrainian citizens aged 19–80 years old, including 80 internal war refugees (most of the participants came from Donetsk, Luhansk, Dnipro, Kherson regions) and 47 residents of Ternopil region, Western Ukraine. Surveys and parasitological examination of stool samples by three different light microscopy testing methods (direct smear, decantation, flotation) were performed. The samples were then tested for the presence of *Giardia intestinalis* intestinal protozoa by molecular tests (reverse transcription polymerase chain reaction [RT-PCR]) and immunochromatographic rapid diagnostic tests (RDTs).

**Results:** All RT-PCR and RDT tests to detect *Giardia intestinalis* were found to be negative. The examination of faecal samples taken from 127 patients showed no infections with nematodes, cestodes or trematodes. The examinations only revealed infections with potentially pathogenic *Blastocystis* spp.: 18/80 infections in the population of internal war refugees (22.5%) and 7/47 infections among residents of the Ternopil region (14.9%). Survey results demonstrated frequent use of antibiotics and antiparasitic drugs without physician advice or prescription: 43.9% of the study participants ( $n = 127$ ) were taking antibiotics, and 25.2% were taking antiparasitic drugs during the period of 3 months prior to the study.

**Conclusions:** An absence of intestinal parasite pathogens was detected in the studied population. The authors may explain it by the fact, that many Ukrainian patients have unlimited access to antimicrobial drugs (drugs sold without a valid prescription and taken without consultation with a physician), which could have contributed to the low incidence of intestinal parasite infections.

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**Keywords:** intestinal parasites, internal war refugees, antimicrobial drugs, Ukraine

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**Table 1.** Selected gastrointestinal infections reported in Ukraine, 2022 vs. 2021

Diseases	2022		2021	
	No.	Incidence	No.	Incidence
Salmonellosis	3,195	7.71	3,350	8.03
Shigellosis	223	0.54	222	0.53
Other intestinal infections:				
Total	18,484	44.6	17,119	41.0
<i>Campylobacter</i> infection	109	0.26	189	0.45
<i>Yersinia enterocolitica</i> infection	48	0.12	47	0.11
Intestinal protozoan infections:				
Total	3,868	9.34	4,617	11.06
Giardiasis	3,480	8.40	4,105	9.84
Cryptosporidiosis	10	0.03	11	0.03
Viral hepatitis type A	281	0.68	398	0.95

Source: Ministry of Health of Ukraine.

Available at: <https://phc.org.ua/kontrol-zakhvoryuvan/inshi-infekciyni-zakhvoryuvannya/infekciyna-zakhvoryuvanist-naselennya-ukraini>. Accessed: 27 July 2023

## INTRODUCTION

The armed aggression of the Russian Federation against Ukraine resulted in the destruction of the country's infrastructure and a decline in the standard of living for many of the country's citizens (shortages of electricity and safe drinking water, limited access to healthcare). For this reason, a lot of Ukrainians living in the eastern, southern and central parts of the country were forced to flee their homes. According to the European Centre for Disease Prevention and Control the epidemiological situation of infectious diseases in Ukraine is one of the worst in Europe [1]. Apart from numerous cases of childhood diseases (e.g. measles), tuberculosis, sexually transmitted diseases (HIV/AIDS, syphilis, gonorrhoea) and infections caused by multidrug resistant bacteria (*Acinetobacter baumannii* and *Klebsiella pneumoniae*) [2–4], Ukrainian medical services also report a high number of gastrointestinal infections (Table 1). We assume that due to limited diagnostic capacity of the laboratories operating in Ukraine (which is one of the consequences of the war with Russia), the number of gastrointestinal infections is largely underreported.

The aim of this study was to assess the prevalence of intestinal parasite infections among internal war refugees and residents of Ternopil, a city in Western Ukraine in response to the worsening of the epidemiological situation in the country.

## MATERIALS AND METHODS

Surveys and faecal samples were collected from 127 Ukrainian adults, aged 19–80 years old. The study population involved 80 internal war refugees (mostly

from the Donetsk, Luhansk, Dnipro, and Kherson regions; recruitment for the study took place in hospitals in Ternopil and Lviv, Western Ukraine and in centres for refugees in Ternopil) and 47 permanent residents from the Ternopil region. The parasitological diagnostics was performed in June 2023. The samples were first tested for intestinal parasites by three different light microscopy methods (direct smear in Lugol's solution, preparation from decantation in distilled water, preparation from Fülleborn's flotation) [5, 6] at the Department of Epidemiology and Tropical Medicine at the Military Institute of Medicine – National Research Institute (MIM-NRI) in Poland. Next, the samples were screened for *Giardia intestinalis* protozoa using molecular tests and immunochromatographic rapid diagnostic tests. Reverse transcription polymerase chain reaction (RT-PCR) assays were performed at MIM-NRI, and the rapid diagnostic tests (RDTs) at the Department of Infectious Diseases and Epidemiology, Dermatology and Venereology, I. Horbachevsky National Medical University in Ternopil, Ukraine.

## STATISTICS

All statistical analyses were carried out using StatSoft Inc. (2014) STATISTICA (data analysis software system) version 12.0 [www.statsoft.com](http://www.statsoft.com) and an Excell spreadsheet. Quantitative variables were characterized as an arithmetic mean, standard deviation, median, minimum and maximum values (range), and a 95% confidence interval. Qualitative variables were presented as frequencies and percentages (proportion). Values  $p = 0.05$  were considered statistically significant.

**Table 2.** Intestinal parasite infections in internal war refugees from eastern, central, and southern Ukraine (n = 80)

Internal war refugees	N (%)	Gastrointestinal symptoms	
		Yes N (%)	No N (%)
Total	80 (100.0%)	38 (47.5%)	42 (52.5%)
Negative (-)	62 (77.5%)	31 (38.75%)	31 (38.75%)
<i>Blastocystis</i> spp.	18 (22.5%)	7 (8.75%)	11 (13.75%)
Nematodes	-	-	-
Cestodes	-	-	-
Trematodes	-	-	-

**Table 3.** Intestinal parasite infections in inhabitants of the Ternopil region, western Ukraine (n = 47)

Inhabitants of Ternopil region	N (%)	Gastrointestinal symptoms	
		Yes N (%)	No N (%)
Total	47 (100.0%)	29 (61.7%)	18 (38.3%)
Negative (-)	40 (85.1%)	26 (55.3%)	14 (29.8%)
<i>Blastocystis</i> spp.	7 (14.9%)	3 (6.4%)	4 (8.5%)
Nematodes	-	-	-
Cestodes	-	-	-
Trematodes	-	-	-

## ETHICAL CONSIDERATIONS

The research project titled “Intestinal parasite infections among internal war refugees and inhabitants of Ternopil, western Ukraine” was approved by the Committee on Bioethics at the I. Horbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine (Protocol No. 73/2023 of 28 June 2023). Researches conducting the present study took appropriate measures to ensure the safety of all patients and their right to dignity; they observed all moral and ethical standards as defined by the provisions of the European Convention on Human Rights and Biomedicine (4 April 1997), the World Medical Association Declaration of Helsinki on ethical principles for medical research involving human subjects (1964–2000 and 2001), the Order of the Ministry of Health of Ukraine No. 281 (1 November 2000), and the Ukrainian Ethical Code of Scientist (2009).

## RESULTS

The study found that all RT-PCR and RDT tests for *Giardia intestinalis* were negative. The examination of the faecal samples taken from 127 patients showed no infections with nematodes, cestodes or trematodes. The examinations revealed infections with potentially pathogenic *Blastocystis*

spp. only (what may explain the lack of helminth and protozoan infections in connection with the use of antiparasitic drugs, which are often ineffective in the treatment of *Blastocystis* infections). The infections were seen in both study arms: 18/80 cases in the population of internal war refugees (22.5%) and 7/47 cases among residents of Ternopil (14.9%). The study showed no statistically significant differences in rate of *Blastocystis* infections in both groups. Gastrointestinal symptoms (abdominal pain, loose stools, constipation, nausea, vomiting, weight loss) were reported by 7 infected and 31 non-infected war refugees, and by 3 infected and 26 non-infected residents of the Ternopil region (Tables 2, 3). The study showed no statistically significant differences between infected vs. non-infected patients in terms of the presence of gastrointestinal symptoms. The study was conducted in a group of adults aged 19–80 years old (mean 40.5); 36.2% of the group were women and 63.8% were men. It is worth pointing out that 43.9% of the study participants (n = 127) were taking antibiotics (without providing the name of the drugs in the survey), and 25.2% were taking antiparasitic drugs (metronidazole, tinidazole, ornidazole, albendazole) over a period of 3 months prior to entering the study (Table 4).

**Table 4.** Study group variables, including sex, age, and the use of antiparasitic drugs and antibiotics (n = 127)

Study group variables	Light microscopy (-) (n = 102)	Light microscopy (+) (n = 25)	Total (n = 127)
Sex:			
Female	40 (39.2%)	6 (24.0%)	46 (36.2%)
Male	62 (60.8%)	19 (76.0%)	81 (63.8%)
Age:			
Mean (SD)	41.6 (14.9)	36,3 (7.9)	40.5 (13.9)
Range	19,0–80,0	21.0–47.0	19.0–80.0
Median (IQR)	39.0 (22.0)	37.0 (10,0)	39.0 (20,0)
95% CI	[38.6; 44.5]	[33.0; 39.6]	[38.1; 43.0]
Receiving antiparasitic drugs during the previous 3 months:			
No	73 (74.5%)	19 (76.0%)	92 (74.8%)
Yes	25 (25.5%)	6 (24.0%)	31 (25.2%)
Receiving antibiotics during the previous 3 months:			
No	57 (58.2%)	12 (48.0%)	69 (56.1%)
Yes	41 (41.8%)	13 (52.0%)	54 (43.9%)

CI – confidence interval; IQR – interquartile range; SD – standard deviation

## DISCUSSION

Because of a poor epidemiological surveillance system and due to the war, there is little data available on the prevalence of intestinal parasitic infections in Ukraine. Currently, giardiasis and cryptosporidiosis are the only notifiable intestinal diseases in the country. In 2022, a total of 3,480 cases of giardiasis and 10 cases of cryptosporidiosis were reported in Ukraine (Table 1). However, it should be emphasized that the epidemiological situation of most parasitic infections is not known. According to World Health Organization report “Antimicrobial resistance surveillance in Europe 2023–2021” published in April 2023, we observe extended microbial resistance in many countries of Europe. Higher levels were reported in the southern and eastern parts of the Europe. It is a serious threat to health, and many countries have limited treatment options for patients with infections caused by these pathogens.

Irrational and excessive consumption of antibiotics and antiparasitic medications is one of the major public health issues in Ukraine [7]. A survey which was conducted in a group of pharmacists working in Ukraine showed that as much as 90.7% of the respondents admitted to the sales of antimicrobial drugs without a valid prescription (only in August 2022 the electronic prescription forms were provided in the country and it means that patients can buy antibiotics only with a doctor's prescription, but the military full scale Russian invasion led to a lack of respect for this regulation). There are two major reasons which may explain this situation. On the one hand, the sale of drugs without a prescription increases the profits of pharmacies,

on the other, a lot of patients are not aware of the risks associated with self-medication or simply do not have money to consult a specialist [8]. In 2019, the Ministry of Health of Ukraine implemented a series of measures to fight antibiotic resistance by limiting the use of antimicrobial drugs but, widespread corruption in the health sector slows down the process [9]. In addition, the newly imposed restrictions do not apply to pharmacies located in a war-zone or territories occupied by the Russian Federation. In those places pharmacies are authorized to sell drugs without a valid prescription. Also, voluntary associations and charities have been given permission to purchase antibiotics directly from distributors (without a prescription) whenever they get such a request from any military unit or a medical facility [10].

In 2020, when the COVID-19 pandemic was declared, the use of antimicrobial drugs in Ukraine increased by 50.5% compared to 2019 [11]. Only 2 years later, the Russian Federation waged a full-scale military operation against Ukraine, which hit the country's healthcare system even harder. The medical infrastructure was partly destroyed and thus the authorities were forced to transform some hospitals into bomb shelters or to move hospital wards to the basements of hospital buildings. In addition, a considerable number of doctors were moved to the frontline. The evidence from the studies conducted during the military operations in Iraq and Afghanistan [12] shows that people working or serving in areas affected by a war are exposed to high levels of emotional stress. Since emotional stress is one of the major factors contributing to an increased consumption of drugs (especially broad-spectrum antimicrobials) it could explain

why the use of drugs in Ukraine has grown so much in recent years. The present study revealed that as much as 43.9% of the participants were taking antibiotics and 25.2% were taking antiparasitic drugs within 3 months prior to entering the study. Antimicrobial therapies (e.g. drugs used to treat giardiasis, such as metronidazole or tinidazole) can have a significant impact on the susceptibility of a host to parasitic infections [13] and could be the reason why all the tests for *Giardia intestinalis* in the present study were negative. Iakovlieva et al. [14] analysed the use of antiparasitic medications in the period from 2018 to 2020. The study showed that the consumption of this type of drugs in Ukraine was 1.4-fold higher than in Lithuania, 3-fold higher than in Estonia and 4-fold higher than in Norway. The study also found that the most common antiparasitic drugs in Ukraine included: mebendazole, albendazole, pyrantel and praziquantel.

The present study found no infections with protozoa, nematodes, cestodes or trematodes, which might be explained by the fact that a high proportion of the study participants were taking antiparasitic medications prior to the enrolment in the study. Examinations performed as part of this study have only revealed infections with potentially pathogenic *Blastocystis* spp. The infection rate was slightly higher among internal war refugees than among residents of the Ternopil region, which might be linked to poor sanitation in areas affected by the war. Shortages of safe drinking water and poor access to sanitation and hygiene contribute to the spread of gastrointestinal infections, including parasitic infections [15]. The present study showed low rates of infections caused by intestinal parasites even though many Ukrainians are now living under poor sanitary conditions. Easy access to antimicrobial drugs (which are often sold without a valid prescription and taken without any consultation with a physician) may have impacted the results of the study. Experts from the European Centre for Disease Prevention and Control have pointed to a growing risk of infections caused by multi-drug resistant bacteria in Ukraine. According to the data reported to CAESAR (Central Asian and European Surveillance of Antimicrobial Resistance network) by Ukrainian healthcare providers, 53% of *Escherichia coli* isolates from Ukrainian patients were resistant to cephalosporins, 54% *Klebsiella pneumoniae* isolates were resistant to carbapenems, 77% *Acinetobacter* spp. isolates were resistant to carbapenems, and 18% *Staphylococcus aureus* isolates were resistant to methicillin (MRSA) [16].

## CONCLUSIONS

Many Ukrainian patients have unlimited access to antimicrobial drugs (which are sold without a valid prescription and taken without a consultation with a physician), which could have contributed to a low prevalence of intestinal parasite infections in the studied population. It is important

to point out that the misuse of antimicrobial drugs leads to an increase in the number of cases caused by multidrug resistant organisms.

**Conflict of interest:** None declared

## REFERENCES

1. European Centre for Disease Prevention and Control. Operational Public Health Considerations for the Prevention and Control of Infectious Diseases in the Context of Russia's Aggression Towards Ukraine, ECDC, Stockholm, 2022. <https://www.ecdc.europa.eu/sites/default/files/documents/prevention-control-infectious-diseases%2088%92Russia-aggression.pdf> (Accessed: 12 August 2022).
2. Marchese V, Formenti B, Cocco N, et al. Examining the pre-war health burden of Ukraine for prioritisation by European countries receiving Ukrainian refugees. *Lancet Reg Health Eur.* 2022; 15: 100369, doi: [10.1016/j.lanpe.2022.100369](https://doi.org/10.1016/j.lanpe.2022.100369), indexed in Pubmed: [35531492](https://pubmed.ncbi.nlm.nih.gov/35531492/).
3. World Health Organization. Regional Office for Europe. World Tuberculosis Day: supporting Ukraine in scaling up TB diagnosis and treatment. 23 March, 2021. <https://www.euro.who.int/en/countries/ukraine/news/news/2021/3/world-tuberculosis-day-supporting-ukraine-in-scaling-up-tb-diagnosis-and-treatment> (Accessed: 10 August 2022).
4. European Centre for Disease Prevention and Control. Operational considerations for the provision of the HIV continuum of care for refugees from Ukraine in the EU/EEA. 5 July 2022. <https://www.ecdc.europa.eu/en/publications-data/operational-considerations-provision-hiv-continuum-care-refugees-ukraine-eueea> (Accessed: 10 August 2022).
5. Procedures for the Recovery and Identification of Parasites from the Intestinal Tract: Approved Guideline, M28-2A. Clinical and Laboratory Standards Institute, Villanova PA, 2005.
6. Garcia LS, Smith JW, Fritsche TR. Selection and use of laboratory procedures for diagnosis of parasitic infections of the gastrointestinal tract. ASM Press, Washington DC 2003.
7. Zhurenko D. Dynamics in regulation and rational use of antibacterial drugs in Ukraine. 2nd International Scientific and Practical Conference 'Innovative Development in the Global Science'. Boston, USA 26-28.06.2023. *Scientific Collection InterConf.* 2023; 160: 209–215.
8. Volkova AV, Tereschenko LV, Zhirova IV. Analysis of the problems of the rational use of antibacterial drugs in Ukraine. *Social Pharmacy in Health Care.* 2019; 5(3): 4–12, doi: [10.24959/sphhcj.19.157](https://doi.org/10.24959/sphhcj.19.157).
9. Batyrgareieva VS, Babenko AM, Kaija S. Corruption in medical sphere of Ukraine: current situation and ways of prevention. *Wiad Lek.* 2019; 72(9 Part 2): 1814–1821, indexed in Pubmed: [31622272](https://pubmed.ncbi.nlm.nih.gov/31622272/).
10. Ministry of Health of Ukraine. Starting today, patients will receive an electronic prescription for an antibiotic. Official web portal of executive authorities of Ukraine. <https://www.kmu.gov.ua/news/moz-vid-sohodni-patsienty-otrymuvatymut-elektronnyi-retsept-na-antibiotyk> (Accessed: 01 September 2023).
11. Zaliska O, Semenov O, Zabolotnya Z, et al. POSC218 Study of Antibiotic Consumption Trends in Public Pharmacies during the COVID-19 Pandemic in Ukraine. *Value in Health.* 2022; 25(1): S150, doi: [10.1016/j.jval.2021.11.733](https://doi.org/10.1016/j.jval.2021.11.733).
12. Murray CK, Yun HC, Griffith ME, et al. Recovery of multidrug-resistant bacteria from combat personnel evacuated from Iraq and Afghanistan at a single military treatment facility. *Mil Med.* 2009; 174(6): 598–604, doi: [10.7205/milmed-d-03-8008](https://doi.org/10.7205/milmed-d-03-8008), indexed in Pubmed: [19585772](https://pubmed.ncbi.nlm.nih.gov/19585772/).

13. Beyhan YE, Yıldız MR. Microbiota and parasite relationship. *Diagn Microbiol Infect Dis.* 2023; 106(4): 115954, doi: [10.1016/j.diagmicrobio.2023.115954](https://doi.org/10.1016/j.diagmicrobio.2023.115954), indexed in Pubmed: [37267741](https://pubmed.ncbi.nlm.nih.gov/37267741/).
14. Iakovlieva L, Gerasymova O, Tkachova O, et al. POSC310 Assessment of Anthelmintics Consumption in Ukraine in Comparison with Other Countries of the World. *Value Health.* 2022; 25(1): S208–S209, doi: [10.1016/j.jval.2021.11.1016](https://doi.org/10.1016/j.jval.2021.11.1016).
15. Lee ACK, Khaw FM, Lindman AES, et al. Ukraine refugee crisis: evolving needs and challenges. *Public Health.* 2023; 217: 41–45, doi: [10.1016/j.puhe.2023.01.016](https://doi.org/10.1016/j.puhe.2023.01.016), indexed in Pubmed: [36848796](https://pubmed.ncbi.nlm.nih.gov/36848796/).
16. Wroczyńska A, Rymer W, Kuna A, et al. Prevention and control of infectious diseases in the context of Russia's aggression against Ukraine. Discussion of the recommendations of the European Center for Disease Prevention and Control. *Med Prakt.* 2022; 4: 80–88.