



## INTESTINAL PARASITIC INFECTIONS IN POLISH SOLDIERS DEPLOYED TO KOSOVO

Zarażenia pasożytami jelitowymi u polskich żołnierzy rozmieszczonych w Kosowie



Krzysztof Korzeniewski, Wanesa Richert

Military Institute of Medicine – National Research Institute, Department of Epidemiology and Tropical Medicine, Poland

Krzysztof Korzeniewski –  0000-0002-0505-6279

### Abstract

**Introduction and objective:** Soldiers of the Polish Military Contingents currently stationed in foreign countries serve under difficult environmental conditions. Military service abroad is associated with the risk of importing infectious pathogens back to soldiers' home country. The aim of the study was to assess the current prevalence of infections caused by intestinal parasites in soldiers from the Polish Military Contingent Kosovo serving as part of the Kosovo Force operation in the Balkans. **Material and methods:** Parasitological diagnostics was carried out in June 2023 in a group of 221 soldiers from the Polish Military Contingents Kosovo stationed in several military camps across the country. Each participant was asked to provide three stool samples collected at 2–3-day intervals. Faecal examinations were performed using three different light microscopy testing 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, all of protozoan aetiology, were found in 28 out of 221 Polish soldiers taking part in the Kosovo Force operation in Kosovo included in the study (0.9% participants were infected with *Giardia intestinalis* and 11.7% with potentially pathogenic parasites, *Blastocystis* spp. and *Dientamoeba fragilis*). There were no infections with nematodes, cestodes or trematodes among the study participants. No correlation was found between the detection of a parasitic infection and the presence of diarrhoea or other gastrointestinal symptoms within six months prior to the study. The analysis demonstrated that infections with protozoa were most often found in soldiers aged 35–45 years old. As for the military ranks, the rate of infections in each corps (privates, non-commissioned officers, and officers) was similar. **Conclusions:** Cases of intestinal parasitic infections in soldiers from the Polish Military Contingent Kosovo could be associated with the effects of environmental conditions (poor standards of sanitation in the areas of deployment) and failure to comply with disease prevention principles (food and feed hygiene).

### Streszczenie

**Wprowadzenie i cel:** Żołnierze Polskich Kontyngentów Wojskowych stacjonujący obecnie poza granicami kraju pełnią służbę w trudnych warunkach środowiskowych. Służba wojskowa poza granicami kraju wiąże się z ryzykiem importu zakaźnych patogenów do ojczyzny. Celem badania była ocena aktualnej częstości występowania zakażeń wywołanych przez pasożyty jelitowe u żołnierzy Polskiego Kontyngentu Wojskowego Kosowo pełniących służbę w ramach operacji Kosovo Force na Bałkanach. **Materiał i metody:** Diagnostykę parazytologiczną przeprowadzono w czerwcu 2023 r. w grupie 221 żołnierzy Polskich Kontyngentów Wojskowych Kosowo stacjonujących w kilku obozach wojskowych na terenie całego kraju. Każdy uczestnik badania został poproszony o dostarczenie trzech próbek kału pobranych w odstępach 2–3 dni. Badanie kału wykonano trzema różnymi metodami mikroskopii świetlnej (rozsmaz bezpośredni, dekantacja, flotacja) w Zakładzie Epidemiologii i Medycyny Tropikalnej Wojskowego Instytutu Medycznego – Państwowego Instytutu Badawczego. **Wyniki:** Spośród 221 objętych badaniem polskich żołnierzy biorących udział w operacji Kosovo Force w Kosowie infestację pasożytami jelitowymi stwierdzono u 28 osób, we wszystkich przypadkach o etiologii pierwotniakowej (0,9% uczestników było zarażonych *Giardia intestinalis*, a 11,7% potencjalnie patogenymi pasożytami: *Blastocystis* spp. i *Dientamoeba fragilis*). Wśród uczestników badania nie stwierdzono przypadków zakażeń nicieniami, tasiemcami ani przywrami. Nie stwierdzono również korelacji między wykryciem infekcji pasożytnej a obecnością biegunki lub innych objawów ze strony przewodu pokarmowego w okresie sześciu miesięcy przed badaniem. Z analizy wynika, że zarażenia pierwotniakami występowały najczęściej u żołnierzy w wieku 35–45 lat. W zakresie stopni wojskowych, odsetek zakażeń był podobny w każdym korpusie (szeregowych, podoficerów i oficerów). **Wnioski:** Przypadki zarażeń pasożytami jelitowymi u żołnierzy Polskiego Kontyngentu Wojskowego w Kosowie mogą być związane z wpływem warunków środowiskowych (niskie standardy sanitarne w przydzielonych rejonach) oraz nieprzestrzeganiem zasad profilaktyki chorób (higiena żywności i żywienia).

**Keywords:** Kosovo, Polish Military Contingent, soldiers, intestinal parasites

**Słowa kluczowe:** Kosowo, Polski Kontyngent Wojskowy, żołnierze, pasożyty jelitowe

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**Corresponding author:**

Krzysztof Korzeniewski  
 Military Institute of Medicine – National Research  
 Institute, Department of Epidemiology and Tropical  
 Medicine, 128 Szaserów St., 04-141, Warsaw  
 e-mail: kkorzeniewski@wim.mil.pl

**Introduction**

Forces of the Polish Military Contingents (PMCs) currently deployed on foreign operations serve under difficult environmental conditions. Military service abroad is associated with the risk of importing infectious pathogens back to soldiers' home country. This fact was supported by the results of a large study carried out between 2010 and 2014 by researchers from the Military Institute of Medicine in Poland. The study, which involved a total of 24 thousand soldiers, was part of a large project aiming to prevent the transmission of gastrointestinal parasitic diseases among Polish troops deployed on operations overseas. The study findings showed that 5.7% of the participants were infected with intestinal parasites (nematodes, trematodes, cestodes or protozoa) [1]. In order to prevent the spread of parasitic diseases, researchers from the Military Institute of Medicine – National Research Institute have undertaken to continue the epidemiological surveillance of parasitic infections in all areas of deployment of the Polish forces. They are responsible for the parasitological diagnostics and management of cases before the soldiers return to Poland. In 2023, parasitological testing was performed in the contingents relocated to Iraq, Lebanon, and Kosovo [2]. The Polish Military Contingent serving as part of the KFOR (Kosovo Force) operation in the Republic of Kosovo was established by virtue of the Regulation of the President of the Republic of Poland under the act on the forms of engagement or deployment of the Polish Armed Forces outside the country, upon a request from the President of the Council of Ministers. The Polish Military Contingent KFOR in Kosovo is composed of approximately 250 Polish soldiers. They are stationed in several military bases across the country, including the Novo Selo, Film City (KFOR Headquarters in Pristina), Bondsteel, Villaggio Italia, and a camp in Brezovica. Currently, KFOR mainly operates in the northern provinces of Kosovo, i.e., the territories bordering with Serbia. PMC KFOR is carrying out a stabilisation operation. It is part of the Multinational Combat Group – East, whose primary tasks are to fight against organised crime, prevent smuggling and trafficking, and support local authorities and law enforcement agencies in their efforts to ensure law and order in the region [3].

**Environmental situation in Kosovo**

Kosovo is a landlocked country lying in the centre of the Balkan Peninsula, bordering with Serbia (352 km), Macedonia (159 km), Albania (112 km), and Montenegro (79 km). The country's total area is 10,908 km<sup>2</sup>. The territory is dominated by mountainous and high terrain with a mean elevation of 300-600 metres above mean sea level (AMSL), but there are also mountain ranges exceeding 2,000 metres AMSL in Kosovo. The

country has a warm temperate climate, with average temperatures in the capital (Pristina) ranging from 6°C in January to 26°C in July and August. The mean annual rainfall in Kosovo is 1,630 mm, with most rain falling between September and March and in May. The country is rich in surface water. The two major rivers in the country include the Sitnica (which is a tributary to the Ibar river belonging to the Black Sea drainage basin) and the White Drin (which belongs to the Adriatic Sea drainage basin). Around 30% of the land in Kosovo is covered by forests, mostly in the mountainous regions [4].

**Gastrointestinal health risks in Kosovo**

A study by Azemi et al. conducted in a group of 1,050 infants hospitalised at the Kosovar paediatric clinic for acute diarrhoea showed that most infections were of bacterial aetiology (*Salmonella* spp. 38.9%, *Escherichia coli* 21.7%) [5]. In 2017, there was a large outbreak of acute gastroenteritis (manifesting with diarrhoea, abdominal pain, vomiting) among the troops deployed in the region. The outbreak affected not only soldiers from the Polish contingent but also troops of other nationalities. Examinations of cases revealed that most of them were caused by norovirus [6]. Research findings suggest a high prevalence of gastrointestinal parasitic infections in Kosovo. A study by Korzeniewski et al. carried out in Eastern Kosovo (Gnjilane region, Kaçanik municipality) in a group of over 530 children, found infections caused by intestinal parasites in 19.1% of the examined cases, of which 14.9% were caused by *Giardia intestinalis* and 3.8% by nematodes (*Ascaris lumbricoides*, hookworm, *Trichuris trichiura*) [7]. Another study, which involved 773 Polish soldiers serving in Kosovo between 2019 and 2021, showed that 9.6% of the examined cases were caused by infection with *Blastocystis* spp. [8]. Gastrointestinal infections of bacterial and viral aetiology are particularly common in the summer months, whereas parasitic infections (which often take the form of asymptomatic carriage) are reported all year-round.

**Aim of the study**

The aim of the study was to assess the current prevalence rates of infections caused by intestinal parasites in soldiers from the PMC Kosovo serving as part of the UN-mandated KFOR mission in the Balkans.

**Material and methods**

Parasitological diagnostics was carried out in June 2023 in a group of 221 soldiers from the PMC Kosovo. The soldiers were stationed in five different military bases (Novo Selo, Film City (Pristina), Bondsteel, Villaggio Italia, and

Brezovica). Their tour of duty in Kosovo took six months. Each participant was asked to provide three stool samples collected at 2–3-day intervals. The samples were fixed with SAF fixative (sodium acetate – acetic acid – formalin) and 70% ethanol. Next, they were transported to the Department of Epidemiology and Tropical Medicine at the Military Institute of Medicine – National Research Institute (in accordance with the regulations for transporting biological material) for parasitological examination by light microscopy methods (direct smear in Lugol’s solution, decantation in distilled water, Fülleborn’s flotation) [9, 10].

### Ethical considerations

Each participant was required to submit informed written consent to participate in the study and be tested for intestinal parasites by researchers from the Department of Epidemiology and Tropical Medicine at Military Institute of Medicine – National Research Institute in Poland. The participants also had to provide their personal details (age, sex). The information clause on personal data processing by the Military Institute of Medicine – National Research Institute was drawn up pursuant to Article 14 (1) and (2) of the Regulation 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, hereinafter referred to as the GDPR. The legal basis for the processing of personal data is defined in Article 6 (1) (e) of the GDPR, which stipulates that the processing of personal data is necessary to perform tasks carried out in the public interest.

### Results

Intestinal parasites, all of protozoan aetiology, were found in 28 out of 221 Polish soldiers taking part in the KFOR operation in Kosovo (0.9% infected with *Giardia intestinalis* and 11.8% with potentially pathogenic parasites (10.8% *Blastocystis* spp. and 0.9% *Dientamoeba fragilis*). No infec-

tions caused by nematodes, cestodes or trematodes were found in the study participants. No correlation was found between the detection of a parasitic infection and the presence of diarrhoea or other gastrointestinal symptoms within six months prior to the study. The analysis demonstrated that infections caused by protozoa were most often found in soldiers aged 35–45 years old (50%). As for the distribution of infections across the military ranks, the rate of infections in each corps was similar (35.7% among privates, 35.7% among non-commissioned officers, NCOs, and 28.6% among commissioned officers) (tab.).

### Discussion

Infections caused by intestinal parasites are a major health issue in soldiers deployed on operations abroad. Increased prevalence of parasitic infections is caused primarily by two factors: poor standards of sanitation in areas of deployment and failure to adhere to disease prevention principles (personal hygiene, food and feed hygiene) [11]. According to Hotez and Gurwith [12], Kosovo is one of the poorest countries in Europe. A series of conflicts in the Balkans, which have continued since the 1990s, led to the destruction of the healthcare system in the country and promoted the spread of infectious diseases in the local communities. A study by Kondaj [13] conducted in a group of Kosovar refugees seeking shelter in Albania showed 2,179 cases of diarrhoea in a group of over 400,000 officially registered refugees. Quamilè et al. [14], who studied the aetiology of diarrhoea in children admitted to one of the hospitals in Kosovo, reported a high prevalence rate of *Giardia intestinalis* infections in the examined cases. Studies by Korzeniewski conducted in a group of Kosovar children confirmed that *G. intestinalis* was the most common pathogen in the examined cases [7]. The World Health Organization estimates that the prevalence of *G. intestinalis* infections in countries with warm temperate climates (such as Kosovo) might range between 2 and 10% in the general adult population [15]. A study involving

Table. Intestinal parasitic infections in soldiers from the PMC Kosovo (n = 221)

Soldiers from PMC Kosovo			Gastrointestinal symptoms				Sex				Age						Rank					
			Yes		No		Male		Female		<35		35–45		>45		Private		NCO		Officer	
n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
<b>Total</b>	221	100.0	8	3.6	213	96.4	205	92.8	16	7.2	87	39.4	109	49.3	25	11.3	80	36.2	95	43.0	46	20.8
<b>Positive (+)</b>	28	12.6	0	0.0	0	0.0	27	12.2	1	0.45	10	4.5	14	6.3	4	1.8	11	5.0	10	4.5	7	3.2
<b>Negative (-)</b>	193	87.3	8	3.6	213	96.4	178	80.5	15	19.5	77	34.8	105	47.5	21	9.5	69	31.2	85	38.5	39	17.6
<i>Giardia intestinalis</i>	2	0.9	0	0.0	0	0.0	2	0.9	0	0.0	0	0.0	2	0.9	0	0.0	1	0.45	0	0.0	1	0.45
<i>Dientamoeba fragilis</i>	2	0.9	0	0.0	0	0.0	2	0.9	0	0.0	1	0.45	0	0.0	1	0.45	0	0.0	2	0.9	0	0.0
<i>Blastocystis</i> spp.	24	10.8	0	0.0	0	0.0	23	10.4	1	0.45	9	4.1	12	5.4	3	1.3	9	4.1	8	3.6	7	3.2
<b>Nematodes</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Cestodes</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Trematodes</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NCO – non-commissioned officer; PMC – Polish Military Contingent

a group of Polish soldiers deployed to Kosovo found *G. intestinalis* infections in 0.9% of the study participants. Given the fact that a similar study of German soldiers conducted before they returned home after completing their tour of duty in the Balkans showed no infections with intestinal parasites, and considering that *G. intestinalis* in humans is predominantly transmitted via the faecal-oral route, or in some cases via contaminated water, one may assume that the transmission of parasitic infections in the Polish contingent was linked to poor food and water hygiene [16]. The present study showed infections with potentially pathogenic *Blastocystis* spp. protozoa in 10.8% of the examined cases.

According to Kowalewska et al. [17], *Blastocystis* spp. is the most common parasitic species in Poland and its prevalence is growing each year (in contrast to other parasitic species). A comparison between the findings of the present study and the results of a similar study carried out among members of the PMC Kosovo between 2019 and 2021 (where *Blastocystis* spp. infection rate was found to be 9.6%) reveals an upward trend in the prevalence of infections with this protozoan species [8]. A similar rate of *Blastocystis* spp. infections (13%) was observed in a group of Kosovar children presenting with gastrointestinal disorders [18]. Although there is no consensus among researchers on the pathogenic role of *Blastocystis* spp. in humans, it is crucial that medical services monitor its prevalence in the general population in view of the confirmation of symptomatic cases [19, 20].

## Conclusions

The occurrence of intestinal parasitic infections in soldiers from the PMC Kosovo is associated with two major factors: the effects of environmental conditions (poor standards of sanitation in the areas of deployment), and failure to adhere to disease prevention principles (food and feed hygiene).

## Conflict of interest statement

Authors declare no conflict of interest in relation to this article.

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