

Assessment of the prevalence of intestinal parasite infections among patients at the Laboratory of Department of Biology and Medical Parasitology of the Pomeranian Medical University in Szczecin in the years 1983–2012*

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ABSTRACT

Introduction: Intestinal parasitoses are among the most common parasitic diseases in Poland.

The aim of this study was to assess their prevalence in patients of the Laboratory of the Department of Biology and Medical Parasitology (LDBMP) of the Pomeranian Medical University in Szczecin (PMU) in the years 1983–2012.

Materials and methods: The analysis concerned the results of parasitological surveys conducted between 1983–2012 in 9760 patients. Parasitological diagnosis was performed by standard faecal examination method (direct swab) and/or perianal swab.

Results: During the study period, 486 cases of infection with intestinal parasites were recorded. The mean prevalence of intestinal parasites was 4.98%, and the percentage of infected patients ranged from 8.8% in 1993 to 0% in 2002. The most frequently detected parasitic species were: *Entamoeba coli* (1.52%),

Giardia lamblia (0.95%), *Blastocystis* spp. (0.89%), *Enterobius vermicularis* (0.79%), and *Taenia saginata* (0.36%). In the period 2003–2012 the most prevalent parasites were *Blastocystis* spp., *E. coli*, and *E. vermicularis*. An increase in the prevalence of intestinal parasitic infections from 2009–2012 was associated with an increase in the prevalence of *Blastocystis* spp.

Conclusions: The prevalence of intestinal parasites among the patients of the LDBMP in the years 1983–2012 was lower in comparison with other Polish regions. The high prevalence of 2 protozoan species – potentially pathogenic *Blastocystis* spp. and non-pathogenic *E. coli* – among intestinal parasites detected in the years 2003–2012 may indicate improvement in the epidemiological situation regarding intestinal parasitoses in patients of the LDBMP in comparison to the 1980s and 1990s.

Keywords: intestinal parasites; parasitic diseases; prevalence; Poland.

INTRODUCTION

Intestinal parasitoses are among the most common parasitic diseases in Poland [1, 2]. Their transmission and range depends on many factors, including sanitary and hygienic conditions, socioeconomic conditions, and education. The viability of dispersive stage of parasites depends on environmental factors such as temperature and humidity [1].

The prevalence of intestinal parasite infections in Poland varies depending on the region and age of individuals [2, 3, 4, 5]. Recent results of screening tests carried out among 1st class children in 15 voivodeships in Poland in the school year 2002/2003 showed the highest prevalence of intestinal parasites among children in north-eastern Poland (Warmian-Masurian Voivodeship). Other regions with high percentages of children infected with intestinal parasites were Lublin Voivodeship (eastern Poland) and West Pomeranian Voivodeship

(north-western Poland). Research also showed systematic improvement of the epidemiological situation with regard to intestinal parasitoses caused by *Enterobius vermicularis*, *Ascaris lumbricoides*, *Giardia lamblia*, *Entamoeba coli*, and *Trichuris trichiura* [6]. *Taenia solium* cysticercosis and geohelminth infections have been eradicated due to an improvement in sanitary conditions in Poland [7, 8].

A few studies on intestinal parasite infections in Poland have been conducted over extensive observation periods [3, 9, 10], the aim of this study was to determine the epidemiological situation of intestinal parasitoses among patients of the Laboratory of the Department of Biology and Medical Parasitology (LDBMP) of the Pomeranian Medical Academy, currently Pomeranian Medical University in Szczecin (PMU), on the basis of analysis and assessment of the prevalence of intestinal parasite infections in the period 1983–2012.

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MATERIALS AND METHODS

The analysis included the results of parasitological examinations performed and archived at the LDBMP in the years 1983–2012. The study included patients who reported to the laboratory and patients referred from the clinics of the Independent Public Clinical Hospital No. 2 at the PMU with suspected gastrointestinal parasite infections. In the study period (30 years), a total of 18,897 parasitological examinations were performed in 9,760 patients from Szczecin and its surrounding areas. Parasitological diagnostics were performed using coproscopic methods. Feces samples were examined by direct swab stained with Lugol fluid. Patients with suspected giardiasis, since 1999, in addition to direct swab, were also subject to immunoenzymatic tests (ProSpecT Giardia EZ Microplate Assay) detecting specific *G. lamblia* coproantigen (GSA 65). Parasitological examination for the presence of *E. vermicularis* (perianal swab) was performed using Graham's method.

Average prevalence over the entire study period was calculated for all detected and individual species of intestinal parasites [11], and for the 5 most common parasite species, prevalence was also calculated for each year. The results did not allow for assessment of the age-dependent prevalence of intestinal parasites, because the questionnaires providing additional information about patients were introduced in 2011. The prevalence of enterobiasis was determined on the basis of the presence of mature forms and/or parasite eggs in feces and/or eggs in perianal swabs. In order to determine potential trends of intestinal parasite prevalence, the results of the study were statistically analyzed using linear regression with Microsoft Excel 2007.

RESULTS AND DISCUSSION

Between 1983–2012, 486 cases of intestinal parasite infections were diagnosed at LDBMP. The average prevalence of intestinal parasites was 4.98% and the percentage of infected persons ranged from 0% in 2002 to 8.8% in 1993 (Tab. 1).

In the analyzed period, the following intestinal parasites were identified: *Ascaris lumbricoides*, *Balantidium coli*, *Blastocystis* spp., *Endolimax nana*, *Entamoeba coli*, *Entamoeba hartmanni*, *Entamoeba histolytica* sensu lato, *Enterobius vermicularis*, *Enteromonas hominis*, *Giardia lamblia*, *Hymenolepis nana*, *Strongyloides stercoralis*, *Taenia saginata*, *Taenia* spp., and *Trichuris trichiura*. The most frequently detected species were: *Entamoeba coli*, *Giardia lamblia*, *Blastocystis* spp., *Enterobius vermicularis*, and *Taenia saginata* (Tab. 2).

Among patients, the most frequently detected species was the non-pathogenic, cosmopolitan *Entamoeba coli* colon commensal, whose prevalence in the years 1983–2012 was 1.52% (Tab. 2). Although the pathogenicity of this amoeba in healthy immunocompetent patients has not been confirmed, its prevalence in the human population is considered an indicator of the sanitary and hygienic conditions of the environment [9, 12, 13]. In the years 1983–1992, the percentage of patients infected

with this amoeba did not exceed 3%, while in 1993, the highest percentage of patients infected with *E. coli* was registered, amounting to 6.02%. Between 1994–1999, *E. coli* prevalence among patients ranged 4.06–1.47%, while between 2000–2012 it remained below 2% – from 0% in 2000 and 2002 to 1.97% in 2005 (Fig. 1A).

A review of literature shows that the prevalence of this protozoan in Poland varies. Lower prevalence of *E. coli*, compared to our results, was observed in the Silesian Voivodeship, both among 7-year-old children (0.12–0.43%) and adults

TABLE 1. Prevalence of intestinal parasites among patients of the DBMP of the PMU in years 1983–2012

Year	Number of examinations	Number of patients	Number of positive results	Percentage of patients with positive results (%)
1983	1160	523	37	7.07
1984	945	452	39	8.63
1985	922	435	21	4.83
1986	964	458	32	6.99
1987	1198	494	9	1.82
1988	1068	454	28	6.17
1989	851	388	19	4.90
1990	1047	481	22	4.57
1991	927	421	14	3.33
1992	505	218	14	6.42
1993	580	216	19	8.80
1994	942	271	19	7.01
1995	696	277	18	6.50
1996	669	307	21	6.84
1997	472	235	13	5.53
1998	432	204	8	3.92
1999	251	152	8	5.26
2000	207	124	3	2.42
2001	266	202	5	2.48
2002	255	189	0	0.00
2003	346	249	8	3.21
2004	437	323	6	1.86
2005	338	254	8	3.15
2006	403	335	10	2.99
2007	418	315	6	1.90
2008	546	400	8	2.00
2009	544	390	24	6.15
2010	480	322	19	5.90
2011	535	342	25	7.31
2012	493	329	23	6.99
TOTAL	18897	9760	486	4.98

TABLE 2. Prevalence of intestinal parasite infections among patients of the Laboratory of the Department of Biology and Medical Parasitology at the Pomeranian Medical University in Szczecin in the years 1983–2012

Species	Cases with detected infection	Prevalence (%)
<i>Enteromonas hominis</i>	9	0.09
<i>Giardia lamblia</i>	93	0.95
<i>Entamoeba histolytica</i> sensu lato	1	0.01
<i>Entamoeba coli</i>	148	1.52
<i>Entamoeba hartmanni</i>	6	0.06
<i>Endolimax nana</i>	9	0.09
<i>Blastocystis</i> spp.	87	0.89
<i>Balantidium coli</i>	3	0.03
<i>Taenia</i> spp.	7	0.07
<i>Taenia saginata</i>	35	0.36
<i>Hymenolepis nana</i>	1	0.01
<i>Strongyloides stercoralis</i>	1	0.01
<i>Enterobius vermicularis</i>	77	0.79
<i>Ascaris lumbricoides</i>	4	0.04
<i>Trichuris trichiura</i>	5	0.05

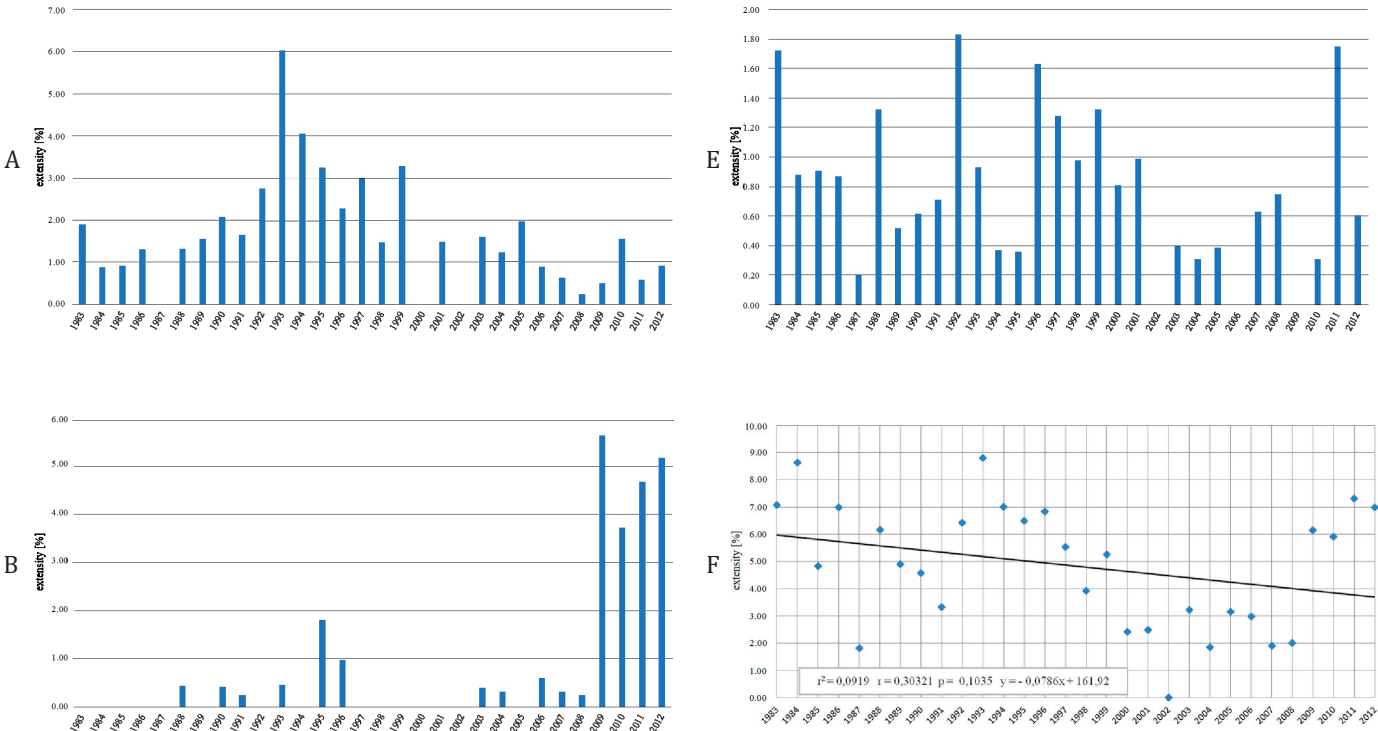


FIGURE 1. Prevalence of *Entamoeba coli* (A), *Giardia lamblia* (B), *Blastocystis* spp. (C), *Enterobius vermicularis* (D) i *Taenia saginata* (E) and trend of prevalence of intestinal parasites (F) among patients of the Laboratory of the Department of Biology and Medical Parasitology of the Pomeranian Medical University in Szczecin in the years 1983–2012

(0.1–0.16%) in the years 1999–2003 [5]. Similar prevalence of *E. coli* to that found in the patients in LDBMP was observed in studies conducted in the Laboratory of Parasitology of the District Sanitary-Epidemiological Center (LPDSEC) in Kraków in the years 2000–2006, in which *E. coli* was observed in 0.89% of adults [4]. Compared to the results obtained in LDBMP,

a higher percentage of persons infected with *E. coli* (4.29%) was observed among patients of the Outpatient Division of Maritime and Tropical Medicine (ODMTM) in Gdynia in the years 2000–2010 [3].

In our study, the 2nd most frequently observed intestinal parasite in the laboratory patients was *G. lamblia*

protozoan, whose prevalence in the analyzed period was 0.95% (Tab. 2). Between 1983–1992, the percentage of patients infected with *G. lamblia* ranged 0.48–2.32%, and in 1993–2002, from 0% to 2.58% in 1994, when the highest number of *G. lamblia* infections was diagnosed among the patients in LDBMP. A study conducted by Ramisz et al. showed that in the years 1991–1996 the percentage of patients infected with this protozoan among the inhabitants of Szczecin was 0.78% [14]. These results are consistent with the *G. lamblia* prevalence recorded in patients in our study (0.99% in the respective period). In the years 2003–2012, a clear decrease in *G. lamblia* prevalence was observed among patients of LDBMP in Szczecin, which did not exceed 1%, ranging from 0% (in 2003, 2004, 2006, 2007, 2009 and 2011) to 0.79% in 2005 (Fig. 1B). A decrease in the number of *G. lamblia* infections (to approx. 1.1%) was also observed in patients in ODMTM in Gdynia between 2001–2010, among whom the percentage of infected persons ranged 0.85–1.65% [3]. Low prevalence of giardiasis (0.19%) was also observed at LPDSEC in Kraków in the years 2000–2006 [4], which was similar to the prevalence of *G. lamblia* in patients in our study (0.24%) in the same time period. However, a study carried out in 1999–2003 in Silesia showed that *G. lamblia* was the most common parasite in the examined adults, among which the percentage of infected persons ranged 1.7–10.74% [5].

The overall prevalence of *G. lamblia*, amounting to about 5% in Poland [10], is similar to the frequency of infection observed in most European countries [11]. In Europe, a decreasing trend in giardiasis prevalence has been observed since 2006 [12], with the exception of Romania, where the prevalence of *G. lamblia* has increased, and the reported infections between 2006–2008 accounted for more than 90% of all reported cases of giardiasis in the European Union [13]. In Poland, the decreasing trend of *G. lamblia* prevalence is confirmed by collective data from the National Institute of Hygiene (NIH), according to which 3182 cases of giardiasis were registered in 2008, while 50% fewer cases (1653) were reported in 2012 [15, 16, 17].

Protozoan *Blastocystis* spp. with an average prevalence of 0.89% (Tab. 2) was the next most frequent cause of intestinal parasite infection in the patients of this study. Although sporadic cases of *Blastocystis* spp. infections were reported in 1988, as well as in the 1990s and 2003–2008, a significant increase in *Blastocystis* spp. prevalence (4.8%) was observed between 2009–2012. The highest percentage of patients infected with *Blastocystis* spp. (5.64%) was reported in 2009 (Fig. 1C), and infections with this protozoan constituted more than 90% of all detected intestinal parasite infections that year. An increase in the number of infections with *Blastocystis* spp. (8.56–18.8%) was also seen in patients at ODMTM in Gdynia, in whom it was the most frequently detected parasite between 2001–2010 [3].

It should be emphasized that detection of *Blastocystis* spp. is not performed by all national laboratories, and in only some studies do the authors present data on blastocystosis prevalence [3, 4]. *Blastocystis* spp. is a cosmopolitan protozoan, often detected by travelers returning from tropical and subtropical

countries [18, 19, 20]. In developing countries, the prevalence of this protozoan is 30–50% [21]. Despite the fact that more than 100 years have passed since the description of this species, it still arouses much controversy among researchers due to its polymorphism, taxonomy, and pathogenicity [3, 19, 22]. Until recently, this *Blastocystis* spp. was considered to be a commensal of the large intestine. However, currently the prevailing view is that blastocystosis is a parasitic disease found both in asymptotically infected individuals and in patients with gastrointestinal disorders such as acute or chronic diarrhea, abdominal pain, nausea, vomiting, anorexia, and weight loss [19]. It should also be emphasized that, due to diagnostic difficulties and diverse clinical picture, blastocystosis is often underestimated even by gastroenterologists and clinical parasitologists [3].

In our study, the prevalence of enterobiasis among patients in 1983–2012 was 0.79% (Tab. 2), and the proportion of patients infected with *E. vermicularis* ranged from 0% in 2002 and 2009 to 1.83% in 1992 (Fig. 1D). In Poland, enterobiasis is the most frequently detected parasitic infection in children [6]. This is confirmed by the results of studies conducted in the Lublin macro-region (eastern Poland) in the years 1976–2000, which showed a high percentage (over 40%) of children of preschool and school age infected with *E. vermicularis* [15], as well as in the Warmian-Masurian Voivodeship (northern Poland), where in the years 2003–2006, enterobiasis was detected in 9.5% of preschoolers and 36.7% of children in orphanages [2]. In Silesia, in 1999–2003, the percentage of 7-year-old children infected with *E. vermicularis* ranged 4.08–15.34%, while the percentage of infected adults ranged 2.44–6.46% [5]. In the course of the analyzed 30 years, *E. vermicularis* prevalence among the patients at LDBMP in Szczecin was low compared to the aforementioned regions of Poland, but the results obtained are consistent with those of Nowak et al., who diagnosed enterobiasis in LPDSEC in Kraków in 2.35% of children and 1.84% of adults between 2000–2006 [4], and of Kowalewska et al., who diagnosed enterobiasis in only 0.5% of patients at ODMTM in Gdynia between 2006–2010 [3].

In our study, intestinal parasitoses also included taenioses (*T. saginata*), which were identified mainly in the 1980s and 1990s (Fig. 1E). Prevalence of *T. saginata* over the analyzed 30 years was 0.36%, and 7 cases of taenioses (0.07%) were diagnosed as infections of *Taenia* spp. (Tab. 2). Since 1999, *T. saginata* infections have been rare, except in 2006 (Fig. 1E) when 4 cases of *Taenia saginata* infections were reported (1.19%). In the years 2007–2012, only a few cases of *T. saginata* infection were reported among the patients at LDBMP in Szczecin (in 2007 and 2011). The higher prevalence of *T. saginata* infection was reported by Nowak et al. at LPDSEC in Kraków, where in the years 2000–2006, the percentage of patients infected with *T. saginata* was 0.84% [4]. A study conducted among the residents of the Silesia between 1999–2003 showed a low prevalence of *T. saginata* (0.49%) among children and a higher prevalence among adults, ranging 1.29–2.48% [5]. Similar to our study, a decrease in *T. saginata* prevalence was also observed in patients at ODMTM in Gdynia between 2000–2010 [3]. This data

is consistent with observations conducted on a national scale, indicating a downward trend in the prevalence of intestinal cestode infections in Poland [23]. In 2008, 69 laboratory-confirmed cases of *T. saginata* infection were recorded in Poland, compared to 516 in 1998 [23].

Furthermore, sporadically detected species of intestinal parasites included: *Endolimax nana*, *Enteromonas hominis*, *Entamoeba hartmanni*, *Trichuris trichiura*, *Ascaris lumbricoides*, *Balantidium coli*, *Entamoeba histolytica sensu lato*, *Hymenolepis nana*, and *Strongyloides stercoralis* (Tab. 2). Although *E. nana* is considered a non-pathogenic species, some studies indicate that in co-infection with *Blastocystis* spp. it may cause gastrointestinal symptoms, including chronic diarrhea [24, 25]. In the study conducted in LPDSEC in Kraków, *E. nana* was detected in 1.12% of children under the age of 2 and in 0.7% of adults, while the highest percentage of infected patients (5.81%) was found in the group of persons returning from tropical countries [4]. In our study, a few cases of *E. nana* infections were detected in the 1980s (0.09%). The same percentage of infected patients was also found for *Enteromonas hominis*, whose prevalence in Poland is estimated at ~1%. Although its pathogenicity has not been clearly demonstrated, this protozoan is more frequently detected in patients with chronic colitis than in healthy individuals [9]. Another rarely detected parasite was the amoeba *E. hartmanni*, whose presence was found only in 6 patients in 1984. Similar results are also presented by Nowak et al., who, in the years 2000–2006, detected only 2 cases of *E. hartmanni* infection among the inhabitants at Kraków [4].

Prevalence of *T. trichiura* infection among patients examined in the laboratory in Szczecin was low (0.05%), and the few cases of *T. trichiura* infection were reported only in the 1980s. Sporadic occurrence of *T. trichiura* is also confirmed by the results of studies conducted in Poland with 7-year-old children, among whom the percentage of infected individuals was 0.29% in the school year 1997/1998 [26] and 0.12% in the school year 2002/2003 [6]. Lower prevalences of *T. trichiura* infection (0.02%) were also reported between 2001–2012 among patients at ODMTM in Gdynia [3].

Between 1983–2012, the LDBMP in Szczecin identified only 4 cases of *A. lumbricoides* infection, the last of which was detected in 1996. The prevalence of ascariasis in Poland is decreasing and among children does not exceed a few percent [27]. The analysis conducted by Płonka and Dzbeński showed the presence of *A. lumbricoides* in 2.8% of the surveyed 7-year-old children in the school year 1997/1998 [26]. Low prevalence, not exceeding 1.5%, of ascariasis was also observed in the residents of the Silesian Voivodeship in the years 1999–2003 [5]. On the other hand, studies conducted in eastern Poland in 2005–2007 showed that 3.0% of 3-year-old children, 8.1% of children aged 4–7, and 15.8% of children between 8–18 years of age were infected with *A. lumbricoides* [28]. Likewise Żukiewicz et al., studying children and adolescents with symptoms of parasitic diseases in the north-eastern region of Poland, showed a much higher percentage of infections with *A. lumbricoides*, amounting to 40% [29].

In addition, 3 cases of *B. coli* infection were reported in 1986. Individual infections were reported of *E. histolytica sensu lato* in 1991, *Hymenolepis nana* in 2003, and *S. stercoralis* in 1999 [30].

In conclusion, the prevalence of gastrointestinal parasites among the LDBMP patients in Szczecin over the 30-year period showed varying dynamics. Statistical analysis showed a trend of decreasing prevalence of intestinal parasites between the years 1983–2012 (Fig. 1F), although it was not statistically significant ($p > 0.05$). In 1983–1987, the percentage of patients infected with intestinal parasites ranged from 1.82% in 1987 to 8.63% in 1984, while 1988–1991, a decrease in the prevalence of intestinal parasites was observed (6.17–3.33%). Between 1992–1996, the prevalence of gastrointestinal parasite infections was about 6–7%, except in 1993, when the highest percentage of patients infected with intestinal parasites was reported, i.e. 8.8%. Between 2000–2008 the prevalence of intestinal parasites did not exceed 3.21%. In the years 2003–2012 the most prevalent infections were those caused by *Blastocystis* spp., *E. coli*, and *E. vermicularis*. The observed increase in the prevalence of intestinal parasites in 2009–2012, from 5.9% in 2010 to 7.31% in 2011 (Tab. 1), was mainly related to the increase in the prevalence of *Blastocystis* spp., from 3.73% in 2010 to 5.64% in 2009 (Fig. 1C).

Prevalence of intestinal parasite infections (4.98%) among the patients of LDBMP in Szczecin in the years 1983–2012 was lower than in other regions of Poland. This is confirmed, among others, by the results of studies covering 3 decades (1978–1989, 1990–1999, and 2001–2010) conducted among patients at ODMTM in Gdynia, in which the percentage of patients infected with intestinal parasites was 19.3% in the 1st decade and 22.9% (including *Blastocystis* spp.) in the next 2 decades [3]. Moreover, it is worth noting that the number of parasitological examinations performed has been systematically decreasing for several years (Tab. 1). A decreasing tendency in the number of patients referred for parasitological examinations is also indicated by authors from other regions of Poland [3, 4].

CONCLUSIONS

1. Prevalence of intestinal parasite infections among the LDBMP in Szczecin in the years 1983–2012 was lower than in other regions of Poland.
2. The dominant prevalence of 2 protozoans – potentially pathogenic *Blastocystis* spp. and non-pathogenic *E. coli* – among the detected parasites in the years 2003–2012 may indicate an improvement in the epidemiological situation of intestinal parasitoses among LDBMP in Szczecin patients compared to the 1980s and 1990s.

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