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Giardiasis in the Warmia and Mazury province (north-eastern Poland)—an epidemiological analysis

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ABSTRACT

Introduction: Giardiasis is one of the widespread diarrheal diseases of humans caused by the protozoan parasite *Giardia intestinalis*. Annually in Poland, about 2000 symptomatic cases of giardiasis are registered. The clinical symptoms of giardiasis include acute or chronic diarrhea, malabsorption, abdominal pain and weight loss.
Aim: An epidemiological analysis of the morbidity of giardiasis registered in the Warmia and Mazury province between 2009 and 2013.
Material and methods: The symptomatic cases of giardiasis noted in the annual reports of selected infectious diseases (document MZ-57) by the Department of Epidemiology of the Voivodeship Sanitary-Epidemiological Station in Olsztyn were examined. The analyses were conducted with regards to seasonality, the number of cases and their distribution according the patient's age, gender and place of residence.
Results and discussion: In the Warmia and Mazury province between 2009 and 2013 a total of 694 cases (113–177 per year) of giardiasis were registered with the incidence nearly twice as high as the entire country (Poland 5.2 per 100 000 inhabitants; Warmia and Mazury province 9.6). Children up to 9 years of age represented 61.5% ($n = 427$) of all noted cases. No gender-specific differences were observed. Far more infected people were in urban areas ($n = 499$; 72%) than in rural areas ($n = 195$; 28%) ($P < 0.001$). The peak incidences of giardiasis occurred during the winter period.
Conclusions: This paper provides data for public health education concerning the scope and magnitude of giardiasis in the Warmia and Mazury province and can be used to establish research priorities and to plan future prevention efforts.

1. Introduction

Giardiasis is one of the widespread gastrointestinal diseases of humans caused by the cosmopolitan protozoan parasite *Giardia intestinalis* (syn. *G. duodenalis*,*G. lamblia*). Globally, it is estimated that there are 280 million cases of infection by *G. intestinalis* per year.[1] Worldwide, but mainly in Asia, Africa and Latin America, symptomatic giardiasis involves around 200 million people and every year about 500 thousand new symptomatic cases are detected.[2] The prevalence of giardiasis in humans in developed countries is 2% to 7%, and varies from 20% to 30% in developing countries.[3] In the European Union during 2012, a total of 16 368 (5.43 per 100 000 population) confirmed cases of giardiasis were documented.[4] In Poland, according to the National Institute of Public Health – National Institute of Hygiene (NIPH-NIH) there are about 2000 symptomatic cases of giardiasis annually registered, most frequently in children and adolescents.[5]

The most common route of transmission for *G. intestinalis* is direct contact with an infected person or animals (livestock, pets and wildlife) and the transfer of cysts (dispersion forms of the parasite) by the fecal-oral route. Indirectly, the infection may occur through the consumption of food or water contaminated by cysts.[6–8]

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Human *Giardia* infection can be responsible for a broad clinical spectrum of symptoms including acute or chronic diarrhea with or without malabsorption syndrome, abdominal distension, nausea, vomiting and weight loss. It is estimated that in about 13% of adults and 50% of children, the infection of *G. intestinalis* remains asymptomatic.[9,10] Screening tests among non-symptomatic persons in Poland revealed the prevalence of *G. intestinalis* infestation ranging from 0.18% to 3.50% in the examined populations.[11–15]

The diagnosis of human giardiasis is based on clinical symptoms and confirmation by laboratory tests. Most cases of *Giardia* infections are detected by repeated light microscopy examinations of stool samples or duodenal aspirates (detection of cysts or trophozoites) or by immunofluorescence assay (IFA, DFA) methods. *Giardia*-coproantigens (GSA–65 kD) is usually detected by enzyme immunoassay (ELISA), while parasitic DNA detection by polymerase chain reaction (PCR) is rarely used in diagnostics.[16]

2. Aim

The aim of this study was an epidemiological analysis of giardiasis among the inhabitants of the Warmia and Mazury province between 2009 and 2013.

3. Material and methods

The data concerning the symptomatic cases of giardiasis were obtained from the annual reports of selected infectious diseases (document MZ-57) registered in the Warmia and Mazury province between 2009 and 2013 by the Department of Epidemiology of the Voivodeship Sanitary-Epidemiological Station in Olsztyn. The analysis of the documentation from District Sanitary-Epidemiological Stations included all reported cases of giardiasis in the districts of the province, as part of the epidemiological surveillance of infectious diseases. The analyses were conducted with consideration given to the number of cases and their distribution according to the patient's age and gender, their place of residence (urban/rural) and seasonality. The data was compared with the overall incidence and prevalence of giardiasis in Poland from 2009 to 2013, as listed in the annual reports of the NIPH-NIH Department of Epidemiology.[5]

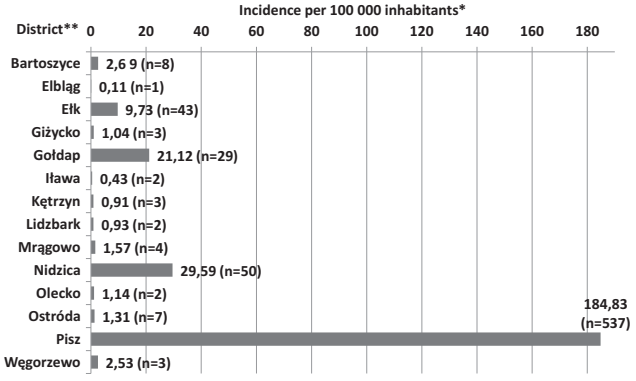
One-way analysis of variance (ANOVA), non-parametric χ^2 and Kruskal–Wallis tests were used to compare differences between groups. The differences were considered to be statistically significant when the P value was less than 0.05. The tests were performed using IBM SPSS Statistics (IBM SPSS, Chicago, Illinois).

4. Results

Between 2009 and 2013, 694 cases of symptomatic giardiasis were reported in the Warmia and Mazury province (Table 1), which constitutes 7.0% of all cases in Poland ($n = 9902$, mean incidence 5.2 per 100 000 inhabitants). The number of *G. intestinalis* infections did not differ significantly between the years ($P = 0.06$) and ranged from 113 cases in 2009 to 177 in 2011. The average annual incidence of giardiasis was 9.6 case-patients per 100 000 population (range, 7.9 in 2009 to 12.2 in 2011).

The districts of the Warmia and Mazury province were significantly different in terms of the average incidence of giardiasis per 100 000 residents (Fig. 1). Most cases were registered in the Pisz district, where 537 cases of *G. intestinalis* infection were reported (mean incidence 184.8 per 100 000 inhabitants), which accounted for 77.4% of cases registered in the entire province. Other districts with significantly high incidence rates were Nidzica, Gołdap and Ełk. No cases of giardiasis were registered in the Braniewo, Działdowo, Nowe Miasto Lubawskie, Olsztyn and Szczytno districts. In other districts, the incidence per 100 000 inhabitants ranged from 0.11 to 2.6. The prevalence of giardiasis in the Warmia and Mazury province was also significantly different between rural and urban areas (Table 2). Many more infected people were registered in urban areas ($n = 499$; 71.9%) than in rural areas ($n = 195$; 28.1%) ($P < 0.001$). Similar trends were observed throughout the country. In Poland, between 2009 and 2013, 17.6% more cases were reported among city residents than rural inhabitants (Table 2).

In the Warmia and Mazury province there were no statistically significant differences in the distribution of giardiasis between males and females ($P < 0.05$) (Table 2). In the group of females, *G. intestinalis* infections occurred 1.4% ($n = 352$) more than in males ($n = 342$). In the study period, the number of *G. intestinalis* infections decreased with age, from 427 in children (0–9 years) up to 63 in patients 35 years and older (Fig. 2). The younger children (0–9 years) constituted 61.5% of all registered cases. The



*differences between districts; Kruskal-Wallis test, p<0.001
** in districts Braniewo, Działdowo, Nw. Miasto, Olsztyn, Szczytno – no cases of giardiasis

Fig. 1. Incidence of giardiasis in the Warmia and Mazury province in 2009–2013 according to districts.

Table 1
Giardiasis in Warmia and Mazury province and Poland in 2009–2013.

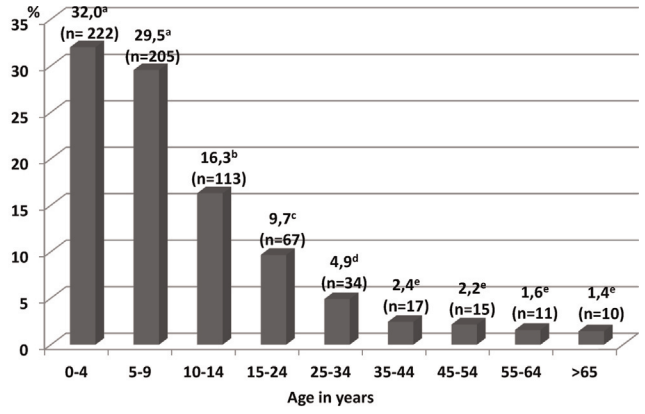
Year	Warmia and Mazury province		Poland*	
	Number of cases**	Incidence per 100,000 population	Number of cases	Incidence per 100,000 population
2009	113	7.9	2280	6.0
2010	154	10.8	2350	6.2
2011	177	12.2	1736	4.5
2012	134	9.2	1655	4.3
2013	116	8.0	1881	4.9
Total	694	mean 9.6	9902	mean 5.2

* According to data from National Institute of Public Health – National Institute of Hygiene, Department of Epidemiology[5].
** χ^2 test, $P = 0.064$.

Table 2
Giardiasis in Warmia-Masuria province and Poland in 2009–2013 according to gender and place of residence.

	Warmia and Mazury province		Poland*
	n (%)	*P* value**	*n* (%)
Gender			
females	352 (50.7)[a]	0.553	5741 (58.0)
males	342 (49.3)[a]		4161 (42.0)
Residence			
city	499 (71.9)[a]	<0.001	5822 (58.8)
village	195 (28.1)[b]		4080 (41.2)

[a,b] Different letters mean significant differences.
[*] According to data from National Institute of Public Health – National Institute of Hygiene – Department of Epidemiology[5].
[**] χ^2 test, *z*-test, $P < 0.05$.

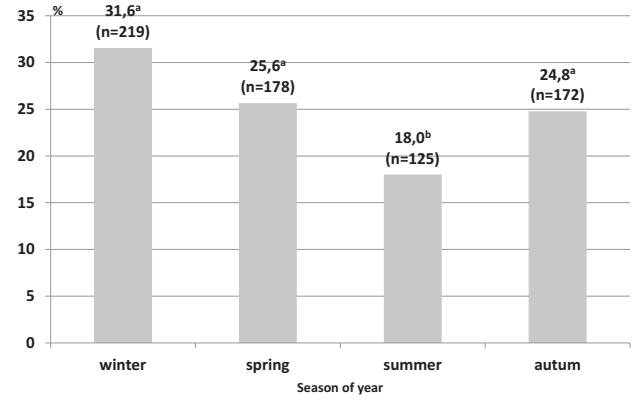


[a,b] – different letters mean significant differences (χ^2 test, z-test, p<0.005)

Fig. 2. Giardiasis in the Warmia-Masuria province in 2009–2013 according to patient age.

differences in the prevalence of giardiasis between age groups were statistically significant ($P < 0.05$).

In the Warmia and Mazury region, the incidence of giardiasis in humans indicates seasonality. The peak of *G. intestinalis* infections was observed in the winter period when 31.6% ($n = 219$) of all registered cases were noted (Fig. 3). Whereas during the summer months, there were nearly twice as few cases (18%; $n = 125$) ($P < 0.05$).



[a,b] – different letters mean significant differences (χ^2 test, z-test, p<0.005)

Fig. 3. Giardiasis in the Warmia and Mazury province in 2009–2013 according to the season of the year.

5. Discussion

Giardiasis is one of the most common human diarrheal diseases occurring throughout the world, both in developed and developing countries. Therefore in many of those nations (e.g. USA, Canada, Serbia, Poland) *Giardia* infections are tracked by mandatory national epidemiological surveillance.[4,17,18] Monitoring demographic parameters (sex, age), seasonality and geographic variation provide data to assess the epidemiological characteristics and estimate the disease burden.

In Poland, the monitoring and assessment of the current epidemiological situation concerning giardiasis, belongs to the NIPH-NIH. According to annual reports, from among approximately 2000 symptomatic cases of *Giardia* infection registered every year, about 5% to 10% of them were recorded in the Warmia and Mazury province. In this area from 2009 to 2013, a total of 694 (113–177 per year) cases were redistricted with the incidence nearly twice higher than in the entire country (Poland 5.2 per 100 000 inhabitants; Warmia-Masuria province 9.6). In Poland, as in other countries, children and adolescents are the most susceptible population to the infection.[4,5,19] In the Warmia and Mazury province, children up to 9 years of age represent 61.5% of all registered cases of giardiasis. The susceptibility of children to an infestation of intestinal parasites results mainly from poor hygiene habits and repeatedly participating in large groups in nurseries, preschools, and primary schools that promote direct contact and behaviors that increase the likelihood of parasitic transmission. On the other hand, infants and young children may have poorly developed mechanisms of immunological defense, which increases their susceptibility to gastrointestinal parasitic infection.[20,21] *Giardia* infections in children have a significant impact on their health and usually result in malnutrition and growth stunting. This has an impact on their social, cognitive and intellectual development.[21–24] The distribution of symptomatic giardiasis among gender in the Warmia and Mazury province is approximately equal, and this is correlated with epidemiological reports from other European countries and the USA.[4,17,18] However, some authors indicate a higher infection rate in women of childbearing age, mostly due to exposure to infected children.[21,25]

Generally in Poland, over the years there has been an observable decrease in the incidence of giardiasis both in children and adults. Among adults from the Pomorskie province (north Poland), cases of giardiasis decreased from 3.1% in 1978–1989 to 1.1% in 2000–2010. Similarly, a nationwide parasitological study showed a decreasing trend in the prevalence of *Giardia* infections among 7-year-old healthy children from 1.6% in 1992/1993 to 0.7% in 2002/2003.[15] In the Warmia and Mazury province, the last parasitological screening tests conducted on groups of children up to 7-years of age revealed the occurrence of *G. intestinalis* in 0.2% of examined subjects, and a much higher infection level (3.8%) among children and adolescents from orphanages.[15,26] Due to the fact that *Giardia* infections can be asymptomatic or characterized by mild symptoms, the prevalence of *G. intestinalis* in the human population is probably much higher than official reports indicate. In the last decade in different asymptomatic child populations, *G. intestinalis* occurred in 0.18% to 3.50% of the examined populations.[11–15]

In developed countries, giardiasis (apart from children) is typically recorded in persons returning from international travel or from immigrant communities.[27] In the United Kingdom (UK), traveling to developing countries, camping, and caravanning were confirmed to be independent risk factors for the disease but, for patients without a history of foreign travel, giardiasis was significantly associated with being exposed to recreational fresh water, drinking unboiled tap water and eating food which can be contaminated by *Giardia* cysts of animal origin.[28] Detection of

Giardia cysts in natural water reservoirs and in farm and wildlife from other regions of Poland suggests that in the region of Warmia and Mazury a high infection rate of giardiasis may be connected with prevalence of many lakes used for recreational activities (bathing, fishing, and sailing), and the presence of wild animals and developed agricultural production.[29–33] This also suggests an increase in the number of cases of giardiasis in the autumn with a peak in the winter months recorded in the Warmia and Mazury province. This is similar to situation in the USA, UK and Canada where human *Giardia* infections are indicated as consequence of outdoor activity and exposure to untreated water sources.[18,34]

6. Conclusions

In the Warmia and Mazury province, symptomatic giardiasis constitutes from 5% to 10% of all registered giardiasis cases in Poland, and concerns mainly children up to 9 years of age (61.5% of cases) from urban areas. The peak incidences of giardiasis occurred in the winter period and could be a consequence of summer outdoor activities and person-to-person *Giardia* cyst transmission during participation in large groups in nurseries, preschools, and primary schools. This paper is a first report documented the selected epidemiological parameters for giardiasis in the Warmia and Mazury province. This study provides data to educate public health practitioners and health-care providers about the scope and magnitude of *Giardia* infection. This data can be used to establish research priorities and to plan future prevention efforts.

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