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THE PREVALENCE OF INTESTINAL PARASITES IN CHILDREN IN PRESCHOOLS AND ORPHANAGES IN THE WARMIA-MASURIA PROVINCE (NORTH-EASTERN POLAND)

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ABSTRACT

OBJECTIVE. A comparison of the prevalence of intestinal parasites (IP) in preschoolers and orphans in the Warmia-Masuria province (Poland).
MATERIAL AND METHODS. Between 2003-2006 fecal samples and perianal swabs from 1052 preschoolers and 859 orphans were tested on the basis of direct saline and iodine mount, decantation test and the adhesive cellophane tape method.
RESULTS. 10.8% of preschoolers and 46,3% of orphans were infected with IP. Among the six detected IP species the *E. vermicularis* was the most common. Infections of *E. vermicularis* were diagnosed in 9.5% of preschoolers and 36,7% of orphans. There were statistically significant differences in the distribution of IP between males and females in preschools. IP infections were the most frequent among 7-year-old children, 19.1% in preschools and 65.7% in orphanages, respectively. In preschools, the prevalence of IP was higher among preschoolers from the rural area (17.3%) than from the urban area (10.3%).
CONCLUSION. Orphans and children from rural areas, especially at the age of 7, should be covered by systematic screening with parasitic tests throughout all of Poland. In this group of children, enterobiasis is the main health problem. The promotion of the awareness of IP infections and their prevention among parents and educational staff is required.

KEY WORDS: *intestinal parasites, children infection, preschoolers, orphans*

INTRODUCTION

Worldwide, intestinal parasites (IP) are one of the major etiological factors of infectious human disease. It is estimated that 25% of these diseases are caused by parasitic protozoa and helminths (tapeworms, nematodes and trematodes) (1). The type and frequency of the incidence of intestinal parasitosis in humans depends on the climate, socio-economic conditions, education, personal and public hygiene practices and nutritional habits (1-2).

A particularly high risk of parasitic infection occurs in children. In contrast to adults, children tend to be more physically active and rarely employ good hygiene habits. The tendency for geophagia in children is also a specific risk factor for infection with orally acquired soil-transmitted nematode parasites (3-4). In addition, a periodic presence in large groups in nurseries, preschools, schools or orphanages promotes direct contact and behaviors which increase the likelihood of transmission or environmental contamination with the parasites (5). The higher susceptibility for intestinal parasitic diseases in children is also caused by their poorly developed mechanisms of immunological defense. On the other hand, the ability of parasites to defend against the reactions of the host immune system may hinder the diagnosis of infection or to mask it for a long time (5).

The monitoring and assessment of the current epidemiological situation concerning infections and infectious diseases in Poland, including parasitic diseases, belongs to the National Institute of Public Health - National Institute of Hygiene (NIPH-NIH). In the years between 1988-2003, the NIPH-NIH in collaboration with the voivodeship sanitary-epidemiological stations, conducted a nationwide screening for IP. This action was repeated at five-year intervals, and covered more than 12 thousand 7-year-old children, who have the most extensive rate of IP infection, as indicated in earlier research (6). Recently, this action has been discontinued for financial, logistical and technical reasons (7). The Voivodeship Sanitary-Epidemiological Station in Olsztyn was one of the institutions actively involved in research, which also included preschoolers and orphans in Warmia and Mazury. The program was coordinated by the Division of Health Promotion and Education. And it covered laboratory diagnostics of intestinal parasitic diseases and educational campaign among parents and staff at institutions with regard to the health consequences of parasitic infections, their prevention in children and the principles of specimen collection.

This paper presents the results of parasitological tests in children from selected preschools and orphanages in the Warmia-Masuria province conducted between 2003-2006 by the Voivodeship Sanitary-Epidemiological Station in Olsztyn.

MATERIALS AND METHODS

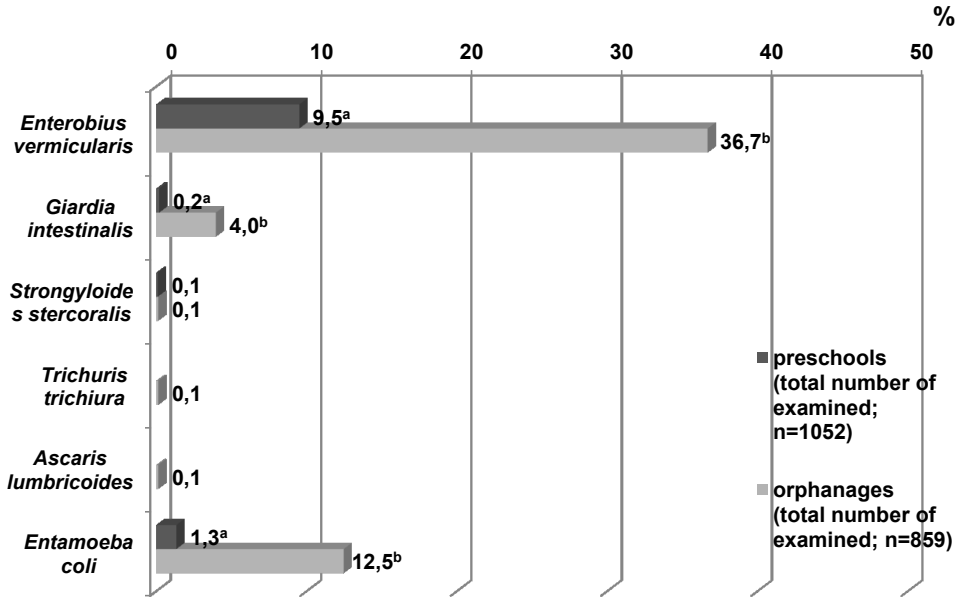
Study participants. The study was conducted in 2003/2004 among children from 28 preschools and in 2005/2006 in 20 orphanages located in 18 districts of the Warmia-Masuria province (an area of 24,192 km2 with a population of 1,427,091 (as of 2006)). The study population consisted of 1052 preschoolers (47,7% boys and 52,3% girls) aged 2-7 years (mean 5.5) and 859 orphans (56.5% boys and 43.5% girls) aged 2-22 (mean 12.3).

Data collection. The prevalence of IP in both examined groups was assessed on the basis of standard fecal examination methods (direct saline and iodine mount, decantation test) and the adhesive cellophane tape method according to Graham (8). Fecal smears and perianal swabs were examined under the microscope at ×100 and ×400 magnification. Samples containing at least one dispersive form of parasite were regarded as positive. A total of 4363 fecal samples and 4897 perianal swabs were tested.

Statistical analysis. The data was analyzed using the χ^2 independence tests and Mann-Whitney test. The differences were considered to be statistically significant when the p-value obtained was less than 0.05. The tests were performed using IBM SPSS Statistics (IBM SPSS, Chicago, Illinois).

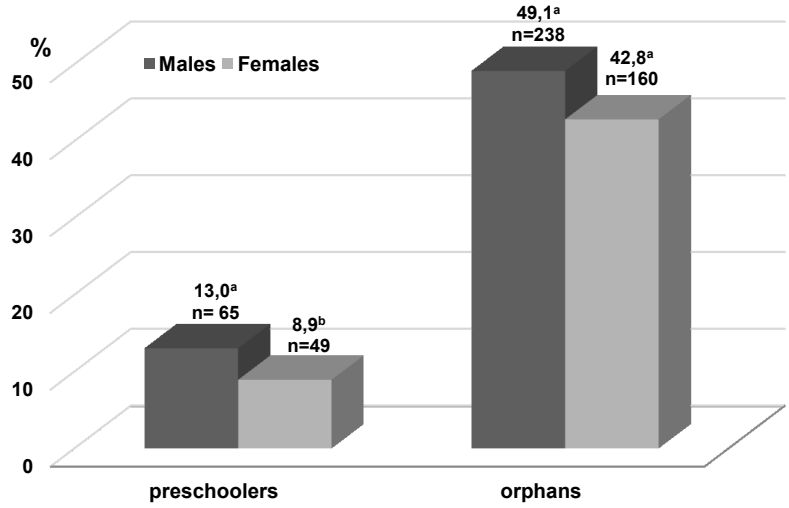
RESULTS

In the examined populations, 114 (10.8%) of the total 1052 preschoolers and 398 (46,3%) of the total 859 orphans were infected with IP species (OR=7.1; 95%CI: 5.61-9; p<0.05) (tab. I). The following parasite species were diagnosed: *Enterobius vermicularis* (*E. vermicularis*), *Giardia intestinalis* (*G. intestinalis*), *Strongyloides stercoralis (S. stercoralis), Trichuris*



a,b – diferent letters mean significant differences (χ^2 test, Z test, p<0,05)

Fig.1 Comparison of the intestinal parasites prevalence among preschoolers and orphans in the Warmia-Masuria province



a,b – diferent letters mean significant differences (χ^2 test, Z test, p<0,05)

Fig.2 Intestinal parasites infections among preschoolers and orphans in the Warmia-Masuria province according to the gender

trichiura (T. trichiura), *Ascaris lumbricoides (A. lumbricoides);* along with one conditionally pathogenic species *Entamoeba coli* (*E. coli*) (Fig. 1).

Among the positive cases 3 (2.6%) of the preschoolers and 60 (15.1%) of the orphans were infected with more than one parasite species. In both examined groups, the most frequently occurring IP was *E. vermicularis* (p<0.05). Single infections of this species were diagnosed in 97 (9.2%) preschoolers and 257 (29.9%) orphans. *E. vermicularis* occurred in co-infections with *E. coli* (0.3% in preschoolers and 6.2% orphans) and *G. intestinalis* (0.5% orphans). In one orphan both of these species were present. Single infections with the protozoa *E. coli* and *G. intestinalis* were the next highest in terms of incidence. *E. coli* was diagnosed in 1.0% of preschoolers and 6.1% of orphans, and *G. intestinalis* occured in 0.2% of preschoolers and 3.1% of orphans. Single cases of *T. trichiura* and *A. lumbricoides* infections were identified only in orphanages. Two cases of *S. stercoralis* infection were diagnosed in both preschools and orphanages (Tab. I, Fig. 1).

The statistically significant differences in the distribution of IP between males and females were only in preschools. The parasitic infections were slightly more frequent among males than females (OR=0.66; 95%CI: 0.44-0.97; p<0.05) (fig.2). However, significant differences were observed in terms of the average age of infected and uninfected groups in both examined populations. Infected preschoolers were slightly older than the uninfected. In the group of orphans opposite

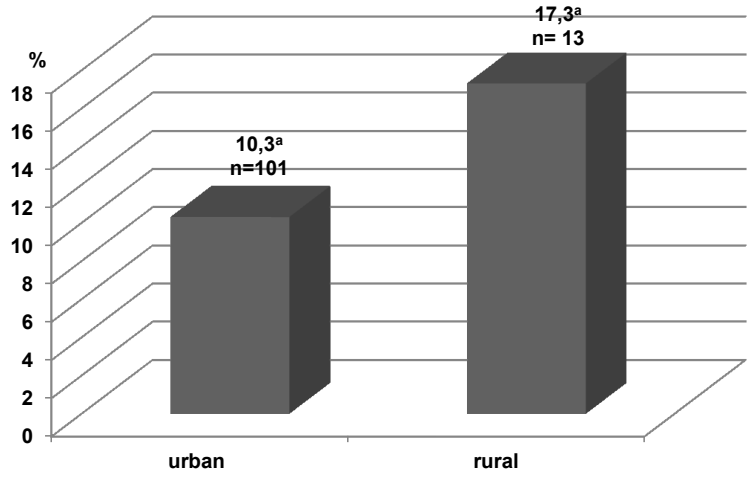
Table I. Number and percentage of intestinal parasites infected preschoolers and orphans in the Warmia-Masuria province

	Preschoolers total examined (n=1052)		Orphans total examined (n=859)	
Species	n	(%)	n	(%)
Single				
Enterobius vermicularis	97	(9,2)	257	(29,9)
Giardia intestinalis	2	(0,2)	27	(3,1)
Strongyloides stercoralis	1	(0,1)	0	
Trichuris trichiura	0		1	(0,1)
Ascaris lumbricoides	0		1	(0,1)
Entamoeba coli	11	(1,0)	52	(6,1)
Multiple				
E. vermicularis + G. intestinalis	0		4	(0,5)
E. vermicularis + E. coli	3	(0,3)	53	(6,2)
G. intestinalis + E. coli	0		1	(0,1)
G. intestinalis + S. stercoralis	0		1	(0,1)
E. vermicularis + G. intestinalis + E. coli	0		1	(0,1)
Total	114	(10,8)a	398	(46,3)b

a,b – different letters mean significant differences (χ^2 test, Z test, p<0,05)

Table II. Intestinal parasites infection among preschoolers and orphans in the Warmia-Masuria province according to the age

	Preschoolers n(%)		Orphans n(%)	
	infected	non-infected	infected	non-infected
<3	3 (4,0)	72 (96,0)	20 (48,8)	21 (51,2)
4	16 (9,5)	153 (90,5)	3 (37,5)	5 (62,5)
5	18 (6,8)	247 (93,2)	19 (61,3)	12 (38,7)
6	21 (8,4)	228 (91,6)	10 (52,6)	9 (47,4)
7	56 (19,0)	238 (81,0)	23 (65,7)	12 (34,3)
8	-		12 (46,2)	14 (53,8)
9	-		28 (57,1)	21 (42,9)
10-15	-		217 (48,9)	227 (51,1)
16-20	-		66 (32,5)	137 (67,5)
>20	-		0	3 (100)
Mean age (±SD)	5,97 (±1,21)	5,43 (±1,25)	11,60 (±4,11)	12,86 (±4,30)
Mann-Whitney U test	Z=-4,524, p<0,001, r=0,139		Z=-4,969, p<0,001, r=0,153	



a,b – diferent letters mean significant differences (χ^2 test, Z test, $p<0,05$)

Fig.3 Intestinal parasites infections among preschoolers in the Warmia-Masuria province according to the residence

trend was observed (Tab. II). The parasite infections were the most frequent among 7-year-old children, 19.1% in preschools and 65.7% in orphanages, respectively (Tab. II). In this age group, the dominant species was *E. vermicularis* (88.1% of samples were positive among 7-year-old preschoolers and 55.2% of samples were positive among orphans).

In preschools, the prevalence of IP was higher among preschoolers from rural areas (17.3% of subjects infected) than from urban areas (10.3% of subjects infected) (Fig. 3).

DISCUSSION

In Poland, a nationwide parasitological study (periodically repeated since 1988) showed a decreasing trend in the prevalence of IP among 7-year-old children (6-11). The results of recent studies conducted during the school year 2002/2003 revealed that 14.6% of the examined children were infected with IP (6). The highest number of infected children were found in the Warmia-Masuria province, where parasitic infestations were determined to be in 29.6% of the examined population, with 19.7% from urban and 41.1% from rural areas. Our parasitological study in the Warmia-Masuria province between 2003-2006 on a group of children from preschools and orphanages confirmed the high level of parasitic infections among children in this area. In the group of children under 7 years of age, IP infections were identified in 10.8% of the study population, and similar to results among 7-year-old children, mainly concerned on preschoolers in rural areas (17.3%). Significantly more cases of IP were diagnosed among children in orphanages, where as many as 46.3% of examined subjects were infected. In our study, a significant association was identified between age and parasitic intestinal infections. In both examined populations, the children with the most cases of parasitosis were diagnosed within the age group of 7 years.

The high overall prevalence of intestinal parasitosis in children from the Warmia and Masuria region is mainly caused by infection with *E. vermicularis*. Eggs of *E. vermicularis* in this area were detected in 9.5% preschoolers, 36.7% of children from orphanages and in 30.6% of 7-year-old children (6). The problem of enterobiasis in children appears to be widespread throughout the country. In Podlasie (Masovian province) between 1998-2004, enterobiasis occurred on average in 31.9% of children under 7 years of age, in 35.5% of children aged 7-15 years, in 64.3% of children from orphanages, and was 20.4% higher in the examined population in rural rather than urban areas (12). In West-Pomeranian province, enterobiasis was diagnosed by *Stelmaszyk and Owsikowski* (13) in more than 70% of children aged 4-16 years. In Silesia, according to the Voivodeship Sanitary-Epidemiological Station, in the years 1999-2003 pinworm infections among 7-year-old children ranged from 4.08 to 15.34%(14). Meanwhile in Krakow (Lesser Poland province), the extensiveness of *E. vermicularis* infection was 2.35% and ranged from 0.46% to 12.31%, (depending on the year) (15). The situation in Poland does not differ from other European countries. In Greece, Italy, Norway, and Estonia the prevalence of *E. vermicularis* invasions were 5.2%, 13,4%, 18% and 24.4% of the child population, respectively (16-19).

The incidence of other identified species of IP (*G. intestinalis*, *S. stercoralis*, *T. trichiura*, *A. lumbricoides* and the conditionally pathogenic species of *E. coli*) in children in the Warmia and Masuria province is comparable to the incidence in child populations from other areas of Poland. Screening tests conducted in the last decade in different child populations revealed the occurrence of the protozoa *G. intestinalis* from 0,18-3,5% (6,13,14,20) and *E. coli* from 0.12 to 9.8% of examined

subjects (6,13,14,20). Geohelmints infections among children in other regions of Poland are also reported sporadically with results similar to what is found in Warmia and Masuria (6, 13,14,20).

The prevalence of IP in humans is significantly correlated with social-environmental factors (5,22). Overcrowding, poor sanitary conditions and hygiene habits, low levels of parental education (or their social or educational incapacity), are the same causal factors found in other studies (23-25), and may be the main factors influencing the high prevalence of infection in children from rural areas and orphanages in the Warmia-Masuria province.

Many studies have shown that IP infections in children have a significant impact on their health and usually result in malnutrition and growth stunting(1,26). *Nematian et al.* (27) revealed that among children in Teheran the prevalence of stunting and wasting were significantly higher in children infected by IP, especially if they were infected with *G. intestinalis* and *E. vermicularis* as compared with the uninfected. A higher prevalence of IP infections was also found by *Quihui-Cota et al.* (28) in Mexican schoolchildren with lower body weight and height than in normally nourished children. The poor nutritional status of infected children is caused by a decline in food intake and an increase in nutrient wastage. IP can disrupt in their hosts the absorption of nutrients, vitamins, and minerals (vit. A, B6, B12, iron, calcium, magnesium) which affects the immunity level and predisposes the host to more serious diseases (1,29). Malnutrition in children also has an impact on their social, cognitive and intellectual development(1,22,30,31).

CONCLUSION

In Warmia-Masuria province, children living in orphanages and in rural areas, especially at the age of 7 years, are risk group of IP infections. In this group of children, enterobiasis is the main health problem. Consequently, there is still a need for the promotion of health education to parents and educational staff at institutions to create awareness about IP infections and their prevention in children.

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