

Enterobiosis — analysis of infections in human populations of villages and towns and infections in families

Stefania Hęciak

Department of Zoology, Institute of Zoology, Agricultural Faculty, University of Podlasie, Prusa 12 Str. 08-110 Siedlce, Poland; Tel. 025-6431357 or 025-6431209; E-mail: shstenia@poczta.fm or E-mail: heciak@ap.siedlce.pl

ABSTRASCT. The study presents the results of a research on the frequency of infection with *Enterobius vermicularis* in different urban and rural human populations, conducted by Zoology Department of Podlaska Academy in Siedlce between 1998 and 2006. Since 2001, samples from one examinee were collected seven times. On the basis of the seven tests, a table of the frequency of infection and the efficiency of its detection was presented. The study indicates the populations in which all the infected were detected earlier than after the seventh test. It also presents the results of family infection examination (there were two groups of the examined: A — only children, B — children as well as parents): out of 125 families 47 (37.6%) were infected. The author concluded that the method of taking pinworm samples should be standardized to the Graham method with the samples collected on seven consecutive days, and that whole families should be examined wherever one person is detected to be infected.

Key words: enterobiosis, family infections, number of infections in towns and in villages.

Introduction

Enterobiosis has not been included in the register of infectious diseases since the 1960s, but it is still an epidemic problem. The level of its detection is reported to be different depending on the method used: the method of egg-searching in the excrement, the NIH method (after Hall [1]) or Graham [2] method as well as on the examined environments, which differ in the level of human population density, sanitary conditions at home and at school or nursery school and in eating habits. The level of infection shown by different authors varies from 2.44% through 5.51% [3], 12.15% [4] and 16.45% [5] to 29.8% [6]. For rural communities the level of infection is usually higher: 19% [4], 20% [7], 60.7% [6] and 24.54% [5], but there are some opposing data, for example 12% for town inhabitants and 9.4% for people living in the country [8].

Generally, more people are diagnosed in towns than in villages. In the research carried out since 1998 in Zoology Department of Podlaska Academy, the material coming from village inhabitants prevails.

Enterobiosis is a family disease, but rarely whole families are examined [9] — when the infection in one person in a family is ascertained, all the family members are cured preventively. That was the reason why the examiners wanted to check if all the people in a family were actually infected. The parents and the staff of the examined institutions were encouraged to examine all the members of families or communities.

The research aimed to answer the following questions:

What is the frequency of infection in the examined populations?

Is it necessary to collect samples seven times?

What is the distribution of the infection in a family?

Material and methods

3 636 people were examined by the use of the Graham method, mainly children from nursery and primary schools, and 80 adults (Tables 1, 2). Thirteen town institutions and eleven village institutions were included in the examination. In 1998, 225 people were examined: samples were collected by the use of the Graham method on one day, the

Table 1. Frequency of the infection with *E. vermicularis* of people living in a town (the Graham method)

N. samples	Place, institution, year of research	N. of exam.	% inf.
3	Siedlce, P, 1999	421	10.45
3	Siedlce, SP n. 6 1998-1999	563	16.5
3-4	Siedlce, OSzW, 2005	33	66.7
7	Biłgoraj, P n. 1, 2001	82	23.2
7	Ostrówek, P, 2001	12	33
7	Siedlce, P 27, 2000-2001	76	10.5
7	Siedlce, WDS, 2001-2002	25	52
7	Siedlce, P n. 15, 2001-2002	43	21
7	Siedlce, DPS, 2002	162	12.2
7	Siedlce, SP n. 7, 2005-2006	126	13.5
7	Siedlce, SP n. 12, 2005-2006	85	16.4
7	Świdnik, P, 2001	75	13.3
7	Wołomin, P n. 3, 2001	18	0
Total		1721	22.2

P — nursery school; SP — primary school; DD — orphanage; WDS — Children's Village, OSzW — boarding school.

Table 2. Frequency of the infection with *E. vermicularis* of people living in a village (the Graham method)

N. of samples	Place, institution, year of research	N. of exam.	% inf.
1	country Ostrówek, SP, 1998-1999	685	29.1
3	Strzała, SP, 1999	348	39.6
3	Kisielany, DD, 1999	44	65.9
3	Gończyce, P, 2000	42	57.1
3	Sobolew, P, 2000	28	25
3	Zbuczyn, SP, 2000	283	22.6
3	Gończyce, P, 2001	42	11.9
3	Sobolew, P, 2001	27	18.5
7	Cisie Zagrodzie, SP, 2001	41	56.1
7	Zbuczyn P, 2001-2002	48	54
7	Kisielany, DD, 2002	45	67
7	Przesmyki, SP, 2002	53	49.0
7	Dziewule, SP, 2002	35	52
7	Strzała, SP, 2002	25	40
7	Rzekuń, P, 2002	37	35
7	Zbuczyn, SP, 2002	25	88
7	Kisielany, DD, 2004	45	60
7	Cisie Zagrodzie, SP, 2005	35	17.1
7	Strzała, SP, 2005	27	22.2
Total		1915	42.6

P — nursery school; SP — primary school; DD — orphanage

NIH method on the second day and the Graham method again on the third day. The results of that research is not presented as it was an introductory analysis conducted in order to choose the easier and more effective method. From 2001, samples were collected on seven consecutive days, both from children and from adults. In the Primary School in Ostrówek county the samples were only collected once.

In the Graham method, a strip of sticky tape is applied to the perianal region with the forefinger and then spread on a slide for examination. On the other side of the slide, a card is fixed with the examinee's name, age and the date of the sample collection. In the research described, the material for analysis was first of all collected by the parents. Older children made the preparations by themselves. In the orphanage in Kisielany and in the boarding school of SOSzW in Siedlce the material was collected by the manager of the boarding school and by the author of this study. The results were elaborated by the use of the statistical chi-square test. It was assumed that all the infected detected make 100% of all the infected among the examined. In the process of analysis of the seven-day test results it was indicated on which day the result was

positive for the first time, and on the basis of this it was hypothetically estimated what the prevalence and efficiency would have been if the samples had been collected on seven consecutive days, every other day, every three, four, five and six days and only once. The method of seven-time sample collecting was adopted after Neva and Brown [10].

Results and discussion

3 636 people altogether were examined, out of whom 1 178 i.e. 32.4% were infected. The number of the infected was much bigger in the country than in towns and cities (42.6% and 22.2% respectively). The differences are statistically important ($\chi 2$ = 188,45, df=1, p=0,0001). Detailed results, divided into 'towns' and 'villages', are presented in Tables 1 and 2. A big span of the infection frequency from 0% to 66.7% for towns and from 17.1% to 88% for villages is visible.

In a group in an urban nursery school 50% of the examined were infected but there were also groups in rural nursery schools or classes in rural primary schools where there was no infection. The conclusion is that it is not a dwelling-place that determines the infection but it is complying with the hygienic rules, living conditions (density of population, separate bedrooms etc.) and sanitary conditions: sewage system, water use for an average inhabitant etc.

The author studied the results of the review examination of first-grade pupils (born in 1995) from the selected primary schools, conducted by the State County Sanitary Inspectorate (PPIS) in Siedlce from September 2002 to May 2003 by the use of the excrement test and the Graham test. 156 pupils altogether were examined from 10 primary schools (83 children from urban schools and 73 from rural schools). 35 children (22.4%) from Siedlce county were diagnosed to be infected, among whom there were 14 from urban schools (16.7%) and 21 from rural schools (28.8%). In 2005/2006 the author examined the children from these two schools, who had been previously examined by PPIS. In Primary School No 7 PPIS had examined 20 children, 3 had been found infected (15%). In the 2005/2006 analysis 95 pupils were diagnosed, among whom 14 (which makes 14.7%) were found infected. Additionally, family examination was conducted for 18 younger children, i.e. between 2 and 5, amongst whom none was found infected, and for 13 adults, out of whom one was infected. In Primary School No 12 PPIS had diagnosed 22 pupils, in 6 of whom (which makes 27.7%) pinworm eggs had been found. The author examined 78 pupils (aged 6–15), 14 were infected (17.9%). One adult and six younger children (aged 3-5) were also examined — all of them were healthy.

The multiplicity of sample collecting has an influence on the results: only 50% of the infected were detected after the first examination [10]. In seven-time tests the infection was 36.2% and in various multiplicity examination — 32.4% (the differences are statistically meaningless).

The distribution of the infection frequency detected and of the efficiency is illustrated in Fig. 1. It was assumed that seven tests detect 100% of the infected. It is clearly visible that the more samples are collected, the more cases of infection are detected. In the primary school in Przesmyki already after the fifth test all the infected were detected. In this small group of examinees (53 people) a special observation was made: even if samples had been taken every three days during the week the same number of infected would have been detected (26 people) that was detected by everyday tests on the seven consecutive days. In the primary school in Cisie in 2001 six samples were enough because among the 41 examinees 23 were infected, but samples collected every three days would not have identified one infected person (22 people instead of 23). Do these data shake the usefulness of seven-time tests? The author does not think so.

The method of examination also has an influence on the results obtained. It is known that the excrement examination shows a small percentage of infections (up to 5%, [11]), also single sample-collecting detects only 50% of the infected (Fig. 1).

The analysis of family infections is based on 125 families divided into two groups: A — children only, B — adults and children. In 47 families infection was detected, i.e. in 37.6% of the analysed families.

The family research comprised 371 people, 80 adults and 291 children, among whom 17.5% and 26.5% respectively were infected.

Out of the 20 infected families from group B in 3 families all the members were infected, in 6 — the adults and (some of) the children, in 9 only the children/child and in 2 families — only the adults.

Such a precise analysis of family infections is presented (Table 3) because whole families are rarely examined but the author's suggestion is that it

Table 3. Distribution of family infections in group B — whole families examined

Family	I					II						III	
age	4	7	9	10	36	8	8	9	10	28	32	7	40
infection	+	+	+	+	+	+	–	+	–	–	–	+	–
Family	IV					V						VI	
age	9	10	15	40	43	5	6	10	13	40	44	14	41
infection	+	+	+	+	+	–	–	+	–	+	–	–	+
Family	VII					VIII							
age	6	11	13	34	40	5	6	10	13	40	44		
infection	+	+	+	+	+	–	–	+	–	+	–		
Family	IX					X					XI		
age	7	10	12	38	42	7	9	11	33	39	10	11	34
infection	+	+	–	–	–	–	+	–	–	–	+	–	+
Family	XII					XIII				XIV			
age	11	12	14	16	38	7	9	32	32	5	9	36	36
infection	+	–	–	–	–	–	–	–	+	–	+	–	–
Family	XV				XVI				XVII				
age	16	20	29	53	16	17	44	45	10	12	41	43	
infection	+	–	–	+	+	–	–	+	+	+	–	–	
Family	XVIII				XIX				XX				
age	9	15	18	42	3	7	28	29	11	41	48	73	
infection	+	+	–	–	–	+	–	–	+	+	+	–	

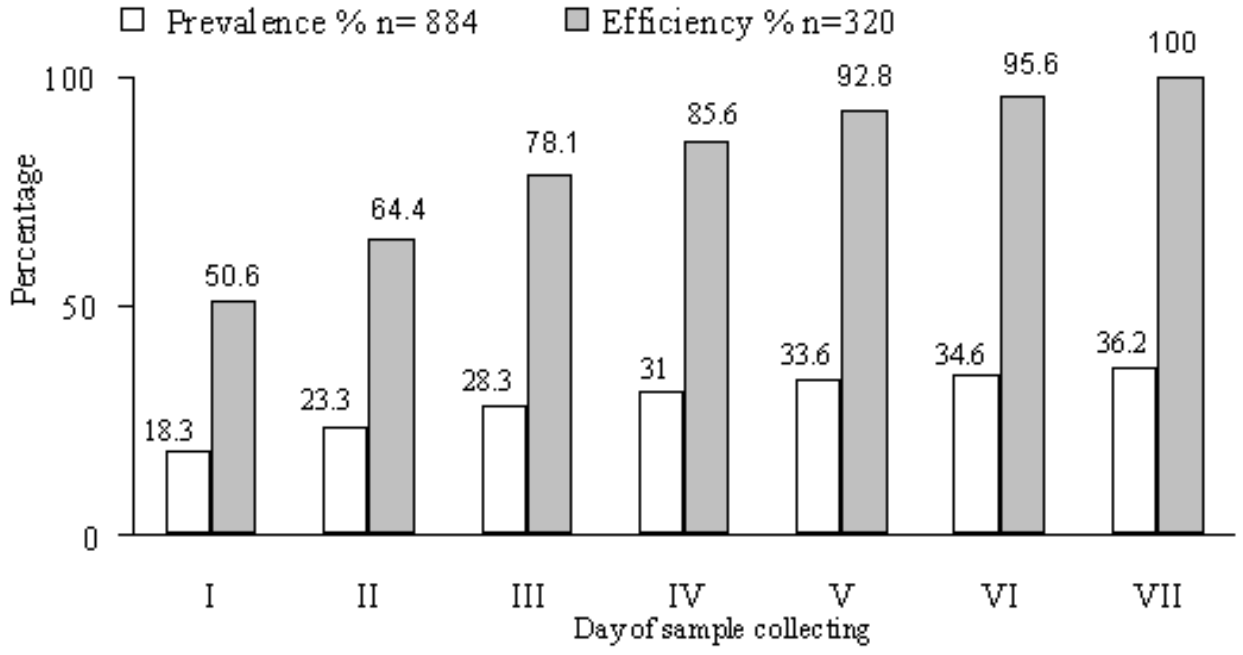

Fig. 1. Distribution of the infection frequency detected and of the efficiency

is worth, when there is an infected person detected, checking if there is someone else infected in the family, especially in cases where a mass infection is detected i.e. where the examined person had seven, six or five positive samples. It would be good practice to check all the people living together in order not to use chemotherapy unnecessarily. The author supports (after [12]) prophylaxis in the aspect of whole family examination, not prescribing medicines without detecting the infection.

Conclusions

(1) According to the literature data the level of infection with *E. vermicularis* in people living in the country is higher than in people living in towns and cities. The results of the research presented lead to the same conclusion (the differences are statistically meaningful).

(2) The results of the research presented suggest the necessity of standardization of enterobiosis diagnostics. The author suggests that it should be a seven-time test with samples collected day after day by the use of the Graham method (confirmation of the recommendation by Brown and Neva [11]).

(3) The examination should cover whole families when enterobiosis is detected in one of the people living together.

Acknowledgements

The author would like to thank Beata Burdelska, Agata Białobrzeska, Ewa Bielecka, Iwona Chrzanowska, Sylwia Cieślak, Renata Dybiak, Dorota Ilczuk-Łapiuk, Anna Karpińska, Justyna Salawerska, Iwona Strojek and Joanna Wysocka for their help with collecting and marking the samples.

References

[1] Hall M.C. 1937. Studies on oxyuriasis. I. Types of anal swabs and scrapers with a description of an improved type of swab. *American Journal of Tropical Medicine and Hygiene* 7: 445–453.

[2] Graham C.F. 1941. A device for the diagnosis of *Enterobius* infection. *American Journal of Tropical Medicine and Hygiene* 21: 159–161.

[3] Spausta G., Gorczyńska D., Ciarkowska J., Wiczkowski A., Krzanowska E., Gawron K. 2005. Występowanie pasożytów człowieka w wybranych populacjach na przykładzie badań przeprowadzonych w Śląskiej Wojewódzkiej Stacji Sanitarno-Epidemiologicznej. *Wiadomości Parazytologiczne* 51: 29–34.

[4] Bitkowska E., Wnukowska N., Wojtyniak B., Dzbeński T.H. 2004. Analiza występowania pasożytów jelitowych u dzieci klas pierwszych w Polsce w roku szkolnym 2002/2003. *Przegląd Epidemiologiczny* 58: 295–302.

[5] Płonka W., Dzbeński T.H. 1999. Analiza występowania pasożytów jelitowych u dzieci klas pierwszych w Polsce w roku szkolnym 1997/1998 na terenie wybranych województw. *Przegląd Epidemiologiczny* 53: 331–338.

[6] Biaduń W., Chybowski J., Rukasz H., Staniol H. 2001. Występowanie pasożytów jelitowych u dzieci w makroregionie lubelskim w latach 1976-2000. *Wiadomości Parazytologiczne* 47: 417–422.

[7] Nasiłowska M. 1987. Pasożyty jelitowe. *Przegląd Epidemiologiczny* 41: 131–137.

[8] Żółtowska K., Danieluk S. 1999. Owsica u dzieci przedszkolnych i szkolnych z wybranych placówek Olsztyna i jego okolic. *Wiadomości Parazytologiczne* 45: 355–362.

[9] Ochęcka A. 1982. Owsica u dzieci z gminy Żelechlinek z uwzględnieniem inwazji rodzinnych. *Wiadomości Parazytologiczne* 28: 365–368.

[10] Brown H.W., Neva F. 1994. Intestinal nematodes of Human beings. In: *Basic clinical parasitology*. (Eds. F.A. Neva, H.W. Brown) Appletown and Lange, Norwalk, Connecticut: 135–139.

[11] Deryło A. 2002. Parazytologia i akaroentomologia medyczna. Wydawnictwo Naukowe PWN, Warszawa.

[12] Dąbrowski J. 1999. Pasożyty przewodu pokarmowego. In: *Schorzenia pasożytnicze przewodu pokarmowego człowieka*. (Ed. J. Dąbrowski). Polihymnia, Lublin: 32–33.

Wpłynęło 10 lipca 2006
Zaakceptowano 28 sierpnia 2006