

Egg positive rate of *Enterobius vermicularis* among preschool children in Cheongju, Chungcheongbuk-do, Korea

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Abstract: In an attempt to determine the prevalence of pinworm infection, the egg positive rate of *Enterobius vermicularis* was examined using the adhesive cello-tape anal swab method in 1,512 preschool children sampled from a total of 20 kindergartens in Cheongju city, in November to December of 2004 (951 children from 13 kindergartens) and September to October of 2005 (561 from 7 kindergartens). The overall egg positive rate was found to be 7.9% (119/1,512); 9.3% (73/784) for boys and 6.3% (46/728) for girls, respectively. The 5-year age group evidenced the highest egg positive rate (10.9%, 47/430) among the examined age groups. As compared to those reported from previous works (ranged from 9.2 to 26.1%), the prevalence of *E. vermicularis* in the Cheongju city area is relatively low.

Key words: *Enterobius vermicularis*, egg positive rate, preschool children, prevalence, Cheongju

Enterobius vermicularis (pinworm) is one of the most frequently encountered intestinal nematodes, and infects millions of people throughout the world (Neva and Brown, 1994). Human infection occurs when the eggs in infective stage are accidentally ingested from a contaminated environment. Although the majority of infections are asymptomatic, it induces bothersome symptoms in some cases, a condition referred to as 'enterobiasis', which includes an itching sensation and irritation at the perianal area, coupled with mental distraction. Among all age groups, schoolchildren, particularly those who engage in group activities, evidence the highest rates of pinworm infection (Bogitsh et al., 2005). As a consequence of its rapid spread and high rate of reinfection, a long-term follow-up of the infection rate constitutes a prerequisite for the estab-

lishment of an effective *E. vermicularis* control program. For this reason, a continuing epidemiological survey effort into the rate of *E. vermicularis* infection has been undertaken during the last decades.

Reported *E. vermicularis* infection rates have varied significantly, depending on the age groups studied and regions included in the survey, most notably between urban and rural areas, in some previous studies (Im et al., 1986; Choi et al., 1987; Kim et al., 1991), whereas more recent investigations have asserted that differences in egg positive rates between urban and rural areas were not significant (Kim et al., 2001; Lee et al., 2001; Park et al., 2005). Although there have been some reports regarding infection rates in other local areas in Korea, no extensive epidemiological survey regarding its prevalence in Cheongju city of Chungcheongbuk-do (Province) has yet been conducted. Here, we present the results of an epidemiological survey regarding *E. vermicularis* infection profiles, by describing the egg positive rates of preschool

• Received 19 June, 2006, accepted after revision 25 July, 2006.

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children in Cheongju city, Chungcheongbuk-do.

In order to estimate the pinworm infection rate, the adhesive cello-tape anal swab method was applied targeting 1,512 preschool children sampled from a total of 20 kindergartens in Cheongju city, between November and December, 2004 (13 in the first year of survey) and between September and October, 2005 (7 in the second year of survey). All examinations were carried out under permission of preschool teachers.

Of the 1,512 children examined, 119 (7.9%) were identified to be positive for *E. vermicularis* eggs (Table 1). The overall egg positive rates of boys and girls were 9.3% (73/784) and 6.3% (46/728), respectively. The age group of 5 years showed the highest egg positive rate (10.9%, 47/430). The egg positive rate varied markedly depending on kindergartens examined, ranging from 0 to 22% (data not shown). We consider that the fact, that some children had received anthelmintic treatments prior to our investigational visit, may have resulted in findings of 0% infection or of less than the average rate in some kindergartens.

The egg positive rate in 2004 was 4.6%, but this rate was higher, 13.4%, in 2005. The difference between 2004 and 2005 was statistically significant (χ^2 -test, $P < 0.0001$). The much higher infection rate in 2005 is considered to be possibly associated with different sam-

pling strategies. In fact, we failed to avoid bias in sample selection between 2 survey years; namely, in the 2005 survey, the kindergartens in which children received *E. vermicularis* examinations, or anthelmintic treatment for at least 6 months prior to our investigation, were excluded. In the 2004 survey, however, we neglected to count out the kindergartens where anthelmintic drug medication was done before the sampling. Accordingly, this biased sampling appeared to result in a lower estimate of overall egg positive rate in the 2004 census (4.6% and 13.4% in the 2004 and 2005 surveys, respectively) (Table 1).

Our data also demonstrate that the prevalence of infection with *E. vermicularis* in preschool children in Cheongju City was relatively lower than those of other regions published in previous reports. Although a nationwide survey of intestinal parasites showed that the overall *E. vermicularis* egg positive rate of the Korean population was 0.6%, and that the highest infection rate was found among children in the age range of 5 to 9 years (Ministry of Health and Welfare and Korea Association of Health, 2004). Compared to those reported in previous studies (Yang et al., 1997; Lee et al., 2000; Yoon et al., 2000; Kim et al., 2001; Lee et al., 2001; Kim et al., 2003; Song et al., 2003), which ranged from 9.2 to 26.1%, the total egg positive rate of

Table 1. Age and sex distribution of *Enterobius vermicularis* egg positive cases among preschool children in Cheongju city

Age (year)	No. children showing eggs/No. children examined (%)								
	Boys			Girls			Total		
	2004	2005	Total	2004	2005	Total	2004	2005	Total
< 3	0/57 (0)	2/25 (8.0)	2/82 (2.4)	0/46 (0)	1/19 (5.3)	1/65 (1.5)	0/103 (0)	3/44 (6.8)	3/147 (2.0)
3	7/107 (6.5)	6/63 (9.5)	13/170 (7.7)	2/89 (2.3)	2/59 (3.4)	4/148 (2.7)	9/196 (4.6)	8/122 (6.6)	17/318 (5.4)
4	4/129 (3.1)	15/86 (17.4)	19/215 (8.8)	8/120 (6.7)	5/67 (7.5)	13/187 (7.0)	12/249 (4.8)	20/153 (13.1)	32/402 (8.0)
5	8/116 (6.9)	21/96 (21.9)	29/212 (13.7)	8/151 (5.3)	10/67 (14.9)	18/218 (8.3)	16/267 (6.0)	31/163 (19.0)	47/430 (10.9)
6	2/66 (3.0)	8/37 (21.6)	10/103 (9.7)	5/67 (7.5)	5/40 (12.5)	10/107 (9.4)	7/133 (5.3)	13/77 (16.9)	20/210 (9.5)
7 & over	0/2 (0)	0/0 (0)	0/2 (0)	0/1 (0)	0/2 (0)	0/3 (0)	0/3 (0)	0/2 (0)	0/5 (0)
Total	21/477 (4.4)	52/307 (16.9)	73/784 (9.3)	23/474 (4.9)	23/254 (9.1)	46/728 (6.3)	44/951 (4.6)	75/561 (13.4)	119/1,512 (7.9)

7.9% in Cheongju City was relatively lower. The lower rate detected in this survey may be associated with the fact that we included children who had experienced *E. vermicularis* examinations, or anthelmintic treatments prior to our 2004 survey, which thereby reduced the overall egg positive rate reported in the 2004 census. Therefore, it is anticipated that the exhaustive investigation with a well planned sampling strategy will bring more reliable estimation for the prevalence of pinworm. In addition, the egg positive rate tests were inspected at only one time in the present survey. It is generally known that the estimation of infection rate via a single examination often understates the real rate of infection. Thus, multiple examinations are recommended for an accurate approximation of the real infection profile of the population (Yoon et al., 2000).

Enterobius vermicularis is one of the most frequently encountered and ubiquitous nematodes known. It is highly contagious, and parasitizing the human intestinal tract. The majority of human infections have been shown to occur in preschool children and grade schoolchildren, particularly those who engage in group activity. Due to its rapid rate of spread and high reinfection rate among children in the same class or among family members, a long-term follow-up of the infection rate should facilitate the establishment of an effective *E. vermicularis* control program, especially when coupled with the vigilant and timely administration of appropriate medication.

ACKNOWLEDGMENTS

We are indebted to two anonymous reviewers and to the editor, who helped to improve this manuscript. This work was supported by a Research grant from Chungbuk National University in 2005. The Cheongju Branch of the Korea Association of Health Promotion provided the cello-tape for the anal swab.

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