

Recent Patterns of *Enterobius vermicularis* Infections among Preschool Children in Daegu, Korea*

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Abstract : From March 5 to April 30 in 2004, 1,021 children were examined for *Enterobius vermicularis* in the vicinity of Daegu area, Korea. A modification of the Graham's scotch tape swab technique was employed. All were examined once in the morning. The overall infection rate was found to be 3.5% (36 out of 1,021). There was no significant gender difference in the rate. The infection was first detected in 3 year old group with an average of 2.9%. The rate of infection among children in Northern district was 4.6% and 2.3% among children in Eastern district. The difference in the rate of infection among children was not significant between the districts in Daegu city. It is clear from the present survey that the rate of *Enterobius* infection among the preschool children in Daegu city is lower than that found in the previous reports of enterobiasis in Korea.

Key Words : Daegu city, Enterobiasis, *Enterobius vermicularis*, Graham's scotch tape swab technique, Preschool children

Introduction

Enterobiasis is more common in infected families or in asylums than in populations at large, and is more common in children than in adults.

The detection of *Enterobius* eggs on the perianal region signifies a past infection or the exit of the last worm, and Graham's scotch tape swab technique has generally been used for

diagnostic purpose. Therefore, the positive Graham's test has been assumed that infection exists presently and likely to continue. Comprehensive search in the literature indicates that the first record of enterobiasis among Korean was documented by Hunter *et al.*[1], who observed prevalence of 22.0% in 9 areas of Korea. In a study of parasite eggs from fingernails, Soh[2] found many pinworm eggs and stated that inadequate hand washing and

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poor facilities for personal hygiene are additional factors which influence the prevalence of the worm.

Based on a modification of the Graham's technique, Choi *et al.*[3] reported that the overall detection rate of *Enterobius vermicularis*, was approximately 42.6% of infants and children examined in the vicinity of Daegu. A much higher proportion of children living in unsanitary areas and those in orphanages were included in the above report than in the present study. After the beginning of the new community project in the third 'Five-year economic development plan' in 1972, the Korean government then made plans to eradicate helminthic infections, and performed the mass treatment of egg positive cases. At the same time, environmental measure, especially night soil disposal, was taken into serious consideration, although its enforcement was not sufficient. As a result, these operations resulted in a gradual decrease in the infection rates of intestinal parasitic diseases.

This paper deals with the detection rate of *E. vermicularis* among preschool children, because the rate of intestinal parasite in the vicinity of Daegu has not been reported since 1973.

Materials and Methods

Surveyed areas: Daegu city is situated in the southeastern part of the Korean Peninsula, having an area of 455 km², and there are many mountains, on the border such as Mt. Wyalong, Mt. Biseol and Mt. Moonam, arranged in a circle that makes the city seem to be a big hollow. On January 1st 1988, the area of Daegu city was divided into eight districts (ku or kun) and was promoted to the city status under the direct

control of the government (Fig. 1). The more detailed geographical conditions of the surveyed areas have been presented by Kim and Joo[4].

Parasitological methods: During the period from March 5th to April 30th in 2004, this survey was carried out with the children from the Children's house and the kindergarten pupil aged from 1 to 6 years. The heterogeneity of age, sex and locations of the children surveyed for *Enterobius* egg examination are summarized in Table 1 and Fig. 1.

A modification of the Graham's scotch tape swab technique was used.

The scotch tape used was 80 mm in length and 19 mm in width. The adhesive side of the tape was put on a slide in the laboratory prior to use. They were stripped from the slides, and the adhesive side was applied to the perianal region. The tape was then placed adhesive down, adding a drop of toluene on a slide.

The preparations were made on each child in the morning (9:00 to 11:00 a.m.) in Children's houses and kindergartens. One swab preparation

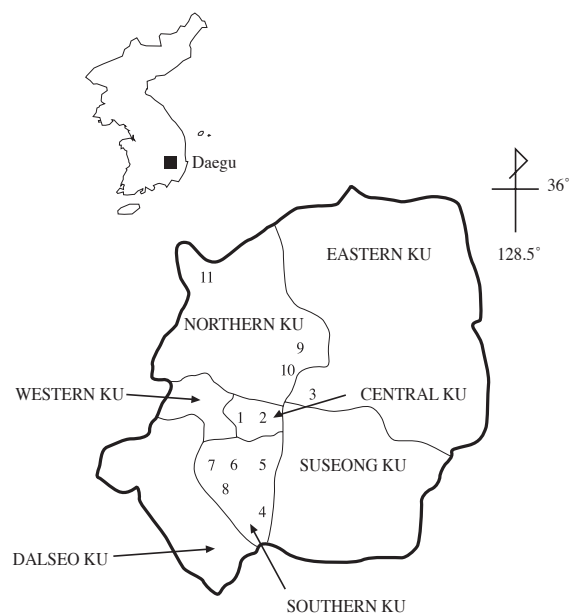


Fig. 1. Map showing the Daegu city under survey.

per child was examined, and it was then examined under a microscope. Any one with positive tape test was considered infection.

Results

Table 1 shows the prevalence rates of *Enterobius vermicularis* by a single Graham's scotch tape swab technique in surveyed districts in Daegu city. Thirty-six children in all surveyed districts were found with *Enterobius vermicularis* eggs, amounting to 3.5% of the children. The highest prevalence of *Enterobius vermicularis* was found among the children of Northern district, being present in 4.6%, followed by Southern district with the rate of 3.3%. Eastern district was the least, having

2.3%.

The infection rate of *Enterobius vermicularis* among the children according to their sex and age is listed in Table 2. Of total 1,021 children examined, 36 children or 3.5% were found to harbor the worm. As for the sex-specificity, the infection in males was not significantly higher than in females: 4.4% in males and 2.5% in females. Actually, there was considerable variation in the detection of eggs, depending on different age groups studied: 0% in both 1 year and 2 years groups, and 2.9% in both 3 years and 4 years groups. The rate increased to 3.4% in 5 years age group and reached 5.8% in the 6 years age group, with a maximum infection in 6 years of age group in males and in 5 years age group in female.

The data presented in Table 3 were compiled

Table 1. Prevalence of *Enterobius vermicularis* according to surveyed districts in Daegu city, revealed by a single Graham's scotch tape swab technique (2004)

District (ku)	Children's House	Male		Female		Total	
		No. examined	Percent positive	No. examined	Percent positive	No. examined	Percent positive
Center	1. Dongsan	11	9.1	13	0	24	4.2
	2. Sicheong	28	0	31	3.2	59	1.7
	Subtotal	39	2.7	44	2.3	83	2.4
Eastern	3. Cheongsan	45	2.2	42	2.4	87	2.3
	Subtotal	45	2.2	42	2.4	87	2.3
Southern	4. Donghak	57	5.3	38	7.9	95	6.3
	5. Hodong	47	0	49	0	96	0
	6. Kyoungbuk	96	3.1	67	3.0	163	3.1
	7. Yangzi	50	2.0	56	1.8	106	1.9
	8. Sohwa	56	8.9	62	1.6	118	5.1
	Subtotal	306	3.9	272	2.6	578	3.3
Northern	9. Docheong	28	7.1	21	0	49	4.1
	10. kumdongsan	74	8.1	57	1.8	131	5.3
	11. Kwanum	54	3.7	49	4.1	103	3.9
	Subtotal	156	6.4	127	2.7	283	4.6
Total		546	4.4	475	2.5	1,021	3.5

to indicate sex and age of the children. In 1973, 33.1% and 48.1% of the children in the private homes and in institutions, respectively, were found to be pinworm infected, whereas 4.4% were positive in 2004. In general, the prevalence rate was higher among males than females in both surveys. The overall prevalence rate of *E. vermicularis* in 1973 was found among the children in institutions, being present in 48.4%, followed by private homes with the rate of 38.8%, whereas the rate in 2004 was 3.5%. This

was about 90% reduction. Great difference in the rate of infection between 1973 and 2004 was found in the youngest age, and the difference decreased progressively with age.

Discussion

The findings in this study are based on *E. vermicularis* eggs discovered by modified Graham's scotch tape anal swab techniques on

Table 2. Prevalence of *Enterobius vermicularis* among children in Daegu city by sex and age groups (2004)

Age group (yrs)	Male		Female		Total	
	No. examined	Percent positive	No. examined	Percent positive	No. examined	Percent positive
1	1	0			1	0
2	7	0	11	0	18	0
3	68	4.4	68	1.5	136	2.9
4	218	3.7	191	1.6	409	2.9
5	132	2.3	100	5.0	232	3.4
6	120	8.3	105	2.9	225	5.8
Total	546	4.4	475	2.5	1,021	3.5

Table 3. Comparison of prevalence of *Enterobius vermicularis* among children in Daegu city in 1973 and 2004, by a single Graham's scotch tape swab technique

Age (yrs)	Male						Female						Total					
	Choi <i>et al.</i> [3]				Authors		Choi <i>et al.</i> [3]				Authors		Choi <i>et al.</i> [3]				Authors	
	No. exam.	posit. %	C.H.	C.O.	No. exam.	posit. %	No. exam.	posit. %	C.H.	C.O.	No. exam.	posit. %	No. exam.	posit. %	C.H.	C.O.	No. exam.	posit. %
1	10	2	20.0	50.0	1	0	24	5	8.3	0	0	0	34	7	14.7	14.3	1	0
2	30	6	16.7	33.3	7	0	45	7	11.1	71.4	11	0	75	13	13.3	53.8	18	0
3	24	5	16.7	2.0	68	4.4	45	26	33.3	34.6	68	1.5	69	31	27.5	32.3	136	2.9
4	34	3	16.1	33.3	218	3.7	40	25	35.0	60.0	191	1.6	71	28	26.8	57.1	409	2.9
5	46	4	21.7	25.0	132	2.3	34	30	58.9	56.7	100	5.0	80	34	57.5	52.9	232	3.4
6	125	7	49.6	100.0	120	8.3	147	41	60.5	46.3	105	2.9	272	48	55.5	54.2	225	5.8
Total	266	27	33.1	48.1	546	4.4	335	134	43.3	48.5	475	2.5	601	161	38.8	48.4	1,021	3.5

exam.: examined; posit.: positive.

1,021 subjects.

In practice, however, this does not indicate of the true prevalence among the preschool children in Daegu city, because a single examination of Graham's technique is not reliable enough to obtain accurate prevalence of *E. vermicularis*, and repeated examinations on 4 consecutive days at least are necessary[5]. However, the present results are quite comparable with earlier reports which were based on a single anal swab by means of similar laboratory procedures.

From the data presented in Table 4, it is noted that, although higher prevalences are

expected if examinations were repeated, the present results show a marked decrease in the prevalence of enterobiasis, compared with earlier reports available.

The exact prevalence of the worm in Daegu is not known, however, earlier reliable reports by some investigators[3,6] indicate that the rates of infection are higher than that found in our figures of 3.5% in the preschool children. On the basis of the results by Choi *et al.* [3], Joo and Jheon[6], and the present survey, it is assumed that, enterobiasis among the preschool children in Daegu city has decreased since 1973.

The exact causes of lower prevalence of

Table 4. Reported prevalence of enterobiasis in Korea

Source (Year)	Locality (County)	No. tested	Prevalence (%)	Group tested
Joo <i>et al.</i> (1983)	Daegu	1,005	30.1	School children
Huh & Park (1984)	Woobo			
	Yongyang	2,227	64.1	School children
Im <i>et al.</i> (1986)	Cheongyang	243	55.6	School children
	Wyando	291	46.8	School children
Kim <i>et al.</i> (1991)	Inchon	326	13.8	School children
	Wonju	1,262	19.9	School children
Yang <i>et al.</i> (1997)	Chunchon	789	7.5	School children
Yoon <i>et al.</i> (2000)	Chunchon	4,711	9.2	Preschool children
Kho <i>et al.</i> (2000)	Pusan	1,619	16.0	School children & Preschool children
Kim <i>et al.</i> (2001)	Hamyang	720	12.6	School children
Song <i>et al.</i> (2003)	Seoul	1,191	9.5	Preschool children
Kim <i>et al.</i> (2003)	Geojae	754	9.8	School children
Authors (2004)	Daegu	1,021	3.5	Preschool children

enterobiasis are difficult to explain, however, remarkable improvements of sanitary conditions and dwellings together with extensive public health education, specific chemotherapeutic administrations, and attention to personal hygiene should be cited in this regard. Such considerations have also been recognized by some investigators [7-13]. As for the sex-specific rates in a prevalence of *E. vermicularis* among the school children in Daegu, Choi *et al.* [3] reported a lower prevalence of 40.7% in male than in female with 44.4%, and the data by Joo and Jheo [6] showed 30.4% to be male and 31.7% for female. Furthermore, Kim *et al.* [9] examined 251 cases of enterobiasis among the children near Wonju area of Kangweon Province, and found that prevalence in females was little higher than in males. This is in general similar to data reported by some investigators [7-13] who studied in other districts of Korea. Although many reports on the difference in the prevalence by sex have been published, the results are not in all agreement. It may partly be due to habits and physical conditions of each sex, as well as environmental factors. In a study of prevalence and risk factors for enterobiasis among preschool children in a metropolitan city in Korea, Song *et al.* [8] obtained a prevalence of 9.5% in 25 daycare centers in Seoul, ranging from 0 to 31.1%, in disagreement with ours. This variation may perhaps have been due to different epidemiological situation. An epidemiological studies of *E. vermicularis* among primary school children in Hamyang-gun, Gyeongnam Province, Korea, which was surveyed by Kim *et al.* [10], had a overall rate of 12.6%, which is comparable to the rate (19.9%) presented by Kim *et al.* [9] who studied children in rural and urban areas and in orphanages. The difference of

environmental condition may be responsible in part for this variation, however, the home environment of inhabitants in surveyed areas such as overcrowding, poor housing, and general lack of sanitary facilities may also contribute to the variation. No plausible explanation for this difference in the rate of infection between Hamyang and Wonju has been offered. However, rapid improvement of economic and environmental hygiene of preschool children occurred, in recent years, and the prevalence of enterobiasis was found to vary considerably with the data available, depending on authors (Table 4). Nevertheless, the analysis revealed that the pattern of *E. vermicularis* infection among preschool and school children are changing.

References

1. Hunter GW, Ritchie LS, Chang ID, Rolph WD, Manson HC jr, Szewcxak J. Parasitological studies in the Far East. 7. An epidemiological survey in Southern Korea. *J Parasit* [Index for December supplement] 1949;35:41.
2. Soh CT. A survey of helminth eggs from fingernails in rural school children [in Korean]. *Choongpook Med Press* 1949;2:1-5.
3. Choi DW, Joo CY, Ahn DH, Kim YM. Prevalence of *Enterobius vermicularis* in Daegu. *Kyungpook Univ Med J* 1973;14: 421-9.
4. Kim DS, Joo CY. Epidemiological studies of *Entameba histolytica* and other intestinal protozoa in Daegu city, Korea. *Keimyung Univ Med J* 1988;7:7-17.
5. Chyu I, Lim YC. Study of pinworm egg detection rate [in Korean with English summary]. *Theses Catholic Med College* 1963;7:239-44.
6. Joo CY, Jheon SH. Recent pattern of *Enterobius*

- vermicularis* infections among elementary school children in Kyungpook Province, Korea [in Korean]. *New Med J* 1983;**26**:687-90.
7. Im KI, Rhy JS, Yong TS, Lee JH, Kim TU. The egg detection rates of *Enterobius vermicularis* among school children in the various regions [in Korean]. *Korean J Parasit* 1986;**24**:205-8.
 8. Song HJ, Cho JH, Kim JS, Choi MH, Hong ST. Prevalence and risk factors for enterobiasis among preschool children in a metropolitan city in Korea. *Parasitol Rev* 2003;**91**:46-50.
 9. Kim BJ, Yeon JW, Ock MS. Infection rates of *Enterobius vermicularis* and *Clonorchis sinensis* of primary school children in Hamyang-gun, Geongsangnam-do (Province), Korea. *Korean J Parasit* 2001;**39**:323-5.
 10. Kim JS, Lee HY, Ahn YK. Prevalence of *Enterobius vermicularis* infection and preventive effects of mass treatment among children in rural and urban areas, and children in orphanages [in Korean]. *Korean J Parasit* 1991;**29**:235-43.
 11. Huh S, Park CB. Status of *Enterobius vermicularis* infection in primary school children, Yongyang-gun, Kyongbuk Province. *Korean J Parasit* 1984;**22**:138-40.
 12. Yoon HJ, Choi YJ, Lee SU, Park HY, Huh S, Yang YS. *Enterobius vermicularis* egg positive rate of preschool children in Chunchun, Korea. *Korean J Parasit* 2000;**38**:279-81.
 13. Kim BJ, Lee BY, Chung HK, Lee YS, Lee KH, Chung HJ, et al. Egg positive rate of *Enterobius vermicularis* of primary school children in Geojae island. *Korean J Parasit* 2003;**41**:75-7.