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Prevalence of *Entameba histolytica* in school children of Taegu city, Korea*

Sun Jin Kim, MD, Tae Chan Kwon, MD, Chin Moo Kang, MD, Doo Hyun Baik, MD, Chong Yoon Joo,** MD**

*Department of Pediatrics and Department of Parasitology***
Keimyung University School of Medicine, Taegu, Korea

= 國文抄錄 =

大邱市內 國民學校 學童들에 있어서 痢疾 아메바 有病率

啓明大學校 醫科大學 小兒科學敎室 및 寄生蟲學敎室**

金善眞, 權泰燦, 姜眞無, 白斗鉉, 朱鍾潤,****

大邱市內 國民學校 學童들에서의 痢疾아메바 感染狀을 알아보기 위해 1987年 11月부터 1988年 9月까지 大邱市內 2個 國民學校 學童을 調査對象으로 選定하여 formalin-ether 集卵法으로 集卵한 후 Lugol 氏液으로 染色하여 原虫類 胞囊과 蠕蟲類卵을 調査하였다.

總被檢者 2,500名中 痢疾아메바 胞囊 檢出者는 86名, 그 率은 3.4%였으며, 이中 小形胞囊 檢出者는 52名으로 가장 많았고, 大形胞囊檢出者는 23名이었으며, 小形胞囊과 大形胞囊의 混合感染이 11名이었다.

痢疾아메바의 年齡別 感染率에 있어서는 最少値2.8%, 最大値 4.2%를 나타내었으며 性別 感染率에 있어서는 男女間에 有意的 差를 認定할 수 없었다.

腸內蠕蟲類 感染率에 있어서는 1種 以上의 感染者가 54名, 總感染率은 2.2%였고, 이中 蟯蟲은 1.6%로 가장 높았으며, 그 다음은 1.4%를 나타내는 鞭蟲, 1.2%의 肝吸蟲 順位였으며, 毛樣線虫과 條蟲類는 0.1%로 가장 낮았다.

以上의 成績으로 미루어 보아 大邱市內 國民學校 學童들에서의 痢疾아메바 및 腸內 寄生虫 感染率은 生活改善과 保健敎育으로 減少되었음을 알았다.

Introduction

The extensive studies on *Entameba histolytica* and other intestinal parasites were undertaken by many investigators since Kessel's first report on the human intestinal protozoa infections in Seoul, Korea in 1925.

In these studies, the infection rate of *E. histolytica* among residents is found to be high, and the distribution of this protozoan disease is now recognized as ubiquitous, determined by prevailing conditions of hygiene and sanitation.

Nishimura(1943) studied the incidence of intestinal parasites in Taegu and Yeongcheon areas of Kyungpook Province, and reported for the first time that 9.9 per cent of the residents showed *E. histolytica* cysts in their specimens.

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From the studies on the status of intestinal protozoan infections in Koreans, Lee(1969) found *E. histolytica* in 3.6 per cent among residents and draftees in the recruitment camp in Kyungpook Province, and Choi et al. (1971) in a study of intestinal parasites of Kyungpook National University hospital patients found that the prevalence of *E. histolytica* was estimated to be more than 10.0 per cent.

Recently, Kim and Joo(1988) conducted an epidemiological studies of *E. histolytica* and other intestinal protozoa in Taegu city, Korea, and reported that the infection rate of *E. histolytica* was relatively high, being 4.2 per cent, and the sex-specific rate of demonstration was a little higher in females than in males.

However, few reports on the prevalence of *E. histolytica* among school children in Taegu city have been available.

The purpose of this study is to attempt to obtain some information on the recent patterns of infection rates of *E. histolytica* and other intestinal parasites among school children of Taegu city.

Materials and Methods

During the period from November, 1987 to August, 1988, the authors carried out a parasitological survey in order to estimate *E. histolytica* and other intestinal parasitic infections among school children in Taegu city.

The surveyed area was divided into two localities, the urban and suburban areas of the city.

Chong-ro primary school located in the central district of Taegu city was selected as an urban school and Banya-weol primary school in the east district of the city, which was incorporated from Kyungsan county in 1981, was taken as a suburban one.

The specimens were collected in cardboard cartons and brought to the laboratory.

Since trophozoites disintegrate within a short time, only cysts were examined in solid stools. The formalin-ether sedimentation method(Ritchie, 1948) was used to recover protozoan cysts and helminthic eggs. One drop of the sediment was first placed on a microscopic slide and one drop of Lugol's iodine solution was mixed.

The preparation was mounted with a cover slip, and the entire area was examined for cysts. When *E. histolytica* cysts were found, the size of a sufficient number of cysts was measured with a micrometer to determine the relative prevalence of large and small races, cysts measuring smaller than 10 micron being assigned to the latter.

Results

The proportion of the number of school children tested relative to the total number of school children of two schools surveyed is presented in Table 1. A total of 2,500 children was tested. The proportion varied from 59.1 per cent at Banya-weol primary school to 77.3 per cent of Chong-ro primary school.

The sex-specific rate for children tested was almost equal and an average of 65.9 per cent of all the school children was included in the test.

Table 2 shows the comparison of infection rates for *E. histolytica* among school children in urban and suburban areas in Taegu city.

In the urban area, of 1,098 children examined, 4.0 per cent harbored the *E. histolytica* cysts. In the suburban area, 3.0 per cent of 1,402 children examined showed the cysts. There was no significant difference in the infection rate of cysts between urban and suburban children.

Table 3 summarize the infection rate of *E. histolytica* among the school children of Taegu city by sex and age groups.

A total of 2,500 children were examined, 86 or 3.4 per cent were found to be infective cases. The sex-specific rate of infection was a little higher in males than in females; 3.5 per cent in males and 3.4 per cent in females.

The age-specific rate of infection varied from age to age. *E. histolytica* was most prevalent in the 13 year old group in both sexes and showed

Table 1. Total number of school children and number tested in two different schools surveyed in Taegu city, Korea (1987-1988)

Surveyed area		sex	No. children	No. tested	Percent positive
District	Primary school				
Central	Chong-ro	Male	748	572	76.5
		Female	672	526	78.3
		Subtotal	1,420	1,098	77.3
East	Banya-weol	Male	1,249	692	55.4
		Female	1,123	710	63.2
		Subtotal	2,372	1,402	59.1
Total			3,792	2,500	65.9

Table 2. Comparison of infection rate for *Entameba histolytica* among school children in urban and suburban areas of Taegu city (1987-1988)

Area	sex	Number examined	Number infected	Percent positive
Urban	Male	576	24	4.2
	Female	526	20	3.8
	Subtotal	1,098	44	4.0
Suburban	Male	692	20	2.9
	Female	710	22	3.1
	Subtotal	1,402	42	3.0
Total		2,500	86	3.4

Table 3. Demonstration of *Entameba histolytica* cysts by sex and age among elementary school children of Taegu city, Korea (1987-1988)

Age (Year)	Male		Female		Total	
	No. examined	Percent positive	No. examined	Percent positive	No. examined	Percent positive
6	136	3.7	145	2.8	281	3.2
7	162	3.1	175	4.0	337	3.6
8	148	3.4	114	3.5	262	3.4
9	124	4.0	136	2.9	260	3.5
10	251	3.6	239	3.3	490	3.5
11	186	2.7	177	2.8	363	2.8
12	213	3.8	198	4.0	411	3.9
13	44	4.5	52	3.8	96	4.2
Total	1,264	3.5	1,236	3.4	2,500	3.4

about the same proportion among males and females of each age group.

Table 4 lists the species and infection rates for intestinal amebae detected in 2,500 children of Taegu city. Of the protozoa, *Endolimax nana* was found most frequently, in 4.8 per cent of the children, followed by *E. histolytica* with 3.4 per cent and *Iodameba bütschlii* with 1.4 per

Table 4. Demonstration of cysts for intestinal amebae in the school children of Taegu city, Korea (1987-1988)

Species	Male		Female		Total	
	No. infected	Percent positive	No. infected	Percent positive	No. infected	Percent positive
Entameba histolytica						
Small race	24	1.9	28	2.3	52	2.1
Large race	14	1.1	9	0.7	23	0.9
Both*	6	0.5	5	0.4	11	0.4
Entameba coli	8	0.6	11	0.9	19	0.8
Endolimax nana	73	5.8	46	3.7	119	4.8
Iodameba bütschlii	16	1.3	18	1.5	34	1.4
Total No. examined	1,264		1,236		2,500	

* Both : Samll race and large race.

Table 5. Comparison of infection rates for intestinal amebae from school children in Taegu city, Korea in 1980 and 1988

Species	Choi and Hwang (1980)		Authors (1988)	
	No. infected	Percent positive	No. infected	Percent positive
Entameba histolytica				
Small race	139	19.0	52	2.1
Large race	58	7.9	23	0.9
Both*	—	—	11	0.4
Entameba coli	35	4.8	19	0.8
Endolimax nana	10	1.4	119	4.8
Iodameba bütschlii	8	1.1	34	1.4
Total No. examined	731		2,500	

* Both : Small race and large race

cent. *Entameba coli* was the least prevalent species. Both large and small races of *E. histolytica* were detected.

Fifty-two children had small race cysts only; 23 large race cysts only; and 11 both large and small races cysts.

The data in Table 5 shows the comparison of the infection rates for intestinal amebae detected from school children in Taegu city in 1980 and 1988.

As shown in Table 5, there was a marked decrease in the rate of intestinal amebae. In the infection rate of *E. histolytica*, of the 731 children examined in 1980, 26.9 per cent of the children were infected with the cysts, while only 3.4 per cent of the 2,500 children examined in 1988. Similarly a decrease in the rate of infection in the *E. coli* occurred between 1980 and 1988. On the other hand, an increase in the rate of infection in the two species, *E. nana* and *I. bütschlii* were found.

Table 6 shows the prevalence of intestinal helminths found by formalin-ether sedimentation technique. Among the 2,500 children examined, one or more species of helminths were found in 54, indicating an overall positive rate of 2.2 per cent.

Of the helminths, *E. vermicularis* was found

Table 6. Prevalence of intestinal helminths based on formalin-ether sedimentation technique in school children of Taegu city, Korea (1987-1988)

Species	Male		Female		Total	
	No. infected	Percent positive	No. infected	Percent positive	No. infected	Percent positive
Ascaris lumbricoides	2	0.2	3	0.2	5	0.2
Enterobius vermicularis	19	1.5	22	1.7	41	1.6
Trichostrongylus species	—	—	1	0.1	1	0.1
Trichuris trichiura	16	1.3	19	1.5	35	1.4
Taenia species	1	0.1	1	0.1	2	0.1
Hymenolepis nana	4	0.3	—	—	4	0.2
Hymenolepis diminuta	3	0.2	8	0.6	11	0.4
Clonorchis sinensis	16	1.3	14	1.1	30	1.2
Metagonimus yokogawai	3	0.2	6	0.5	9	0.4
Total No. examined	1,264		1,236		2,500	

most frequently, the rate being 1.6 per cent among the children, followed by *T. trichiura* with a prevalenec of 1.4 per cent and *C. sinensis* with 1.2 per cent. *Trichostrongylus* species was the least prevalent.

As to the sex-specific rate of overall helminth infections, female were a little higher than males, while in the cases of *C. sinensis* and *Hymenolepis nana* the infection rates in males were higher than that in females.

Discussion

Epidemiological, clinical, immunological and therapeutic studies on *E. histolytica* and other intestinal parasites among the residents by age groups and regional groups in Korea have been performed by many investigators.

As a result, the overall positive rate of intestinal protozoa among residents is estimated to be more than 20.0 per cent, and *E. histolytica* is recognized as a major public health problem in Korea.

The findings in the present study are based on discovery of protozoan cysts and helminthic eggs by formalin-ether sedimentation method and Lugol's iodine stained technique on 2,500 specimens.

Actually, this is not an indication of the true prevalence among children in Taegu city because one time fecal examination is not adequate to determine the true infection rate of all intestinal parasitic diseases.

However, the results are quite comparable with earlier reports based on one time examination of feces by means of similar laboratory procedures.

From the data presented in table 5, it is noted that, although higher prevalence is expected if examinations were repeated, the present results show a marked decrease in the prevalence of *E. histolytica* and *E. coli* compared with earlier reports available.

In the studies on *E. histolytica* and other intestinal parasites in Kyungpook Province, Nishimura(1943) studied the infection rates of intestinal parasites in Taegu and Yeongcheon areas, and reported for the first time that *E. coli* was the most prevalent protozoa, being found in 24.1 per cent among the residents, followed by *E. histolytica* with a prevalence of 9.9 per cent and *I. bütschlii* with 4.0 per cent.

Aa a part of a nation-wide survey on the status of intestinal protozoan infections in Koreans, Lee(1969) conducted a survey based on the discovery of protozoan cysts by formalin-ether sedimentation method and Lugol's iodine stained technique from the fecal specimens obtained th-

roughout the Wiseong and Seonsan counties. He reported that the infection rate of *E. histolytica* was 3.6 per cent of 549 individuals examined, and also commented that the sex-specific rate of infection was higher in females than in males and the highest infection rate was in the 40-49 year age groups of both sexes.

Subsequently, Kim et al. (1971) also conducted an intestinal parasite survey based on direct smear method, zinc sulfate floatation method and formalin-ether sedimentation method among 203 fecal specimens which were collected from Kyungsan county, Kyungpook Province, and reported a higher prevalence of *E. histolytica* with 9.9 per cent and *E. coli* with 28.1 per cent, respectively.

A study of Choi and Hwang(1980) reported that there were no significant differences in the age and sex specific rates demonstrated between urban and rural children but there was a predominance of the small race of *E. histolytica* over the large race.

Quite recently, Kim and Joo(1988) carried out an extensive survey on *E. histolytica* and other intestinal protozoa by formalin-ether sedimentation technique and Lugol's iodine stained method among 2,381 specimens which were collected randomly to represent 1,000 persons referred to in the census of 1980, with the conclusion that the prevalences of *E. histolytica* and other intestinal protozoa were much lower, due to improvement of sanitation through the New Community Movement in combination with extensive public health education.

In the present survey in which a total of 2,500 fecal specimens were examined, the overall prevalence of *E. histolytica* was found to be 3.4 per cent with no significant differences in the rate of demonstration in either sex or age groups, and the prevalence given for *E. histolytica* and *E. coli* in this survey are considerably lower than those recorded in similar previous surveys made in Kyungpook Province (Nishimura, 1943; Lee, 1969; Kim et al., 1971; Choi and Hwang, 1980; and Ha and Joo, 1987), and are similar to data reported by Kim and Joo(1988) in Taegu city.

The main reasons contributing to the decrease of infection rates for *E. histolytica* and other intestinal amebae among residents during the period of the past 20 years were considered to be the adequate, safe supplies of water for drinking and household purposes obtained by filtration, sedimentation, or by sterilization, and protection from contamination of human excreta used as fertilizer and from infected food-handlers, flies and cockroaches.

There is good reason to believe that the marked diminution in *E. histolytica* infections in Taegu city was due to improvements in the sanitary conditions and traditional habits through the New Community Movement in combination with extensive public health education.

In the present survey, the infection rate of small race *E. histolytica* was higher than that of the large race, and the rate for *E. coli* was very low. As previously indicated by Choi and Hwang (1980), there was a predominance of the small race *E. histolytica* over the large race.

E. nana cysts were found in 4.8 per cent of the children, and the infection rate in males was a little higher than in females.

This figure in general is similar to data reported by Lee(1969) in Seonsan and Wiseong counties. However, it is higher than that reported by Choi and Hwang(1980), Ha and Joo(1987), and Kim and Joo(1988).

As previously indicated by Ha and Joo(1987), it would be possible for inexperienced technicians to fail to detect the small race *E. histolytica*, when confronted with a microscopic field dense with *E. nana* cysts and with only a few *E. histolytica* cysts scattered among them. This size relationship between *E. nana* cysts and small race *E. histolytica* cysts required that the closest scrutiny must be applied to each microscopic field when such mixed infections are encountered.

As part of the study of *E. histolytica* and other intestinal amebae among children, the infection rates for intestinal helminths have derived.

The prevalence of the common soil-transmitted helminths, *A. lumbricoides*, hookworm, *Trichostrongylus* species, and *T. trichiura* in present study are markedly decreased as compared with earlier data found by Choi et al. (1970), Joo (1984), and Joo and Baik(1986), and is indicative of a true lowering of the amount of infection during the intervening time. There is good reason to believe that the marked diminution in the soil-transmitted helminthic infections in Taegu city is due to the sanitary improvement.

It is true that a large proportion of the individuals found positive for helminths were given treatment at the Korean Parasitic Eradication Association.

In this study, *E. vermicularis* infections among males and females were found in 19 and 22 cases, with prevalence rates of 1.5 per cent and 1.7 per cent, respectively. However, this is not indicative of the true prevalence among children in Taegu city, as stool examination is unsuitable for determining the infection rate of this parasite. It is known that special technique for the detection of pinworm infection was not employed, so only a few of these were found.

Summary

In order to determine the recent patterns of *Entameba histolytica* and other intestinal parasitic infections among the school children in Taegu city, Korea, a survey based on discovery of protozoan cysts and helminthic eggs were performed during the period from November, 1987 to August, 1988.

Fecal specimens collected from urban and suburban children were examined first by the formalin-ether sedimentation technique and then by the Lugol's iodine stained technique.

A total of 2,500 specimens were examined, of which 86, or 3.4 per cent, harbored the *Entameba histolytica* cysts. Of them, fifty-two individuals had small race only; 23 large race only; and 11 both large and small race cysts.

The infection rate for *Entameba histolytica* cysts by age groups varied from 2.8 per cent to 4.2 per cent, in both sexes.

There was no significant difference in the infection rate of cysts between urban and suburban areas; 4.0 per cent in urban and 3.0 per cent in suburban children.

The infection rates of other intestinal amebae were much lower, and similar rates in both sexes were observed.

Among the 2,500 individuals examined, one or more species of helminths were found in 54, which gives an overall positive rate of 2.2 per cent. *Enterobius vermicularis* was the most frequently found helminth, being in 1.6 per cent of the children, followed by *Trichuris trichiura* with a prevalence of 1.4 per cent and *Clonorchis sinensis* with 1.2 per cent.

Summarizing the results, this study indicates that the infection rates for *Entameba histolytica* and other intestinal amebae are now much less common due to improvement of sanitary conditions in combination with extensive health education.

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