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INTESTINAL PARASITE SURVEY OF KYUNGPOOK NATIONAL UNIVERSITY HOSPITAL PATIENTS*

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Although many surveys of the prevalence of intestinal parasites in Kyungpook Province have been undertaken, the results vary so considerably that the incidence is still undetermined.

The purpose of this survey was to estimate the present status of parasite incidence in this Province, and to provide parasitologic and epidemiologic information.

MATERIALS AND METHODS

This survey was performed at the Parasite Research Center from 1962 to 1968. Fecal specimens were collected from the in-and outpatient clinics of Kyungpook University Hospital for the recovery of intestinal helminths. All the specimens were collected "at random". Pertinent data, such as age, sex, and present address, were obtained from the consultation charts. Paper boxes were used as container.

On arrival at the Research Center, immediately a small lump of the specimen was removed from the paper box with a glass probe. Each person found to be infected with intestinal helminths by means of the Formalin-ether sedimentation technic was requested to bring in an additional fecal specimen for the protozoan examination. In the case of protozoa, Lugol solution was dropped into the centrifuge tube, in which parasite eggs and cysts were concentrated, and Iodine-stained wet mounts were prepared from the concentrated sediments and examined microscopically. If a cyst was found, Heidenhain's Iron-hematoxylin method was applied for the identification of protozoan cysts.

RESULTS

Protozoan infection among patients: Two thousand four hundreds and fourteen fecal speci mens in total were examined. The incidence of infection with intestinal protozoa amounted to 35.7 percent. Six species of intestinal protozoa were detected. *Entamoeba coli* was found to be highest in percentage (15.3%), followed by *Entamoeba histolytica* of 11.9 percent. And the least frequently observed was *Enteromonas hominis* (1 case). *Giardia lamblia* rate was not as high as expected. The *Dientamoeba fragilis* was not observed (Table 1). In general, there seems to be no differ ence between incidence of males and that of fema-les, except in the case of *Giardia lamblia*.

Protozoan infection by age groups:

*The result of this study was presented in part at the 8th annual meeting of the Korean Society for Parasitology in 1966.

Table 1. Incidence of intestinal protozoa in 2,414 patients of Kyungpook National University Hospital based on Heidenhain's Iron-hematoxylin stain (1962-1968).

Protozoa	Male		Female		Total	
	Number positive	Percent positive	Number positive	Percent positive	Number positive	Percent positive
Entamoeba histolytica	150	11.1	139	13.2	298	11.9
Entamoeba coli	188	13.9	183	17.3	371	15.3
Endolimax nana	88	7.8	89	8.4	177	7.3
Iodamoeba bütschlii	7	0.5	5	0.4	12	0.5
Giardia lamblia	8	0.6	4	0.3	12	0.4
Enteromonas hominis	1				1	

Of 2,414 patients, 1,386 were male and 1,058 female.
Unidentified protozoa are not recorded.

No significant fluctuation according to age group was observed except for 0-9 and over 70 years of age (Table 2).

Helminthic infection among patients: Of 5,288 fecal specimens examined, 4,585 or 86.7 percent were positive for intestinal helminths (Table 3). The incidence of *Trichocephalus trichiurus* was the highest (83.6%), and *Trichostrongylus orientalis* being next in positivity (61.6%). The incidence of *Ascaris lumbricoides* was unexpectedly low in this study. On the contrary, Chung (1926), Lee et al. (1960), Matsumoto (1915), and Nishimura (1943) had observed the highest infection rate in *Ascaris lumbricoides* among the residents of Kyungpook Province up to 1960. The incidence rate for hookworm and *Clonorchis sinensis* was 22.4 percent and 29.8 percent respectively. The incidences of *Enterobius vermicularis*, *Paragonimus westermani*, and *Taeniae* represented in table 3 were all low. These were not determined by special method for the respective helminths. The incidence by sex, as indicated in Table 4, was not significant except in the case of *Clonorchis sinensis*, where incidence in males was twice as high as that in females.

Helminthic infection by age group: The data on the age distribution of the incidence of *Ascaris lumbricoides* and *Trichocephalus*

Table 2. Incidence of intestinal protozoa by age groups (1962-1968).

Age group	Number exam'd	Incidence (percent)			
		E. histolytica	*E. coli*	*E. nana*	*I. bütschlii*
0-9	111	6.2	14.4	4.5	
10-19	231	15.4	18.1	7.8	0.4
20-29	566	9.6	12.1	6.7	0.4
30-39	576	13.0	17.9	7.1	0.3
40-49	490	10.8	13.4	9.2	0.2
50-59	314	11.1	14.4	6.7	0.3
60-69	111	12.8	19.0	6.3	
70-	15	5.9	5.9	6.7	
Total	2414	11.7	15.3	7.3	0.3

E. histolytica·····*Entamoeba histolytica.*
E. coli·····*Entamoeba coli.*
E. nana·····*Endolimax nana.*
I. bütschlii·····*Iodamoeba bütschlii.*

Table 3. Incidence of intestinal helminths in 5,288 patients of Kyungpook National University Hospital based on single stool examination (1962-1968).

Helminths	Male		Female		Total	
	Number positive	Perccent positive	Number positive	Percent positive	Number positive	Percent positive
Ascaris lumbricoides	1,425	39.7	736	43.4	2,161	40,9
Trichocephalus trichiurus	3,097	86.21	322	77.9	4,419	83.6
Hookworm	883	23.2	353	20.8	1,186	22.4
Trichostrongylus orientalis	2,238	62.3	1,021	60.2	3,259	61.6
Enterobius vermicularis	68	1.9	26	1.5	94	1.8
Clonorchis sinensis	1,310	36.5	264	15.6	1,574	29.8
Paragonimus westermani	2	0.05	1	0.06	3	0.06
Metagonimus yokogawai	6	0.2			6	0.2
Taenia species	24	0.7	9	0.5	33	0.6

Of 5,288 patients, 3,591 were male and 1,697 female

trichiurus showed increase with age, reaching a maximum in the age group 10 to 19 years and then followed by a gradual decrease; and in the case of *Trichostrongylus orientalis*, the peak incidence was in the age group 40 to 49 years, followed by a gradual decrease. On the other hand, the incidences of hookworm and *Clonorchis sinensis* showed an abrupt increase in the age group, 10 to 19 years, and then a slow steady increase with age. In the age group, over 70 it tended to decrease. Generally, the incidence of intestinal helminths in the older age group was higher than in the younger age group.

Number of helminth species in the same person: Single or multiple infections with int estinal helmiths are given in Table 5. The number of parasite infections varied from single to 7 species: triple infections had the highest percentage (37.7%); and next was double infections in 25.7 percent. Mixed infections of six or more species were observed in 3.8 percent, consisting of 3.0 percent with 6 species and 0.8 percent with 7 species. Of all triple infections, *Trichocephalus trichiurus*, *Trichostrongylus orientalis* and *Ascaris lumbricoides* were observed to be most frequent in this study.

DISCUSSION

Many investigations on the incidence of intestinal parasites were reported in Korea by various workers. However, the literature reviewed concerning intestinal protozoa and helminths was limited to Kyungpook Province only for the purpose of convinience.

In the present survey, the incidence of *Ascaris lumbricoides* in Kyungpook Province was low (40.9%) as a whole (table 3). Matsumoto (1915) was the first investigator to report the incidence of *Ascaris lumbricoides*, 77.9 percent (272 out of 349), for Taegu primary school children. Recently Lee et al. (1960) reported infection rates of *Ascaris lumbricoides*, 83.3 percent, 81.1 percent, and 83.6 percent for the primary school children, high school boys and the residents of Kyungpook Province, respectively. The variation in the rate of *Ascaris* infection described above appears to be due to the differences in economic and environmental changes. The incidence of *Trichocephalus trichiurus* was the highest (83.6%) for both male and female groups. In early record of trichuriasis reported by Matsumoto (1915) indicated that 82.8 percent of 349 primary school children were found to

Table 4. Incidence of intestinal helminths by age groups (1962–1968).

Age group	Number tested	incidence (percent)					
		A. lumbricoides	*T. trichiurus*	Hookworm	*T. orientalis*	*C. sinensis*	*Taenia sp.*
0–9	243	32.5	60.5	4.1	20.2	4.9	2.1
10–19	508	52.6	88.2	15.7	54.9	14.6	1.4
20–29	1,239	38.3	83.7	22.8	62.9	20.5	0.6
30–39	1,261	43.3	85.0	21.6	66.4	32.0	0.6
40–49	1,074	40.9	86.3	24.9	67.9	42.2	0.2
50–59	684	37.3	83.7	29.8	64.2	39.9	0.2
60–69	242	35.1	77.7	24.8	56.2	36.4	0.4
70–	34	41.2	73.5	23.5	52.9	44.1	0
Total	5,288	40.9	83.6	22.4	61.6	29.8	0.6

A. lumbricoides·····*Ascaris lumbricoides.* *T. orientalis*·····*Trichostrongylus orientalis.*
T. trichiurus·····*Trichocephalus trichiurus.* *C. sinensis*·····*Clonorchis sinensis.*

be positive for *Trichocephalus* in Taegu, Korea. Later the report of Chung (1926) showed that 62.7 percent of 579 primary school children harbored *Trichocephalus* eggs in the Andong area, Kyungpook Province. Recently Lee et al. (1960) made the fecal examination by means of direct smear and NaCl floatation technique among the inhabitants of Kyungpook Province, and they stated that the incidence of trichuriasis to be 46.4 percent of the examined. It is assumed on the basis of the results by Matsumoto (1915), Chung (1926), and authors that *Trichocephalus trichiurus* is one of the most prevalent parasites in Kyungpook Province. However, results reported by Lee et al. (1960) does not agree with those made in this Province.

A possible explanation for this high rates of *Trichocephalus* infection in the Province was presented by Yun et al. (1968) who reported on the basis of Stoll egg-counts that almost all residents were infected lightly, and these cause no noticeable symptoms. Besides the antihelminthic drug for this *Trichocephalus* will remove only a small percentage of the worms.

The hookworm and *Clonorchis* infection have been considered a serious public health

Table 5. Number of different helminth species in the same person among the Kyungpook University Hospital patients by age groups (1962–1968).

Age group	Number examined	Single		Double		Triple		Quadruple		5 species		6 species		7 species	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0–9	243	49	20.2	73	30.0	40	16.5	21	8.6	8	3.3	5	9.1		
10–19	508	68	13.4	148	29.1	147	28.9	73	14.4	43	8.5	10	2.0	4	0.8
20–29	1,239	85	6.9	326	26.3	386	31.2	242	19.5	119	9.6	47	3.8	9	0.7
30–39	1,269	68	5.4	327	25.2	402	10.7	285	22.6	110	8.7	33	2.6	10	0.8
40–49	1,074	48	4.5	259	24.1	341	31.8	248	23.1	108	10.1	28	2.6	11	1.0
50–59	687	43	6.3	157	22.9	221	32.2	143	20.8	70	10.2	26	3.8	6	0.9
60–69	242	14	5.8	62	25.6	77	31.8	45	18.6	25	10.3	8	3.3	3	1.2
70–	34	4	11.8	9	26.5	11	32.4	7	20.6	2	5.9				
Total	5,228	379	7.2	1,361	25.7	1,625	30.7	1,064	20.1	485	9.2	157	3.0	43	0.8

problem in Kyungpook Province as well as on a nation-wide scale.

Regarding the incidence of hookworm in Kyungpook Province Matsumoto(1915) recognized a relatively high rate(29.2%) in 249 Taegu primary school children. Afterwards Nishimura(1943) reported hookworm in 13.0 percent to the Japanese and 11.0 percent of the Korean in Yeongcheon area.

Lee et al. (1960) reported hookworm infection rates of 21.4 percent and 30.3 percent for the primary school children and the inhabitants of Kyungpook Province, respectively, Recently Yun et al. (1968) found similar infection rates (19% in the residents, 7% in the high school boys, and 2% in the primary school children), and indicated that there were only a few instances of correlation with age and sex of the individuals.

The incidence of hookworm in this survey was found 22.4 percent (Table 3). This survey seems to have covered all areas of Kyungpook Province, and the result agreed well with other investigators. Both *Ancylostoma duodenale* and *Necator americanus* exist in Korea but no attempt was made in this study to differentiate between the two species. However, it is assumed the former is predominant.

The infection rate of *Clonorchis sinensis* was 29.8 percent (1,574 out of 5,288) in this survey , and the result showed relatively high incidence among those with the intestinal helminths.

As for the survey on human *Clonorchis* infection in Kyungpook Province, Matsumoto(1915) reported *Clonorchis sinensis* in 18.6 percent of Taegu primary school children, and this is to be said the first report on clonorchiasis in Korea. Regarding this high rate of infection Matsumoto(1915) pointed out that clonorchiasis is widely distributed in Kyungpook Province. Among the Koreans, however, the south Koreans showed a high incidence of *Clonorchis* infection, whereas among inhabitants of north Korea only a few cases of *Clonorchis* infection were observed. The difference is due to the fact that south Koreans usually consume raw fish, while north Koreans do not. The first intermediate host of *Clonorchis sinensis*, *Parafossarulus* snail, is widely distributed in south Korea, whereas the vector snail is non existent in north Korea. In addition, the lack of public health education among the inhabitants in the endemic areas can not be disregarded.

Chung(1926) reported *Clonorchis sinensis* in 12.0 percent of the primary school children in Andong area, the northern side of Kyungpook Province. Nishimura(1943) reported remarkably high rates of 41.1 percent for Yeongcheon primary school children and 3.5 percent for those of Taegu. He also pointed out that Yeongcheon is one of the endemic areas of clonorchiasis.

Later Lee et al. (1960) found that 22.1 percent were positive for *Clonorchis* egg among 20,000 inhabitants in 21 areas in Kyungpook Province and proved that the incidence of intestinal helminths in suburbanite was higher than that of the farmers in rural areas and the citizens of Taegu. In the same Province, Shin (1964) reported that 27.7 percent among 24,252 inhabitants were positive for *Clonorchis* eggs, and that clonorchiasis was still prevalent in this province. According to him, the incidence of *Clonorchis* infection among the inhabitants in the vicinitity of the river Nakdong was slightly higher than that of the mountain regions far from the river. He also found *Clonorchis* metacercaria in fresh water fish such as *Pseudorasbora parva*, *Pungtungia herzi*, *Sarcocheilichthys wakiyae*, *Gnathopogon coreanus*, *Pseudogobio esocinus*, and *Hemibarbus labeo*, from the Nak-dong river.

The incidence of *Clonorchis sinensis* in this survey was found to be 29.8 percent and similar to the report of Shin(1964). These results reveal that in the basin of the river,

Nakdong and Gumho, clonorchiasis is still prevalent. In addition, most of the rivers were suitable for the appropriate intermediate host.

Concerning the survey of *Enterobius vermicularis*, *Paragonimus westermani*, *Metagonimus yokogawai* and *Taenia* species, the data in Table 3, is clearly uureliable because no sputum examination or perianal swabs were taken. Therefore, the authors wish to publish the true incidence of above helminths in other reports.

On reviewing the literature of protozoan infection in this Province there is unique report of Nishimura (1943). The results showed that *Entamoeba coli* was observed most freently (24.1%), and *Entamoeba histolytica* in 9.9 percent, *Giardia intestinalis* in 6.6 per cent, *Iodamoeba bütschlii* in 4.0 percent, in decreasing order. The incidence of *Entamoeba histolytica* in this survey was found to be 11.7 percent, and that of other protozoa in Table 1, are remarkably similar to Nishimura's report (1943). This would appear to indicate that during the past 30 years, fecal co ntamination of vegetables had not been reduced.

SUMMARY

For seven years from 1962 to 1968, fecal specimens of the patients were examined not only for the discovery of intestinal protozoa and helminths, but also to provide data on the incidence of intestinal parasites among the residents of Kyungpook Province, Korea. The Formalin-ether sedimentation, Lugol solution, and Heidenhain's iron-hematoxylin stained films were prepared for the recovery of intestinal parasites.

Of 2,414 samples of feces examined, 35.7 percent were found to be infected with one or more species of protozoa. Among six species of protozoa detected, *Entamoeba coli* was observed most frequently (15.3%) followed by *Entamoeba histolytica* (11.9%), and then the *Enteromonas hominis* least often (1 case).

For the survey of helminth, of a total of 5,288 fecal specimens examined, 86.7 percent were positive for one or more species of helminths. *Trichocephalus trichiurus* revealed the highest infection rate (83.6%), while *Trichostrongylus orientalis* was next (61.6%), and *Ascaris lumbricoides* was unexpectedly low (40.9%). The incidence for hookworm and *Clonorchis sinensis* was 22.4 percent and 29.8 percent respectively. Triple infections were found more frequently than double infections, and mixed infections of six or more species of helminths were observed in 3.8 percent of specimens.

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=抄 錄=

경북의대 대학병원 외래 및 입원환자에 대한 기생충조사성적

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경북도내의 장내기생충감염율을 규명하기 위해 1962년 부터 1968년까지 경북의대 대학병원 외래 및 입원환자의 대변을 임의추출하여 검사하였다.

연충류검사에는 Formalin—ether집난법을 썼고 원충류검사에는 처음 Lugol염색법으로 검사한 다음 Iron hematoxylin염색법으로 검사하였다.

총 2,414명에 대하여 원충검사를 한 결과 35.7% 검출할 수 있었고 검출된 6종의 원충가운데서 대장아메바는 15.3%로서 가장 많았고 이질아메바는 11.9%로서 제2위였으며 인장엔터로모나스는 1예 검출할수 있었다.

연충류에 대하여서는 총 5,288명을 검사한 결과 86.7% 검출 되었다. 이가운데서 편충의 검출율은 83.6%로서 가장 많았으며 동양모양선충은 61.6%로 제2위였고 회충은 40.9%로서 낮았다. 구충과 간디스토마의 검출율은 각각 22.4%, 29.8%였다. 기생충난이 검출된 대상자 가운데서 3종의 연충을 가진 사람이 가장 많았고 6종이상의 기생충을 가진 사람은 3.8%였다.