The Prevalence of Intestinal Helminthes in Inhabitants of Cheju Do

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INTRODUCTION

Cheju Do (=Province), the southern-most, largest island in Korea, has some interesting characteristics in parasitological points of view. And it has been well-known that Cheju Island is one of the most highly endemic foci of filariasis (Seo et al., 1965), taeniasis (Kang et al., 1965: Cho et al., 1967), amebiasis (Cho et al., 1967: Seo et al., 1970) and paragonimiasis (Sadun et al., 1958: Kang et al. 1966: Kim, 1969) in Korea.

And interestingly enough, only stool examinations undertaken on the limited numbers or samples were presented until present time (Hunter et al., 1949: Kang et al., 1964: Seo et al., 1969), and no detailed informations could be obtained on the status of intestinal helminthic infections of inhabitants in Cheju Island.

In this paper, the authors try to present the results of stool examination conducted on July, 1970 for the evaluation and apprehension of status of intestinal helminthic infections.

MATERIALS AND METHODS

Methods employed: Cellophane thick smear techique was employed throughout the survey for the examination of fecal specimens. Only one smear was examined in each cases.

Subjects of study: Cheju Do administratively consists of one City, three Eups (towns), nine Myons (subcounties) and two (South and North) Goons (Counts) (Fig. 1.). Among them, inhabitants in Cheju City, 2 Eups (Seogwi and Hanlim) and 4 Myons (Hankyung, Aewol, Pyosun and Namwon) were subjected in this study. The total number examined were 3,169 among total population about 350,000 (Fig. 2).

RESULTS

Table 1 shows the results analysed by the locality. The positive rate of A. lumbricoides was 44.3% and the proportion of cases with only unfertilized ova was 22.1% among positive cases. The positive rate of T. trichiurus was 65.6%. These two kinds of the most prevalent soil-transmitted helminthes were remarkably low in rural areas (Aewol, Hanlim and Hankyung) than urbanized areas. The infection rates of hookworm and T. orientalis were extremely low and 1.5% and 0.8% in respect.

The hookworm infection rate was highest in the urbanized areas, Cheju City and Seogwi Eup.

The trematodes infections, such as Clonor-
Fig. 1. The localities examined, sample size and positive rate in Cheju Do.

![Map of Cheju Do with surveyed localities]

Fig. 2. The age and sex distribution of surveyed population in this study.

![Age and sex distribution chart]

Table 1. Results of Stool Examination of Cheju Province Inhabitants by Cellophane Thick Smear Method

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<td>172</td>
<td>48.5(15.5)</td>
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<td>11.5</td>
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<td>Cheju City</td>
<td>330</td>
<td>296</td>
<td>41.5(40.1)</td>
<td>83.6</td>
<td>7.0</td>
<td>0.6</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>3,169</strong></td>
<td><strong>2,606</strong></td>
<td><strong>44.3(22.1)</strong></td>
<td><strong>65.6</strong></td>
<td><strong>1.5</strong></td>
<td><strong>0.8</strong></td>
<td><strong>3.5</strong></td>
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<td><strong>0.4</strong></td>
<td><strong>0.9</strong></td>
<td><strong>12.7</strong></td>
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* (u) and number in parenthesis mean the proportion of unfertilized ova passed among positives of A. lumbricoides.
Table 2. Results of Stool Examination of Cheju Province Inhabitants by Age and Sex

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<th>Age group</th>
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<td>546</td>
<td>108</td>
<td>170</td>
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<td>1.7</td>
<td>2.4</td>
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<td>0.1</td>
<td>0.3</td>
<td>1.8</td>
<td>0.9</td>
<td>1.2</td>
<td>1.7</td>
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<td>Taenia sp. (%)</td>
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<tr>
<td>Male</td>
<td>3.1</td>
<td>3.9</td>
<td>4.3</td>
<td>19.7</td>
<td>23.5</td>
<td>29.7</td>
<td>36.4</td>
<td>30.8</td>
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<td>6.5</td>
<td>4.5</td>
<td>3.9</td>
<td>18.2</td>
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<td>24.2</td>
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<td>28.1</td>
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<td>2.6</td>
<td>1.2</td>
<td>0.8</td>
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<tr>
<td>Female</td>
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<td>2.1</td>
<td>0.6</td>
<td>0.4</td>
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chis, Paragonimus and Metagonimus were 0.2%, 0.4% and 0.9% respectively. The infection of C. sinensis was extremely low and focal. The ova of Metagonimus were discovered throughout the examined areas and it seems to be autochthonous. The ova of Taenia species were discovered in 12.7% of total examined, which means the highest rate of stool examination results ever reported in Korea. The ova of H. nana were found in 1.4% throughout the surveyed areas. Fig. 3 shows the status of soil-transmitted helminthes infections by areas.

Table 2 presents the results of analysis of infections rates in each species by age groups. The A. lumbricoides infection showed the highest prevalence in age group of 5-9, and

Fig. 3. The histogram showing the status of soil-transmitted helminthes infections by areas.

Fig. 4. Graphic presentation of soil-transmitted helminthes infections by age groups.
thereafter stationary. The infection of *T. trichiurus* showed no remarkable differences throughout the age groups but slightly higher in 5-29 age groups (Fig. 4). The infection with *P. westermani* were found in adolescence and senile age groups but *Metagonimus* were found in all age groups.

The positive rate differences in the *Taenia* sp. infection was graphically presented in Fig. 6. The gradual increase of the infection rate was observed from about 4% in childhood and adolescence up to 30-36% in adulthood. No sex difference was observed.

*H. nana* infection was limited in age groups of childhood and adolescence.

The analysis of multiple infections was presented in Fig. 7 by surveyed areas diagrammatically. The negative rate was 17.8%. The rate of single infection was 40.7% and the rate of double, triple and quadruple infection were 34.5, 6.8 and 0.4 per cent respectively.

**DISCUSSION**

Cheju Do is the largest island in Korea and situated in southwestern tip of Korean Peninsula with elliptical shape. This island is largely occupied by the dormant volcano, Mt. Halla and her small allied hills. Because of poor water sources in inner parts of island, the most of villages are situated along the seashore with limited agricultural fields. The climatic condition is subtropical and rainfall amount is heaviest in Korea. These natural conditions are somewhat different from those of mainland Korea and there are many peculiar customs in inhabitants of Cheju island.

With above-mentioned short explanations, it is impossible to explain the peculiarity of parasitological problems in Cheju Island. However, the protozoal and helminthic infections are prevalent and endemic. *Filariasis* is still

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**Fig. 6.** Graphic presentation of positive rate of *Taenia* sp. according to age and sex.

**Fig. 7.** Diagrammatical presentation of polyparasitism in this study.
heavily endemic in rural villages of this island and microfilaria rates of inhabitants above 20% are not uncommonly discovered (Seo et al., 1965). Amebic dysentery and liver abscess are another important public health problem in Cheju island by the report of Cho et al. (1967) and Seo et al. (1970). Cho et al. reported the infection rate of *E. histolytica* as 24.3% by the direct smear technique and Seo et al. (1970) presented the data of 11% of inhabitants were cyst-carriers of *E. histolytica*. Paragonimiasis has brought up for attention to many parasitologists in Korea (Sadun et al., 1958; Kang et al., 1966) and a pilot study of mass treatment was undertaken by Kim (1969). The problem of tapeworm infections in Cheju island was recently presented by Kang et al. (1965) and Cho et al. (1967). According to these authors, *Taenia saginata* is still dominant, occupied 85% of all tapeworm infections, while *T. solium* is 7.1% among them and remained were species undetermined.

The stool examination results reported by Hunter et al. (1949). Kang et al. (1964) and Seo et al. (1969), presented the data on the status of intestinal helminthic infections. Hunter et al. (1949) presented the results among 81 persons in Cheju Do by the formalin ether technique as follows: *A. lumbricoides* 64.2%, *T. trichiurus* 88.9%, Hookworm 24.7 %, *T. orientalis* 4.9%, *P. westermani* 2.5%, *M. yokogawai* 8.6%, *Taenia* sp. 17.3% and *H. nana* 1.2%. Kang et al. (1964) examined by the direct smear technique on the 11,063 schoolchildren and reported the infection rates as follows; *A. lumbricoides* 83.9%, *T. trichiurus* 35.0%, Hookworm 0.2%, *T. orientalis* 0.1% and *Taenia* sp. 8.9%. Among the data of nation-wide helminthic infection survey conducted by Seo et al. (1969), 419 of Primary schoolchildren in North County and 568 of Middle School students in Cheju City were examined by the cellophane thick smear technique. Cheju Do gives the following data: *A. lumbricoides* 24.7%, *T. trichiurus* 75.2%, *T. orientalis* 0.9%, *Taenia* sp. 4.4% and *H. nana* 1.1%.

In this study, the overall positive rate was 82.2% and somewhat lower, compared with data of other parts in Korea. The infection with *A. lumbricoides* was also low(44.3%) especially in rural inhabitants of North Cheju County(30.4—41.5%). The proportion of unfertilized egg passer was 22.1%. The soil-transmitted helminths infections were low in general(*T. trichiurus* 65.6%, Hookworm 1.5 %, *T. orientalis* 0.8%). The causes of these low values might be due to the peculiar traditional habits in using feces as agricultural fertilizer. But it is still uncertain whether the nature of soil in Cheju island is involved in these lower levels of infections epidemiologically.

It seems strange enough that the hookworm infection rate was higher in urbanized areas as Cheju City and Seogwi Eup(7.0% and 3.8%) than the rural counties(0.5—1.0%). This could be hardly interpreted, however it might be a kind of explanation that the traditionally lower level of hookworm infection in indigenous people were heightened by immigrants from endemic parts of Korea chiefly to urbanized areas of Cheju island and the introduction of mainland methodas of disposing feces recently.

The snail-transmitted helminthes, *Clonorchis, Paragonimus* and *Metagonimus* were found in 0.2, 0.4, 0.9% respectively in this study. The *Clonorchis* infection cases may be infected in other parts of Korea because past reports revealed that no snail hosts of this trematode were distributed in this island. And it may be more reasonable to speculate that the cases were immigrants from other endemic foci of
Korea. The ova of _P. westermani_ were recovered in 0.4% and found in Hanlim Eup (4.3%), Seogwi Eup (0.4%) and Cheju City (0.3%). The age distribution of cases were childhood, adolescence and senile cases. It has been well-known that the southwestern parts of Cheju island were one of the heaviest endemic foci of _Paragonimus_ infection in Korea. These areas were excluded in this study and Hanlim Eup which is situated in north-western part was found to be endemic.

And it is to be mentioned that cases would be more detectable in concentration technique for egg detection is employed.

The indigenous infection of _Metagonimus yokogawai_ is certainly to be found in various parts throughout the island, considered with the case distribution detected in the present study. The sweetfish _Plecoglossus altivelis_, the intermediate host of _M. yokogawai_ is abundant in summer season in this island. Further detailed informations are needed.

The infection with _Taenia_ sp. showed interesting results. The rates were higher in inhabitants of rural areas than the urbanized areas. However, this difference should be evaluated further because the subjects in urbanized areas were consisted of largely children and only some of adults were examined. The egg positive rate was characteristically changed if analysed by the age groups. And no sex difference was observed. The relatively higher infection rate of _Taenia_ sp., particularly _T. solium_ in this island appears to be due to their peculiar custom in the disposal of human fecal excreta in hogpen for breeding. They are traditionally accustomed to feed human excreta to hog in their latrine. The excreta of hogs were used as agricultural fertilizer. These customs could explain the highly endemic status of _T. solium_ infection, accompanied with the larval infec-

tion, cysticercosis celluloseae. Cho et al. (1967) reported 38.0% of _Taenia_ infection without any performance of stool examination, based on the results of questionnaire forms on the tapeworm infection. These results and ours are hardly comparable because of different techniques applied for the detection of cases, however the present authors presumed that the results of stool examination with cellophane thick smear technique are certainly more reliable than the questionnaire forms which might cause the faulty results especially in areas which the public health education were not sufficient.

The infection with _H. nana_ showed 1.4% of rate in the present study and the rate is higher than that of the reported in other parts. From the above results of _H. nana_ infection, it is apparently speculated that the contagious helminthic infections such as _Enteroptus vermicularis_ and _Cysticercus celluloseae_ are rather prevalent in Cheju island.

**SUMMARY**

The authors examined 3,169 fecal specimens from inhabitants of seven localities such as City, Eups and Myongs in Cheju Do on July 1970 with cellophane thick smear technique. The results were analysed and summarized as follows:

1) The overall egg positive rate of helminths was 82.2% and it was attributed to high rates of soil-transmitted helminths as in case of others parts in Korea.

2) The infection rates of each species were: _A. lumbricoides_ 44.3%, _T. trichiurus_ 65.6%, Hookworm 1.5%, _T. orientalis_ 0.8%, _C. sinensis_ 0.2%, _P. westermani_ 0.4%, _M. yokogawai_ 0.9%, _Taenia_ sp. 12.7% and _H. nana_ 1.4%.

3) The infection rates of soil-transmitted helminths were relatively lower than those of
mainland Korea especially in case of Hookworm and *T. orientalis*. The proportion of unfer-
illized ova passers among the *Ascaris* infected cases was 22.1%.

4) The ova of heterophyids, most probably *Metagonimus yokogawai* were detected in
lower percentage but discovered throughout the localities surveyed and in all age groups.
It is certainly presumed that *Metagonimus* infection is autochthonous.

5) The most interesting results were obtained in *Taenia sp.* infection and the higher
rates were shown in rural areas than in urbanized areas. The positive rates were
within 5% in childhood and adolescence but abruptly increased up to 36.4% in adults.

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濟州道에서의 腸內蠕虫類 感染狀況

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濟州道 7個 市邑面의 住民 3,169 명의 市邑面의 住民 3,169 名에 適하여 1970年 7월에 實施한 大便檢查을 通하여 興味있으며 從來의 資料를 報告한

檢查地域은 市邑面 1個里，面元面 1個里，西陽邑 2個里，館遼路 1個里，館陽邑 2個里，羅月面 2個里 및 濟州市의
1個 保育園 및 1個 國民學校 兒童이었고 住民은 全年齡層이었다. 檢查方法은 塗抹法 및 液體塗抹法이었다.

1）蠕虫類 非陽性은 82.2%이었으며 土壤媒介性蠕虫의 높은 感染率때문에 虫卵 非陽性이 높아진 것은 地域과 大同小異하다.

2）蠕虫類 感染率相은 蠕虫(A. lumbricoides) 44.3%，細菌(T. trichiurus) 65.6%，鉤虫(Hookworm) 1.5%，東
洋毛纖線虫(T. orientalis) 0.8%，肝吸蟲(C. sinensis) 0.2%，肺吸蟲(P. westermani) 0.4%， 橫川吸蟲(M. yokogawa-
rai) 0.9%，條蟲類(Taenia sp.) 12.7% 및 小條蟲(H. nana) 1.4%이었다.

3）土壤媒介性 蠕虫類는 全般의 住民地方의 靈通보다 感染率이 높으며 特히 鉤虫 및 東洋毛纖線虫은 높았다.。
蠕虫感染者中 不受精卵検出者比率은 22.1%이었다.

4）橫川吸蟲(奇蟲吸蟲)의 感染率은 높으나 地域 및 年全年齡層에서 感染되어있어 土壤性을 認定할 수 있었다.

5）蠕虫類는 非陽虫卵陽性率을 보이나 市邑面에서의 非陽性을 相對的으로 높았다. 幼年期 및 青少年期까지의 陽性率은
5% 以内였으나 20代 以後로 急激히 上昇하여 50代에는 36.4%로 增加하고 性別差異는 없었다.