

# Epidemiology & Health Bulletin

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## Survey of *Clonorchis sinensis* Infection in Miaoli County, Taiwan

### 1. Introduction

*Clonorchis sinensis* is more prevalent in mainland China, Japan, Korea, Vietnam, Taiwan and the southeast Asian countries<sup>(1,2)</sup>. Since the first report by Ohoi<sup>(3)</sup> in 1915 on the infection in Taiwan, there have been several reports suggesting that some townships or villages in Taiwan are high infection areas. The infection rates in high infection areas such as the Sun-Moon Lake area of Nantou County, Meinong and Chishan townships of Kaohsiung County, Chuwei, Toulun and Hsintien villages of Pingtung County, and Shitan Township and Miaoli City of Miaoli County are estimated to be between 10 and 50%<sup>(4-10)</sup>. Cross<sup>(11)</sup> in his 1969 report estimated the infection rate of *Clonorchis sinensis* in man in Taiwan area at 1.5%. Now that most helminthes have been brought under control in Taiwan, the infection of *Clonorchis sinensis* has become more significant.

The infection is highly related to the habits of eating raw fresh water fishes, fish congee, uncooked foods and others<sup>(8)</sup>. These habits are more common among the Hakka people. The high infection areas such as Meinong Township of Kaohsiung County, Pingtung County and Miaoli County are predominantly Hakka. The *Clonorchis sinensis* infection, thus, is considered to be highly related to the Hakkas.

Eighty percent of the population in Miaoli County are Hakka. Thus, 16 townships of the County were selected for the study of the relation between *Clonorchis sinensis* infection and ethnic groups.

### 2. Method and Materials

#### (1) Survey Area and Subjects:

Of the 18 townships in Miaoli County, studies have been done in Miaoli City and Shitan Township to establish that these two areas are high infection areas, the rest 16 townships were, therefore, studied in the present survey. Three villages were

randomly selected from each township, and then, 150 individuals were again randomly selected from each village as study subjects. They were then given by the local health stations containers to collect feces for laboratory examinations.

## (2) Stool Examination:

Tritone sedimentation method (AMS III method) was applied for the examination of parasite eggs in stools<sup>(12-14)</sup>. One gram of stool was mixed and fixed with 10% formalin, filtered with gauze, and centrifuged at 2,000 rpm for 5 minutes. The upper suspension was discarded, the sediment was added with 10 ml of tritone solution and centrifugated again. The sediment was then placed under microscope for examination.

## 3. Findings

A total of 8,028 persons in 53 villages in 16 townships of Miaoli County had been examined with an average infection rate of 11.6%. Of all townships, Tonglo and Touwu had the highest infection rate of 20.0%, and Yuanli the lowest rate of 0.5%. Of all 16 townships surveyed, the infection rates were lower in the four Fukienese predominant townships (Houlung at 4.9%, Chunan at 3.4%, Tunghsiao at 2.6%, and Yuanli at 0.5%), but significantly higher in the rest Hakka townships at 6.8% to 20.9% ( $X^2$  test,  $p < 0.001$ ) (see Table 1 and Figure 1).

The infection rates of *Clonorchis sinensis* among the three ethnic groups, the Hakka, the Fukienese and the Aborigines, were 14.9%, 2.20% and 8.6% respectively (see Table 2). By sex, they were 20.6% for the Hakka male, 9.6% for the Hakka female; 3.5% for the Fukienese male, 1.0% for the Fukienese female; and 9.6% for the aboriginal male and 7.8% for the aboriginal female.

By age (see Table 3), the infection rates for age groups 1-5, 6-14 and 15-19 were 0.2%, 1.2% and 0.7% respectively. The rate increased with age and reached 25.0% for persons above 60 years. By sex, the rates were 6.1% for male and 2.9% for female in the 20-29 age group; 12.5% for male and 3.9% for female in the 30-39 age group; 23.7% for male and 13.2% for female in the 40-49 age group; 32.9% for male and 15.3% for female in the 50-59 age group; and 36.5% for male and 14.0% for female in the 60 and above age group.

## 4. Discussion

Miaoli County is a predominantly Hakka county with 80% of the population being Hakka. In the present survey of 16 townships, with the exception of Yuanli Township at a lower infection rate of 0.5%, the infection rates in other 15 townships were relatively high at an average of 11.6%. This average though was much lower than the rate of 55.7% found by Ong and Lu<sup>(7)</sup> 14 years ago among the civil servants and school teachers in Miaoli City, was still higher than the estimation made by Cross<sup>(11)</sup> of 1.5% for Taiwan Area. It, therefore, can be said that *Clonorchis sinensis* is relatively

prevalent among people in Miaoli. The likely reason could be as stated by Yeh et al.<sup>(10)</sup> that economic conditions though have improved, feeding of feces to fishes is still practiced, and the habits of eating raw fishes and fish congee are common, they could have caused a high *Clonorchis sinensis* infection rate in Miaoli. The infection rates in Fukienese townships such as Chunan, Tonghsiao and Houlung though are lower (between 2.6% and 4.9%), they are still higher than the Taiwan average. This fact may indicate that the Hakka habit of eating raw fresh water fish has already spread to the Fukienese. Health education programs to discourage the eating of raw fish and fish congee, to encourage the use of separate chopping boards to handle cooked and raw foods, and to discourage the feeding of fishes with feces should be promoted in order to reduce infection and to interrupt the cycles of the parasites.

Taian Township is the only aboriginal township of Miaoli County, its inhabitants are primarily the Tayals. The average infection rate of 8.6% in this township indicates that in addition to the traditional habit of eating raw meat, the habit of eating raw fish is also practiced. The rates are not significantly different for male and female (9.3% vs. 7.8%). In the Hakka and the Fukienese ethnic groups, the rates are always higher for male than for female (2.2:1 and 3.5:1 respectively,  $X^2$  test for both  $p < 0.001$ ). This fact corresponds with the findings of Chow<sup>(5)</sup> in Meinong of Kaohsiung County, Ong and Lu<sup>(7)</sup> in Miaoli City and Yen et al.<sup>(8)</sup> in two villages in Pingtung County. In the traditional society, men have more opportunities to attend parties, they are more likely to be infected. Whereas in the aboriginal society, men and women eat and drink together, their chances of being infected are similar. Yen et al.<sup>(8)</sup> in their surveys of aboriginal townships such as Hsiulin of Hualien, Tawu of Taitung and Laiyi of Pingtung, failed to identify *Clonorchis sinensis* among inhabitants of these townships. The fact that the infection rate is as high as 8.6% in Taian could indicate the influence of the Hakka food habits. Infection rates of the three ethnic groups, the Hakka, the Fukienese and the Aborigines are 14.9%, 2.2% and 8.6% respectively, with the Hakka having the highest rate ( $X^2$  test,  $p < 0.001$ ).

Infection rates increase with age (see Table 3). This finding is similar to those of Ong and Lu<sup>(7)</sup> Yen et al.<sup>(8)</sup> and Yeh et al.<sup>(10)</sup>. The lowest rate of 0.2% is found in children aged 1 to 4 years. They are less likely to eat raw fish, their infection could have come from the accidental contamination of chopping boards and utensils in the process of cooking. The rate is lower than 1.5% for people under 19 years of age, and the difference between male and female is insignificant. Infection rates of men after 20 years of age increase with age and reach a high level after 60 years of age. For women, the highest rate is found in the age group between 50 and 59, the rate declines slightly after 60 years of age. In all age groups 20 years and above, the infection rates of men are always higher than those of women ( $X^2$  test,  $p < 0.001$ ). This indicates more social activities with the increase in age, and thus having more opportunities of infection. *Clonorchis sinensis* can survive in human for as long as 20 years. The addition of more parasites with age makes the infection rate increase with age.

The following conclusions can be made: (1) *Clonorchis sinensis* infection is common in Miaoli County, (2) infection rate is higher among the Hakkas than the Fukienese or the Aborigines, (3) infection rate is higher in men than in women, (4) infection

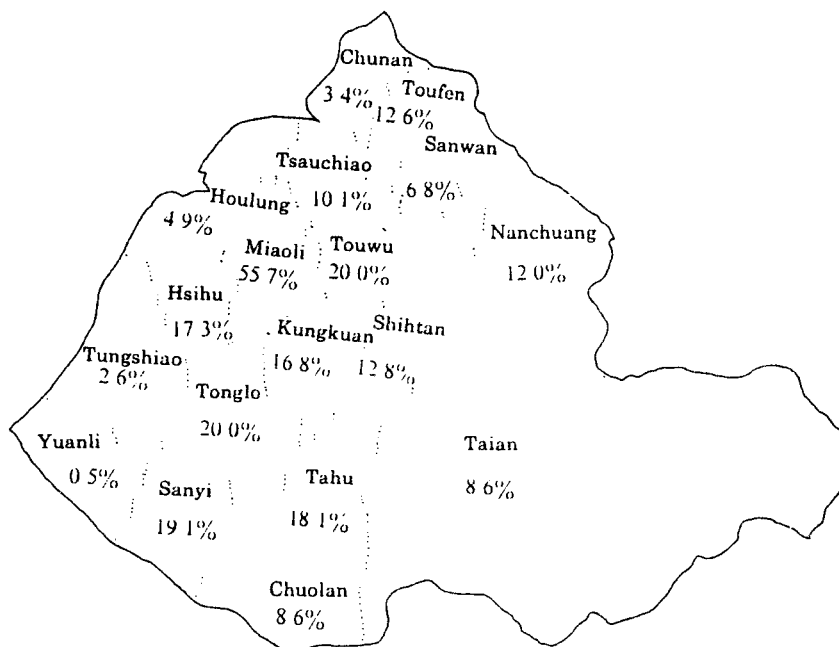
rate increases with age. These conclusions can be used for the future planning of control programs. Health education, particularly discouraging people from eating raw foods, should help reduce the infection.

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**Figure 1. *Clonorchis sinensis* Infection by Township, Miaoli County, Taiwan**



**Table 1. Infection Rates by Township, Miaoli**

(by AMS III Sedimentation Method)

Township	No. of Village	No. Examined	Positive	
			No.	%
Tonglo	3	561	112	20.0
Sanyi	3	602	115	19.1
Tahu	3	476	86	18.1
Hsihu	3	444	77	17.3
Kungkuan	3	525	88	16.8
Toufen	3	476	60	12.6
Nanchuang	3	450	54	12.0
Chuolan	3	489	42	8.6
Sanwan	3	499	34	6.8
Chunan	4	585	20	3.4
Tungshiao	3	393	10	2.6
Yuanli	3	440	2	0.5
Taian	5	304	26	8.6
Touwu	3	521	104	20.0
Tsauchiao	5	775	78	10.1
Houlung	3	488	24	4.9
<b>Total (16)</b>	<b>53</b>	<b>8,028</b>	<b>932</b>	<b>11.6</b>

**Table 2. Infection Rates by Sex and Ethnic Groups**

Ethnic Group	Male			Female			Total		
	No.	Positive	%	No.	Positive	%	No.	Positive	%
Hakka	2,785	574	20.6	3,034	290	9.6	5,819	864	14.9
Fukienese	915	32	3.5	990	10	1.0	1,905	42	2.2
Aborigine	150	14	9.3	154	12	7.8	304	26	8.6

X<sup>2</sup> test, p < 0.001

**Table 3. Infection Rates by Age and Sex**

Age	Male			Female			Total		
	No.	Positive	%	No.	Positive	%	No.	Positive	%
1-5	500	0	0.0	403	2	0.5	903	2	0.2
6-14	677	8	1.2	628	8	1.3	1,305	16	1.2
15-19	117	0	0.0	286	3	1.1	403	3	0.7
20-29	246	15	6.1	410	12	2.9	656	27	4.1
30-39	594	74	12.5	715	28	3.9	1,309	102	7.8
40-49	372	88	23.7	426	56	13.2	798	144	18.0
50-59	423	139	32.9	511	78	15.3	934	217	23.2
60+	729	266	36.5	752	105	14.0	1,481	371	25.0
Unknown	192	30	15.6	228	22	9.7	420	52	12.4
Total	3,850	620	16.1	4,178	312	7.5	8,028	932	11.6