

# INVESTIGATION ON THE EPIDEMIOLOGICAL FACTORS OF *CLONORCHIS SINENSIS* INFECTION IN AN AREA OF SOUTH CHINA

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**Abstract.** To detect the epidemiological factors of *Clonorchis sinensis* infection in Hengxian County, one of counties in Guangxi Zhuang Autonomous Region where *Schistosoma japonicum* was endemic but eliminated in the late 1980s, a questionnaire was designed with 37 questions covering socioeconomic conditions and human behavior, contamination of the environment and fish ponds, inadequate farming/fishery practices; and the formalin-ether sedimentation technique was used to examine the feces of cats, dogs and pigs for the eggs of *C. sinensis*. Fresh fish was sliced and digested to detect the metacercariae of *C. sinensis* under a stereomicroscope. Of 1,521 people interviewed, 64% of the interviewees did not know about fluke disease or its transmission route, 46% of those who knew about the fluke believed that the infection caused no harm or only slight harm to their health. More than half of the interviewees (51%) ate raw fish at least 1-2 times per month, more among the middle-aged males. Eight percent of them used the same utensils for both raw fish and cooked food. When advice was given not to eat raw fish, 73% of the interviewees thought it was not feasible. In relation to pisciculture, 25% and 9% of the owners of fish ponds fed their fish with feces of domestic animals and human feces, respectively. The prevalences of *C. sinensis* infection in cats, dogs and pigs were 70, 50 and 27%, respectively, and the infection rate in fish was 40%. These results indicate the poor knowledge, and beliefs, and unhealthy behaviors in the human population. They also show poor environmental hygiene and inappropriate farming/fishery practices are important in the increase of *C. sinensis* prevalence in humans. Combined interventions, including health education, environmental modification, reform of traditional farming/fishery practices, mass screening and chemotherapy for humans, and the management of domestic animals are needed in developing control strategies to decrease *C. sinensis* infection in the human population.

## INTRODUCTION

The Guangxi Zhuang Autonomous Region is one of the *Schistosoma japonicum* endemic provinces in China, which has been successful in eliminating the disease in both the human and cattle populations since 1989 (Sleigh *et al*, 1998). However, other helminthes are highly prevalent in the Region due to relatively poor socioeconomic development, particularly in the areas of ethnic populations. Hengxian County is one of

ethnic counties in Guangxi Province where schistosomiasis was prevalent before 1989. In surveys of human parasites carried out in 1989 and 2002, the average prevalences of ascaris, hookworm and trichuris infection decreased from 71, 34 and 55% to 15.9, 7.5 and 12.8%, respectively while those of *Clonorchis sinensis* infection increased from 18% to 31.5% (Yu *et al*, 2003; Lin *et al*, 2004). The prevalence of intestinal helminthes decreased due to a chemotherapy campaign, especially in schoolchildren, and an improvement in living standards, environmental hygiene, and health literacy among local population, which also helped to reduce the transmission of soil-transmitted helminthes. However, the *C. sinensis* infection has been increasing in the past decade.

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In order to understand the factors relative to the transmission of *C. sinensis* so as to provide a basis for developing control intervention strategies for preventing transmission, an epidemiological study in Hengxian County was proposed. This paper reports the findings of that survey regarding the epidemiological factors for *C. sinensis* infection.

## MATERIALS AND METHODS

### Areas and subjects

Hengxian County was selected for the investigation, where the earlier survey was conducted in 2002. Three spots (villages) were identified for the study, the entire population in each place, about 500 people, were interviewed. Meanwhile, fecal materials from cats, dogs and pigs were collected to examine for the eggs of *C. sinensis*. Fishes were caught from the ponds/canals for metacercariae detection.

### Methods

A questionnaire was designed with 27 questions covering demographic information, knowledge regarding liver flukes, fish-eating habits, source of fish and processing, and history and attitudes regarding the disease. Nine questions were added for fish pond owners and one more question for restaurant owners and cooks. The answers to the questionnaire were confidential. All the interviewers were briefly trained before the interviews.

The formalin-ether sedimentation method was used to examine the feces of cats, dogs and pigs for the eggs of *C. sinensis*. The fish specimens were sliced and digested with artificial gastric juice in a 37°C incubator for 12 hours to examine for the metacercariae of *C. sinensis* under a stereomicroscope. SPSS software and the  $\chi^2$  test were used for statistical analysis.

## RESULTS

### Questionnaire

The numbers of residents who received questionnaire were 520, 497 and 504 in Shitang, Xiaoyi and Lingzhu, respectively. Only 36% of the 1,521 interviewees showed a knowledge of

clonorchiasis; 32% knew the mode of transmission. Of those who were aware of the fluke, 54% (296/551) believed the infection could be hazardous to people's health, while 46% believed the fluke caused no or only slight harm. Fifty-one percent of those interviewed (773/1521) ate raw fish at least 1-2 times per month, more common in middle-aged males (404/773). Ninety-six percent (81/84) of those who ate raw fish 10 or more times per month were male adults. The major mode of eating fish was as raw fish slices (720/773). The fish most frequently consumed was *Ctenopharyngodon idellus* (grass carp). Most of the subjects ate raw fish at home (689/773). In the restaurants surveyed (33/33), the most favorite dish for the consumers was raw fish slices, according to the cooks and managers.

The survey revealed that 8% of the interviewees (121/1,521) used the same chopping block, knife and other utensils for both raw fish and cooked food. When questioned about a history of infection, 14% (217/1,521) had been examined, 8% (117/1,521) had received treatment. Thirty-six percent (544/1,521) of interviewees answered that they had no desire for an examination for *C. sinensis* infection. When given advice not to eat raw fish, 73% (1,103/1,521) thought that it was not feasible (Table 1).

A survey of contamination of the environment and fish ponds showed 25% (14/56) of the owners of fish ponds fed their fish with feces of domestic animals and 9% (5/56) with human feces. Within a radius of 50 meters, there were latrines around 36% (20/56) of the ponds, pigpens around 36% (21/56) of them, vegetable plots and other farming land where human nightsoil was used as fertilizer around 48% (27/56) of the ponds. During the rainy season, potentially infectious fecal material (from children, animals) and rubbish could be washed into 68% (38/56) of the ponds. Cleaning the ponds, which may reduce the host snail colonies, was carried out once every two years in 52% (29/56) of the ponds.

### The infection of *C. sinensis* in domestic animals and fishes

The prevalences of clonorchis infection in cats, dogs and pigs from the three townships

Table 1  
Some behaviors and attitudes regarding clonorchiasis in different age groups.

Age group	No. interviewed	No. with raw fish-eating habit (%)		No. without intent of taking examination (%)		No. believe impossible to follow advice of no raw fish-eating (%)	
0~	12	1	(8)	9	(75)	7	(58)
10~	291	57	(20)	128	(44)	194	(67)
20~	315	151	(48)	119	(38)	230	(73)
30~	326	204	(63)	83	(26)	252	(77)
40~	243	156	(64)	72	(30)	195	(80)
50~	156	93	(60)	59	(38)	105	(67)
60~	178	112	(63)	74	(42)	120	(67)
Total	1,521	773	(51)	544	(36)	1,103	(73)

were 70% (21/30), 50% (16/32) and 27% (8/30), respectively. Three popular species of fishes were caught from the ponds/canals in each of the townships, 10 fish of each species were examined. The metacercaria rate was 30% in *Rhodeus sinensi* and, *Mylopharyngodon piceus*, 43% in *Opsariichthys bidens* and 60% in *Toxabramis houdemeri*, with a total clonorchis infection rate of 40% (35/88).

## DISCUSSION

As is well known, the prevalence of *C. sinensis* is affected by natural and social factors, like other parasites. The Guangxi Zhuang Autonomous Region is located in the subtropics with warm weather, abundant rain and rivers/canals, which are highly suitable for the intermediate hosts of *C. sinensis*. Hengxian County, as one of the counties of Guangxi Province, where the Zhuangzu are the majority people who live in that area, have a long history of eating raw fish, especially during festivals.

The survey indicates that more than half of the interviewees eat raw fish more than once per month. The majority of those who ate more frequently were middle-aged males, consistent with the higher prevalence of infection in adult males (Yu *et al*, 2003b). While about two-thirds of the interviewees did not know about clonorchiasis and its transmission route, 46% of those who knew about the fluke believed that the infection caused no harm or only slight harm. So some of

them were infected with *C. sinensis* by eating raw fish because of poor knowledge, which the researcher called "unknown-initiative-infected model". Those who were aware of the harm caused by clonorchiasis infection but felt they could not change their habit of eating raw fish, were called by the researcher the "known-initiative-infected model". The former model usually causes a light prevalence, while the latter can cause a heavy prevalence (Zuo *et al*, 1999). Therefore to reduce clonorchis infection, health education is important for improving knowledge of the parasite and changing unhygienic behaviors especially in the former model population.

The fact that 8% of those surveyed used the same utensils for both raw fish and cooked food reveals possible contamination with metacercariae and infection through the utensils. In south China, in some areas, such as Hainan Province, *C. sinensis* is prevalent in the population, with infection rate of 0.4% (Xu *et al*, 1999), mostly due to contamination of utensils rather than eating raw fish (Yu *et al*, 2003a). This indicates that infection through utensil contamination with metacercariae may be an important route for clonorchis infection in the human population. The traditional way of feeding fish with the feces of humans and domestic animals and building latrines/pigpens near ponds also contribute to contamination of water, and increases the infection rate in fishes. Meanwhile, the high prevalence of clonorchis infection in cats, dogs and pigs, and the high metacercariae rate in fishes

all contribute to a vicious circle of maintaining the life cycle of the parasite, which results in an increase in human infection.

In conclusion, study of the epidemiological factors of *C. sinensis* confirmed that poor knowledge and unhealthy behavior in humans, poor environmental hygiene, and inappropriate farming/fishery practices are an important cause of the increase of clonorchis in humans. Combined interventions include health education, environmental modification (proper building and the use of latrines and pigpens, improved hygiene), reform of traditional farming/fishery practices, mass screening and chemotherapy of humans, and the management of infected domestic animals need to be considered in developing a control strategy in the future.

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