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# Prevalence and predictors of food-borne parasites among residents in Tianhe district, Guangzhou city, China.

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## Abstract

**Objective: Foodborne parasitic disease is an emerging public health problem in China, this study aimed at evaluating the factors associated with prevalence of foodborne intestinal parasites among residents in Tianhe district of Guangzhou city, and provides a scientific basis for adjusting the prevention and control strategies.**

**Methods: A cross-sectional survey was conducted from June to October of 2016 using a stratified cluster sampling method, 42 neighborhood committees were sampled from 21 streets as the investigation sites.**

**Results:A total of 956 residents were investigated,and the overall prevalence of infection rate was 4.7% (45/956). *Clonorchis sinensis* and *Trichuris trichiura* were the predominant parasites identified from the stool of study participants. The infection rate in males (5.04%) was higher than that of females (4.25%), and most of cases occurred in 20-35 y-old age group. occupation, low educational level, eating raw fish, separating the cutting boards for raw and cooked food were independent predictors of food-borne intestinal parasitic infection, while separating cutting boards for raw and cooked food, washing hands before eating and after using the toilet and the awareness of hazards were the protective factors.**

**Conclusion:This present study showed high prevalence of food-borne intestinal parasites among the study subjects. Our results revealed poor personal hygiene like poor practice of hand washing before eating and after using the toilet, eating raw fish, the education level were more important cause of food-borne parasitic disease. Much has to be done to improve the personal hygiene and advocate the healthy eating behaviors.**

**Keywords:** Foodborne parasitic disease,*Clonorchis sinensis*, *Trichuris trichiura*, Prevalence.

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## Introduction

Food-borne parasitic zoonoses (FBPZs) are caused by consumption of contaminated food and water infected with intestinal parasites. It has been the major public health and socioeconomic problem and remains a vital cause of morbidity and mortality of developing countries where poor environmental sanitation, poor personal hygiene and low level of education are prominent [1-3]. In mainland China, the problem is particular severe, approximately 150 million people are suffering from FBPZs and more people are at risk [4,5].

Up to now, there are approximately 20 species of food-borne parasites in animals and man in China, including taeniasis/ cysticercosis, trichinellosis, echinococcosis, sarcocystosis and toxoplasmosis caused by eating raw or undercooked meat (pork, lamb, beef, rabbit and chicken), and gnathostomiasis and diphyllobothriasis latum caused by eating raw freshwater fish, such as finless eel and loach [6]. Food-borne parasites have definitive and intermediate hosts to complete their life cycle, including herbivorous mammals, birds, fish and other animals. For example, C. sinensis, the trematode flatworm *Clonorchis sinensis* (the Chinese river fluke) lives in the liver of humans and is the cause of clonorchiasis. Until now, nearly 140 species of freshwater fish and four species of shrimp have been recognized as intermediate hosts for *Clonorchis sinensis*. Because prevalence of infected fish are still very high in some provinces of China [7].

Guangdong is a province of China, located in Southern China on the South China Sea coast. Guangdong province has the highest prevalence and largest number of Food-borne parasites infected people (~5.5 million), as local food customs involve eating raw and undercooked fish [8]. It has attracted great attention of governments at all levels and health and epidemic prevention departments because of the high prevalence of food-borne parasitic disease in Guangdong province. In addition, the prevalence of food-borne parasitic disease in the region has attracted the interest of various institutions and scholars, which had conducted an amount of long-term researches on its epidemiology [9-11]. These studies provide a lot of valuable research data and suggestions for the prevention and control of the disease in China [12].

Guangzhou is the capital and most populous city of the province of Guangdong in southern China. It is among the top

three largest urban economies in China today, along with shanghai and Beijing. Rapid economic development with high population mobility and the habit of eating raw aquatic product makes food-borne parasite diseases becoming the main cause of major public health events in this city.

Newly developed in the past 15 years, the Tian He District could easily be called Guangzhou's Silicon Valley. Pacific Electronic Technology Square (The), New Concept Computer Town and NanFang Computer City all have their roots in this district. Together, they create South Chinas biggest computer market. For this reason. Guangzhou house not just rural-to-urban migrants, but also white collar residents.

Thus, this study was designed to investigate the infection status and influence factors of food-borne parasitic disease in Tianhe district of Guangzhou city, investigate the influence of economic and social factors changes caused by urbanization on epidemic of intestinal parasitic diseasesand to provide scientific basis for making intervention strategies. The present study describes the prevalence and characteristics of food-borne parasitic infestation in Tianhe district of Guangzhou city, which provides clearer overview information and more details on the food-borne parasitic disease distribution in these areas.

## Methods

### *Study area and population*

The study was conducted from June to October of 2016 in Guangzhou city. Guangzhou has a population of 14 million people. Tianhe District is one of the ten districts in Guangzhou, with 21 streets. For the present study, in each of the 21 streets, we selected 2 neighborhood committees of different economic levels. In each neighborhood committee, 20~30 residents were randomly sampled. The total population that was approached to participate included 956 people.

### *Study design*

A cross-sectional study was utilized for determination of the prevalence and predictors of food-borne parasitic infestation among residents in Tianhe district of Guangzhou city.

### *Laboratory methods*

All of the participates were informed of the purpose of the study and were provided with a standard fecal collection bag labelled with the participant's code and containing a dry plastic bag, they were instructed on how to collect and store their fecal sample until it was returned the next day. All samples were processed using five standard stool examination methods: modified Kato-Katz thick smear (a semi-quantitative stool examination technique for detection of *Trichuris trichiura*,*Ascaris lumbricoides*, Hookworm, Threadworm and *Clonorchis sinensis* ova, participates' serums were detected for the specific IgG and IgM antibodies against *A. cantonensis* by an enzyme-linked immunosorbent assay (ELISA).

### *Data collection*

A pretested structured questionnaire administered by trained interviewers was used for collecting information on age, sex, occupation, family economic status, dwelling conditions, sanitary conditions, health condition (Previous history of parasites infection and expelling history), eating habits, educational level, knowledge, attitude and practice of food-borne parasitic diseases of residents.

### *Data analysis*

Data were collected, entered, cleaned, and analysed using SPSS for windows version 17.0. The difference between prevalence of food-borne parasites among different categories was compared using Pearson chi-square test and Fishers exact test where appropriate. Binary logistic regression was used to identify factors associated with parasitic infection. Variables having a p-value of less than 0.2 in the bivariate analyses were considered for multivariate logistic regression. A p-value of $<0.05$ was used to indicate statistical significance.

### *Ethical considerations*

Ethical approval of this study was obtained from the ethics committee of the Zhongshan School of medicine, Sun Yat-Sen University. Informed written consent was obtained from individuals who participated in the study. Individuals found to be positive for food-borne parasites were referred to the nearby health center for appropriate treatment.

## Results

A total of 956 individuals provided complete data on sociodemographic characteristics and parasitological assessments with a response rate of 96.4%. Among them, the indigenous inhabitants accounted for 35.56% of the total population, 36.27% in the Guangdong province and 28.17% in other provinces. 556 (58.2%) were males and 400 (41.8%) were females. The age of the study participants ranged from 3 through 65 with a mean age of 30.3 (SD=11.2). The education level at senior high school and higher accounts for 76.8%. Eating habits of the participants are home cooking (eating cooked food) and drink running water. Participants have good living and sanitary conditions.

The overall prevalence of food borne parasitic infection among the participants was determined to be 4.7% (45/956). *Clonorchis sinensis* (3.77%) was the predominant parasite identified from stool of the study participants followed by Trichuris trichiura (0.42) (Table 1).

The results of the study showed that 5.04% (28/556) of male and 4.25% (17/400) female participants were found to be infected with at least one parasite. There was no significant difference in the prevalence of infection with food borne parasites between male and female (p=0.571) (Table 2).

Individuals aged between 20-35 y of age were found to have a high percentage (6.46%) of infection as compared to other age groups. The association between age groups and food borne

parasitic infection was statistically significant (p=0.00) (Table 2).

In groups of people with different occupation, the prevalence of food borne parasitic infection of private business people, agency personnel, migrant workers, company white-collar worker, and students were 8.63%, 5.95%, 3.59%, 2.93%, and 1.79% respectively. The prevalence rate difference among different occupational population was statistically significant (p=0.01). The prevalence rate of private business people was the highest and that of students was lowest (Table 2).

In groups of people with different education level, the prevalence of food borne parasitic infection of Illiterate, primary education, secondary education and high education were 9.55%, 5.93%, 3.04%, 2.15% respectively. The prevalence rate difference among different education level was statistically significant (p=0.01). The prevalence rate of illiterate was the highest and that of high education was lowest (Table 2).

Different factors were assessed for possible association with food-borne parasitic infection among the participants. Among people who don't separate cutting boards for raw and cooked food, 11.5% were found to be infected with at least one parasite. The practice of separating cutting boards for raw and cooked food had a statistically significant association with food-borne parasitic infection (p<0.001) (Table 2). The multivariate logistic regression model estimated that individuals who had no regular practice of separating cutting boards for raw and cooked food were 111.52 times (Exp (β): 111.516, 95% CI: 14.999, 829.109) more likely to be infected with intestinal parasites than those who separating cutting boards for raw and cooked food regularly (Table 3).

6.8% of individuals who had the habit of raw fish/conch consumption were found to be infected with at least one parasite. The practice of eating raw fish/conch had a statistically significant association with food-borne parasitic infection (p<0.01) (Table 2). The multivariate logistic regression model estimated that individuals who had regular practice of eating raw fish/conch were 60.7 times (AOR: 60.71, 95% CI: 4.943, 745.579) more likely to be infected with food-borne parasitic infection than those who don't eat raw fish/conch (Table 3).

12.44% of individuals who had no practice of washing hands before a meal were found to be infected with intestinal parasites. The practice of hand washing before a meal was significantly associated with parasitic infection among the study participants (p<0.01) (Table 2). However the association was not significant after adjusting for confounders using multivariate logistic regression (Table 3).

9.4% of individuals had regular practice of washing their hands after using the toilet had infection with at least one parasite (Table 2). The practice of washing hands after using the toilet in the study participants had a significant association with the rate of intestinal parasitic infection (p<0.01). The odds of parasitic infection was 547 times higher (AOR: 546.91, 95% CI (47.79, 6258.75)) for individuals who had not regular practice of washing their hands after using the toilet as compared to those did (Table 3).

5.8% of participates who don't have the knowledge of food-borne parasites infection and prevention had infection with at least one parasite (Table 2). The practice of having the knowledge of food-borne parasites infection and prevention in the study participants had a significant association with the rate of intestinal parasitic infection (p=0.02). However the association was not significant after adjusting for confounders using multivariate logistic regression (Table 3).

As shown in Table 2, the gender and age was not significantly associated with food-borne parasites infection (p=0.57 and p=0.14 respectively).

***Table 1.*** *Frequency distribution of food-borne parasites identified from residents of Tianhe district in Guangzhou city.*

| Parasitic species | Population infected | Prevalence (%) | Constituent ratio (%) |
|---|---|---|---|
| *Clonorchis sinensis* | 36 | 3.77 | 80 |
| *Trichuris trichiura* | 4 | 0.42 | 8.89 |
| *Ascaris lumbricoides* | 3 | 0.31 | 6.67 |
| *Hookworm* | 2 | 0.21 | 4.44 |
| Total | 45 | 4.7 | 100 |

***Table 2.*** *The prevalence of food-borne parasitic infection with respect to socio-demographic characteristics of residents in Tianhe district.*

| | No examined | Positive | | |
|---|---|---|---|---|
| **Characteristics** | **No/%** | **No/%** | **$\chi^2$** | **p-value** |
| Gender | | | | |
| Male | 556/58.2 | 28/5.04 | 0.32 | 0.57 |
| Female | 400/41.8 | 17/4.25 | | |
| Age group | | | 3.94 | 0.14 |
| <20 | 288/30.1 | 10/3.47 | | |
| 20~35 | 356/37.2 | 23/6.46 | | |
| >35 | 312/32.6 | 12/3.85 | | |
| Occupation | | | 13.34 | 0.01 |
| Private business people | 220/23.0 | 22/42.22 | | |
| Agency personnel | 168/17.6 | 10/22.22 | | |
| Migrant workers | 195/20.4 | 7/15.56 | | |
| Company white-collar worker | 205/21.4 | 6/13.33 | | |
| Students | 168/17.6 | 3/6.67 | | |
| Educational status | | | 27.86 | 0 |
| Illiterate | 183/19.14 | 22/48.89 | | |
| Primary education | 231/24.16 | 9/20.00 | | |
| Secondary education | 263/27.51 | 8/17.78 | | |

| | | | | |
|---|---|---|---|---|
| High education | 279/29.18 | 6/13.33 | | |
| Separate cutting boards for raw and cooked food | | | 34.67 | 0 |
| Yes | 687/71.9 | 15/33.33 | | |
| No | 269/28.1 | 30/66.67 | | |
| Raw fish/conch consumption | | | 6.72 | 0.01 |
| Yes | 396/41.42 | 27/60.00 | | |
| No | 560/58.58 | 18/40.00 | | |
| Hand washing before a meal | | | 41.14 | 0 |
| Always | 723/75/63 | 16/35.56 | | |
| Sometimes | 233/24.37 | 29/64.44 | | |
| Hand washing after using the toilet | | | 31.37 | 0 |
| Yes | 573/59.94 | 9/20.00 | | |
| No | 383/40.06 | 36/80.00 | | |
| Knowledge of food-borne parasites infection and prevention | | | 5.93 | 0.02 |
| Yes | 282/29.5 | 6/13.3 | | |
| No | 674/70.5 | 39/86.7 | | |

***Table 3.*** *Multivariate logistic regression analysis of predictors of food-borne parasitic infection among residents in Tianhe district.*

| Characteristics | β | S.E. | Wald $\chi^2$ | Sig | Exp (β) | 95% CI (L) | 95% CI (U) |
|---|---|---|---|---|---|---|---|
| Gender | 19.046 | 1790.399 | 0 | 0.992 | 1.87E+08 | 0 | - |
| Age | -1.167 | 0.591 | 3.897 | 0.048 | 0.311 | 0.098 | 0.992 |
| Occupation | 2.052 | 0.633 | 10.502 | 0.001 | 7.78 | 2.25 | 26.907 |
| Education | -1.401 | 0.436 | 10.313 | 0.001 | 0.246 | 0.105 | 0.579 |
| Separate | 4.714 | 1.024 | 21.211 | 0 | 111.516 | 14.999 | 829.109 |
| Rawfish | 4.106 | 1.28 | 10.296 | 0.001 | 60.707 | 4.943 | 745.579 |
| Handwash[1*] | 17.978 | 1790.399 | 0 | 0.992 | 64257721 | 0 | - |
| Handwash[2**] | 6.304 | 1.244 | 25.698 | 0 | 546.91 | 47.791 | 6258.747 |
| Knowledge | -0.845 | 1.195 | 0.5 | 0.479 | 0.429 | 0.041 | 4.465 |

[*]Hand wash before a meal; [**]Hand wash after using the toilet

## Discussion

China has undergone major socioeconomic development in the past two decades. One of the tremendous progress is the control of food-borne parasitic diseases. In this study, to evaluate the factors associated with prevalence of foodborne intestinal parasites among residents in Tianhe district of Guangzhou city, and provide a scientific basis for adjusting the prevention and control strategies, we conducted a cross-sectional survey and evaluate the overall prevalence of infection rate in this district. Our results showed that *Clonorchis sinensis* and *Trichuris trichiura* were the predominant parasites identified from the stool of study participants.

Nationwide survey on parasitic infection status in 1990 and 2012 showed that *Clonorchis sinensis* infection spread most severely in Guangdong province [13-15]. Residents in this province generally have a habit of eating raw and not fully cooked fresh water fishes. Therefore, the district is a highly endemic area of the liver fluke disease. Trichuriasis is a neglected tropical disease (NTD) caused by parasitic nematodes of the genus *Trichuris* (Nematoda), causing considerable human and animal health problems as well as considerable socio-economic losses world-wide [16-18]. Previous studies showed that sex-specific differences have been suggested to be due to differences in parasite susceptibility between the sexes [19], perhaps due to the influence of sex hormones [20,21]. Some parasitologists proved that susceptibility to parasitic infections is greater in males and may contribute to male biased mortality [19]. Our present study, however, did not find the significant difference in the prevalence of parasitic infestation between men and women.

The prevalence rate difference among different occupational population was statistically significant. In groups of people with different occupation, our results showed that the prevalence of food borne parasitic infection of private business people, agency personnel, migrant workers, company white-collar worker, and students were 8.63%, 5.95%, 3.59%, 2.93%, and 1.79% respectively. We supposed that the high prevalence rate of food borne parasitic infection in private business people and agency personnel may be related to their higher exposure rate of fresh fish and raw food.

In groups of people with different education level, the prevalence of food borne parasitic infection of illiterate was the highest, the second was primary education, and we suspect that these people are the main body of labor service workers in

Guangzhou city, they comes from all over the country and easy to adapt the habit of eating raw and fresh food of Guangdong. Also they lack of the health knowledge and their living conditions are relatively low.

Multivariate regression analysis also confirmed that occupation of business people and agency personnel, lower education level, not separating the cutting boards for raw and cooked food, eating raw fish and conch and not having the practice of washing hands after using the toilet are the risk factors of parasitic infestation.

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