
**THE STATUS-QUO AND RISK FACTORS OF LIVER FLUKE INFECTION
CLONORCHIS SINENSIS IN HUMANS IN YEN LOC COMMUNE,
KIM SON DISTRICT, NINH BINH PROVINCE**

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Abstract

Clonorchiasis infection is a food-borne parasitic disease that significantly impacts on public health. Among the three species of small liver flukes, Clonorchis sinensis (C. sinensis) is the most prevalent. It is estimated that approximately 35 million individuals worldwide are infected with C. Sinensis, with those affected having a risk of developing cholangiocarcinoma.

Methods: *This study employed an analytical descriptive study, conducting cross-sectional surveys involving 459 individuals aged 18 and older at the study site.*

Results: *The prevalence of infected C. sinensis among humans in Yen Loc commune, Kim Son district, Ninh Binh province, was found to be 19.39%. Of the infected individuals, 92% exhibited mild infectious intensity, with a mean C. sinensis infection intensity of 241.92 ± 481.45 EPG. More male residents (28.44%) were infected with C. sinensis than female (11.20%) residents ($p < 0.05$). Individuals using fresh manure for farming and animal husbandry had 2.04 times higher odds of infection than those who did not utilize fresh manure (95% CI: 1.21-3.43). Furthermore, those consuming raw fish were 7.17 times more likely to be infected compared to those who had never eaten raw fish (95% CI: 3.60-14.27). The highest prevalence of C. sinensis infection was observed in the group people who consumed raw fish once a week ($p < 0.05$).*

Conclusion: *The prevalence of C. sinensis infection among humans in Yen Loc commune, Kim Son district, Ninh Binh province, is 19.39%, with the majority of cases classified as mild infection intensity.*

Keywords: *Clonorchis sinensis; raw fish consumption.*

Thực trạng và một số yếu tố liên quan đến nhiễm sán lá gan nhỏ Clonorchis sinensis trên người tại xã Yên Lộc, huyện Kim Sơn, tỉnh Ninh Bình (2018-2020)

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Tóm tắt

Nhiễm sán lá gan nhỏ là bệnh truyền nhiễm qua đường ăn uống, gây ảnh hưởng lớn đến sức

khỏe cộng đồng. Trong đó, *C. sinensis* gây bệnh phổ biến nhất trong số 3 loài sán lá gan nhỏ, ước tính có 35 triệu người nhiễm *C. sinensis* trên thế giới. Bệnh nhân nhiễm sán lá gan nhỏ có nguy cơ ung thư biểu mô đường mật.

Phương pháp: Nghiên cứu mô tả có phân tích với các đợt điều tra cắt ngang ở 459 người trên 18 tuổi tại điểm nghiên cứu.

Kết quả: Tỷ lệ nhiễm sán lá gan nhỏ *C. sinensis* trên người tại xã Yên Lộc, huyện Kim Sơn, tỉnh Ninh Bình là 19,39%. Trong đó có 92% nhiễm cường độ nhẹ, cường độ nhiễm trung bình là: $241,92 \pm 481,45$ EPG. Tỷ lệ nhiễm sán lá gan nhỏ ở nam là 28,44% cao hơn so với ở nữ là 11,20% ($p < 0,05$). Người sử dụng phân tươi trong trồng trọt, chăn nuôi có nguy cơ nhiễm sán lá gan nhỏ cao gấp 2,04 lần người không sử dụng (95%CI: 1,21-3,43). Người ăn gỏi cá sống có nguy cơ nhiễm sán lá gan nhỏ cao gấp 7,17 lần những người không ăn gỏi cá (95% CI: 3,6-14,27). Tỷ lệ nhiễm sán lá gan nhỏ ở người ăn gỏi cá sống ít nhất 1 lần/1 tuần cao hơn đáng kể so với những đối tượng ăn gỏi cá ít nhất 1 lần/1 tháng và 2 – 3 lần/tháng ($p < 0,05$).

Kết luận: Tỷ lệ nhiễm sán lá gan nhỏ tại xã Yên Lộc, huyện Kim Sơn, tỉnh Ninh Bình là 19,39%, đa số có cường độ nhiễm nhẹ, các yếu tố liên quan đến nhiễm sán lá gan nhỏ là ăn gỏi cá sống.

1. Introduction

Liver fluke infection is a foodborne infectious disease that significantly impacts public health. Northern Vietnam experiences a subtropical monsoon climate characterized by four distinct seasons, while the southern region is situated within a tropical monsoon zone, marked by consistently hot and humid conditions throughout the year and two primary seasons. These divergent climatic conditions create an environment conducive to the emergence and spread of two small liver fluke species, *Clonorchis sinensis* and *Opisthorchis viverrini*. Ninh Binh province is recognized as a hotspot for *C. sinensis* infection, with prevalence rates ranging from 23.5% to 31.0% [1]. Yen Loc Commune, located in Kim Son District, Ninh Binh Province, features numerous fishponds, a local habit of consuming raw fish, convenient transportation links, and diverse ecosystems, all of which facilitate disease transmission vectors.

The primary risk factor for small liver fluke infection is the consumption of raw or undercooked fish harboring metacercarial cysts. Patients with liver fluke infection often exhibit few or vague symptoms over extended periods, complicating diagnosis, treatment, and prevention efforts. Chronic liver fluke infection may lead to varying degrees of liver fibrosis and carries significant risks of liver cancer, gallbladder cancer, and bile duct cancer [2].

Consequently, conducting epidemiological surveys on small liver fluke infections in humans is vital for enhancing our understanding of the disease's geographical distribution and its impact on human health.

This study aims to describe the status-quo and evaluate factors associated with small liver fluke (*C. sinensis*) infections in humans in Yên Lộc Commune, Ninh Binh Province (2018–2020), focusing on the determination of the prevalence, infection intensity, and related risk factors in the commune.

2. Objectives and methods

2.1. Study Subjects, Location, and Period

- The study targeted residents aged 18 years and older.

- Surveys, sampling, and KAP (Knowledge, Attitude, Practices) interviews were conducted with 309 individuals in 2018 and 150 individuals in 2020.

- The research was carried out in Yen Loc Commune, Kim Son District, Ninh Binh Province, under the auspices of the National Institute of Malariology, Parasitology, and Entomology.

2.2. Study Methods

- Study Design: This research employed a descriptive design with analytical components using cross-sectional surveys.

- Sample Size: The sample size was estimated using the formula for proportions in epidemiological studies:

$$n = Z_{1-\alpha/2}^2 \frac{p(1-p)}{d^2} \times DE$$

n: the minimum sample size required for research per province.

$Z_{1-\alpha/2}$: corresponds to a confidence level of 95%, with $\alpha=0.05$, yielding $Z_{1-\alpha/2} = 1,96$;

p: represents the estimated proportion, reported by the National Institute of Malariology, Parasitology, and Entomology as 0.25 (25%);

d: denotes the allowable absolute error, set at 0.05;

DE: is the Design Effect, selected as 1.5.

The calculated minimum sample size is 433 individuals; however, the study ultimately included 459 participants.

Research Content

The study aimed to determine the prevalence

of small liver fluke infection among the study subjects and identify some of associated factors.

Techniques Used in the Study

Interviews and KAP surveys were conducted.

Real-time PCR techniques were employed to identify small liver, following methodologies established by Cai X.Q and colleagues [3].

Statistical analysis were performed using biomedical methods and SPSS version 22.0.

Ethical Considerations in the Study

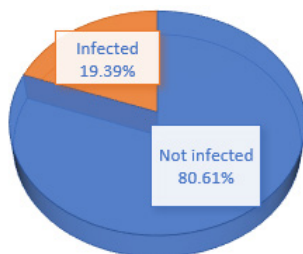
The research protocol received approval from the Biomedical Research Ethics Committee of the National Institute of Malariology, Parasitology, and Entomology.

3. Research results

3.1. Prevalence of *C. sinensis* Infection at the Study Site

Prevalence of *C. sinensis* Infection at the Study Site

Figure 1. Prevalence of *C. sinensis* Infection at the Study Site



The prevalence of *C. sinensis* liver fluke infection in humans is 19.39%.

- Intensity of liver fluke infection

Table 1. Intensity of liver fluke infection ($n = 459$)

Infection intensity	Quantity	Percentage	EPG ($X \pm SD$)
Mild	69	92,0	241,92 ± 481,45
Moderate	6	8,0	
Severe	0	0	
Total	75	100	

The average infection intensity is 241.92 ± 481.453 eggs/gram of feces, with 92% having mild intensity

3.2. Factors associated with liver fluke infection

Table 2. Prevalence of liver fluke infection by age group ($n = 459$)

Gender	Number of tests	Liver fluke infection		p
		Quantity	Percentage (%)	
18 – 29 (1)	39	6	15,38	(3: 1,2,4) > 0,05
30 – 49 (2)	212	46	21,70	
50 – 59 (3)	129	29	22,48	
≥ 60 (4)	79	8	10,13	
Total	459	89	19,39	

The age group of 30 to 59 years exhibits the highest prevalence of liver fluke infection ranging from 21.7% to 22.5%. However, this difference is not statistically significant ($p > 0.05$).

Table 3. Prevalence of Liver Fluke Infection by Gender ($n = 459$)

Gender	Number of tests	Liver fluke infection		p
		Quantity	Percentage (%)	
Male	218	62	28,44	< 0,05
Female	241	27	11,20	
Total	459	89	19,39	

The prevalence of *C. sinensis* infection in males is 28.44%, which is significantly higher ($p < 0.05$) than the prevalence in females, which is 11.2%.

Table 4. Prevalence of Liver Fluke Infection by Occupation ($n = 459$)

Occupation	Number of tests	Liver fluke infection		p
		Quantity	Percentage (%)	
Farmer (1)	291	61	20,96	(1: 2,3,4) > 0,05
Worker (2)	38	6	15,79	
Civil servants, retirees(3)	31	5	16,13	
Others (4)	99	17	17,17	
Total	459	89	19,39	

There is no difference in the prevalence of liver fluke infection between farmers, workers, and other groups, with $p > 0.05$.

Table 5. Prevalence of liver fluke infection by education level ($n = 459$)

Education level	Number of tests	Liver fluke infection		p
		Quantity	Quantity	
Primary school (1)	100	24	24,00	(1: 2,3,4) > 0,05
Secondary school (2)	157	29	18,47	
High school (3)	152	27	17,76	
Vocational high school, college, university (4)	50	9	18,0	
Total	459	89	19,39	

The lower the education level, the higher the prevalence of liver fluke infection, although the difference is not statistically significant ($p > 0.05$).

Table 6. Association between liver fluke infection and the use of fresh manure ($n = 459$)

Use of fresh manure	Liver fluke infection			OR; 95% CI:
	Infected	Not infected	Total	
Yes	28	68	96	2,04; 1,21-3,43
No	61	302	363	
Chung	89	370	459	

There is an association between the use of fresh manure and liver fluke infection, with an odds ratio (OR) of 2.04 (1.21-3.43) for those who do not use fresh manure for farming or cultivation.

Table 7. Association between Liver Fluke Infection and Consuming Raw Fish Salad History ($n = 459$)

Eating raw fish salad	Liver fluke infection			OR; 95% CI:
	Infected	Not infected	Total	
Yes	79	194	273	7,17; 3,6-14,27
No	10	176	186	
Total	89	370	459	

There is an association between eating raw fish salad and liver fluke infection, with an odds ratio (OR) of 7.17; 95% CI: 3.6-14.27.

Table 8. Association between the Prevalence of *C. sinensis* and the Rrequency of Consuming Raw Fish Salad ($n = 459$)

Frequency	Quantity	Quantity	p
At least once a week (1)	22	43,1	(1: 2,3) < 0,05
At least once a month (2)	27	28,4	
2-3 times every 6 months (3)	30	23,6	
Total	79	28,9	

People who consumes raw fish salad at least once a week have the highest prevalence of infection (43.1%), which is 1.5 times higher than those who eat raw fish salad 2-3 times every 6 months (25.2%) ($p < 0.05$).

4. Discussion

4.1. Prevalence of Liver Fluke Infection

The results indicate a relatively high prevalence of liver fluke infection at 19.39%. The findings align with the study conducted by Doan Thuy Hoa (2020) in Kim Son and Yen Khanh, Ninh Binh, which reported a prevalence of 19.5% for *C. sinensis* infection [4]. In contrast, Luong Thi Phuong Lan's study in Nghia Hung, Nam Dinh (2016) identified the prevalence of 15.8% [5] while Nguyen Thi Thanh Huyen (2018) reported a prevalence of 12.8% in Hiep Hoa, Bac Giang [6]. Notably, Nguyen Thi Bich Thao's study in Yen Bai and Thanh Hoa indicated a significantly higher prevalence of 40.4% [7]. The observed differences may stem from variations in diagnostic techniques employed across studies. Furthermore, certain regions have not been adequately assessed or lack prevalence data on liver fluke infections, hindering the implementation of effective control and prevention measures and potentially contributing to elevated rates.

4.2. Intensity of Liver Fluke Infection

Concerning the intensity of *C. sinensis* infection, the majority of cases were classified as mild, with no severe infections observed among participants. Both global and local studies in Vietnam indicate that the intensity of liver fluke infection within communities is generally low. For instance, research conducted by Junling Sun (2020) involving 2,521 individuals in Guangxi reported that 66.2% exhibited mild infection [8]. Similarly, recent studies in Vietnam corroborate that most cases are of mild intensity, aligning with the findings of Doan Thuy Hoa (2020) [4].

4.3. Factors Related to Liver Fluke Infection in Humans

There is a significant difference in the

prevalence of liver fluke infection between men and women. The infection rate in men is 28.4%, which is higher than the 11.2% in women ($p < 0.05$). Our findings are consistent with studies worldwide and in Vietnam. A study in China showed that the prevalence of liver fluke infection in men was 6.51 times higher than in women (95% CI: 4.67-9.08) [9].

People who use fresh manure for farming or cultivation are 2.04 times more likely to be infected with liver flukes than those who use compost (95% CI: 1.21 - 3.43; $p < 0.05$). A study by Luong Phuong Lan (2016) in Rang Dong, Nghia Hung, Nam Dinh indicated that individuals using human or animal manure for fertilization or aquaculture were 6.5 times more likely to be infected than those who did not employ such practices [5]. The use of human and animal manure in fish feeding remains prevalent in Vietnam, often viewed as an effective method to enhance fish nutrition, despite perpetuating the lifecycle of liver flukes.

Most studies examining behaviors, practices, and habits associated with fish farming and the consumption of raw aquatic plants in Vietnam and globally agree that the primary factor driving liver fluke transmission is the habit of consuming raw or undercooked fish [10]. Our research also shows that people who eat raw fish salad are 8.43 times more likely to be infected with liver flukes than those who do not eat raw fish salad (95% CI: 5.23 - 13.57). A study in South Korea along the Muju river showed that people who ate raw fish had a significantly higher prevalence of liver fluke infection (18.6%) compared to those who had never eaten raw freshwater fish (4.5%), $p < 0.001$ [11]. According to the investigation by Doan Thuy Hoa (2020), people who eat raw fish

salad are 6.8 times more likely to be infected with liver flukes compared to those who do not (OR = 6.769; $p < 0.001$) [4].

Our study did not identify a correlation between the prevalence of liver fluke infection and the presence of fishponds at home ($p > 0.05$). This result is consistent with the study by Le Tran Anh et al. (2017), which found no correlation between living conditions (such as proximity to rivers or lakes) and the prevalence of liver fluke infection in humans [12]. The frequency of consuming raw fish salad does affect the status of liver fluke infection in humans. The infection rate in individuals who eat raw fish salad moderately (1–3 times per month) is lower than in those who eat raw fish salad frequently (weekly), and this difference is statistically significant ($p < 0.05$). According to Doan Thuy Hoa (2020), the infection rate in those who eat raw fish salad more frequently (≥ 4 times per month; 45.00%) is significantly higher compared to those who eat it less frequently ($p < 0.05$). People who do not consume raw fish salad may still be infected, but

the intensity of infection is much lower than that of those who consume raw fish salad [4].

5. Conclusion

The prevalence of *C. sinensis* infection among humans in Yen Loc, Ninh Binh is 19.39%, with 92% of cases categorized as mild intensity. The mean intensity of infection is 241.92 ± 481.45 EPG. Notably, the prevalence of liver fluke infection is significantly higher in men (28.44%) compared to women (11.20%) ($p < 0.05$).

Individuals who utilize fresh manure for agricultural and livestock purposes are 1.96 times more likely to be infected with liver flukes than those who do not use fresh manure for farming and livestock (95% CI: 1.36 - 2.84; $p < 0.05$). Furthermore, individuals who consume raw fish salad are 7.17 times more likely to be infected with liver flukes than those who do not consume raw fish salad (95% CI: 3.6-14.27). The prevalence of liver fluke infection is significantly greater among individuals who consume raw fish salad at least once a week compared to those who eat it once a month or 2–3 times per month ($p < 0.05$).

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