

Health Literacy Associated with Raw Cyprinoid Fish Consumption in Northeastern Thailand

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Abstract

Background: Currently, more than 10 million people are at risk of liver fluke infection caused by *Opisthorchis (O.) viverrini* in Southeast Asia, particularly Thailand. The cause is the fish-borne diseases which result from the frequent consumption of undercooked fish.

Method: A cross-sectional analytical study was designed for one-year period. A total of 1,163 respondents at the age of 15-59 was chosen through the cluster random sampling.

Results: Health literacy including inadequate access health information ($OR_{adj} = 2.05$; 95%CI: 1.16 - 3.60, $p < 0.05$), inadequate understand health information ($OR_{adj} = 2.81$; 95%CI: 1.46 - 5.43, < 0.001) inadequate appraise health information ($OR_{adj} = 2.35$; 95%CI: 1.38 - 3.99, < 0.001) and inadequate apply health information ($OR_{adj} = 4.32$; 95%CI: 2.24 - 8.35, $p < 0.001$), had statistical significance associated with raw cyprinoid fish consumption. In addition, feeding dogs and cats with raw cyprinoid fish ($OR_{adj} = 4.94$; 95%CI: 3.48 - 7.00, $p < 0.001$) associated with raw cyprinoid fish consumption with statistical significance.

Conclusions: This study indicates that health literacy was associated with the raw cyprinoid fish consumption. Therefore, *O. viverrini* prevention and control should focus on their health literacy and change their eating behaviors, tradition, context, including feeding dogs and cats.

Keywords: Health literacy, Raw cyprinoid fish consumption, *Opisthorchis viverrini*, Carcinogenic human liver fluke.

Introduction

Neglected tropical diseases are caused by the most parasitic infections affecting health and poverty

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particularly in Southeast Asian countries, mainly including Thailand, Laos People's Democracy Republic (PDR), Cambodia, and central part of Vietnam in which there have been reported of liver fluke infection, *O. viverrini*.¹ There has been a population prone to liver fluke infection and their close relatives, constituting approximately 40.7 million people in worldwide. Common human liver fluke infection can be found among certain groups of individuals, divided into 9 million people suffering *O. viverrini* infection, 1.2 million people with *O. felineus* infection and 35 million people with *Clonorchis sinensis* infection.² *O. viverrini* infection is the main risk factor for cholangiocarcinoma

and is often found in Northeastern Thailand and Laos since people continue to have the habit of extensive consumption of raw or half-cooked fish.^{3,4} In Thailand, more than 6 million people are at risk of the liver fluke infection⁵, which has been found to have the highest prevalence in the northeast (16.6%) and the north (10.0).⁶ The *O. viverrini* infection was frequently found in male, agricultural occupations and in the age group over 35 years.⁷ The infection results from the raw or under-cooked consumption of freshwater cyprinoid fish. Albeit well aware among many people that dosing with praziquantel is a treatment for an episode of the infection, it still poses a high risk for them to suffer long-term consequences, so eventually they will probably engage in a cycle of infection, dosing and reinfection.^{5,8} However, prevention and control campaigns were launched nearly hundred years ago, so it resulted in a nationwide decrease of *O. viverrini* infection (8.7%).^{5,6} Irrespective of such a substantial decrease, novel key success or new focus to eradicate *O. viverrini* or to decrease this infection in correspondence with the underlining requirement of Ministry of Public Health (less than 5.0%) is still in need.

Health literacy (HL) represents the cognitive skills and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health.⁹ HL is a concept of healthcare, disease prevention, and health promotion settings. The ability includes: Access, Understand, Appraise and Apply. It refers to the ability to communicate and use the information to make a decision to maintain and improve health.¹⁰ HL refers to people's competencies to access, understand, judge and apply health information in healthcare, disease prevention, and health promotion by describing the level of HL and the factors associated with its population.¹¹ As a result, the risk of *O. viverrini* infection is posed by a habit of raw fish consumption. Despite its significance, it has been neglected; simply speaking, there is a dearth of studies of HL regarding liver fluke among *O. viverrini* infection risk groups in Northeastern Thailand. Therefore, this study aimed to investigate the HL associated with raw cyprinoid fish consumption in Northeastern Thailand. A large sample group was selected from the population among the 15-59 age group as representatives of the population-based cross-sectional study conducted in Northeast of Thailand. This study confirmed that HL and factors associated with liver fluke that will be useful for further disease prevention and health promotion.

Materials and Method

Study Design: This cross-sectional analytical study was conducted in Northeastern region, Thailand for one-year in 2019. A total population of 17,851 individuals who are living in three Province, Northeastern, Thailand, was included through cluster random sampling and completed self-administered questionnaires. Specifically, among that population, a total number of 1,829 respondents were selected through simple random sampling (Figure 1).

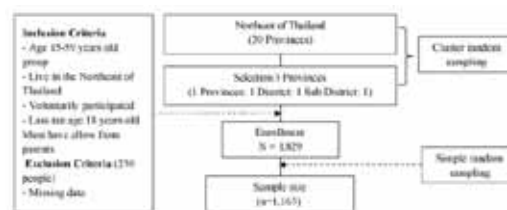


Figure 1. The inclusion flow chart of study design and sampling.

Questionnaires: The questionnaire was applied from the HLS-EU-Q Measurement of HL in Europe: HLS-EU-Q47. The questionnaire consisted of 4 parts, namely: 1) demographic characteristics, 2) knowledge about *O. viverrini*, 3) HL's 4 skills: access information, understand information, appraise information, apply information, and 4) Practice of *O. viverrini* infection. The questionnaire was validated by 7 experts and tested for its reliability. The Kuder-Richardson-20 coefficients of knowledge about *O. viverrini* question were 0.74. The Cronbach's alpha coefficients of HL and practice of *O. viverrini* infection were 0.87 and 0.76 respectively.

Statistical analysis: The primary outcome of this research was raw cyprinoid fish consumption in Northeastern Thailand. Multiple logistic regressions were used for analyzing the raw cyprinoid fish consumption and HL scores by crude, adjusted relative ratios (ORadj) and 95 % confidence intervals (CI). All analyses were performed using Stata version 10.0 (Stata Corp, College Station, TX). All test statistics were two-sided, and a p-value of less than 0.05 was deemed statistical significant.

Result

Demographic Characteristics: Among a total of 1,163 persons, a majority of them 54.34% were female, with a mean age of 42.68 ± 12.30 years old (ranged: 15-59), occupation as unemployed, a farmer and a laborer (85.47 %);, most of the family/monthly incomes were

below 5,000 baht (44.63%), alcohol consumption (47.21%), experience of using praziquantel (39.81%), and feeding dogs and cats with raw cyprinoid fish (30.01%).

Adjusted Odds ratios (OR) of raw cyprinoid fish consumption

The strongest factor that associated with raw cyprinoid fish consumption was access health information at the inadequate, followed by the

understand health information at the inadequate, appraise health information at the inadequate, apply health information at the inadequate, gender in the male, occupation as unemployed, a farmer and laborer, family/ monthly incomes below 5,000 baht and those from 5,001 to 10,000 baht, alcohol consumption, experience of using praziquantel, and feeding dogs and cats with raw cyprinoid fish; all factors listed above were found to be significantly associated with raw cyprinoid fish consumption (Table 1).

Table 1. Odds ratios (ORadj) of raw cyprinoid fish consumption and their 95% confidence intervals for each factor adjusted for all other factors presented in the table using multiple logistic regressions

Factors	Number	% Consumption	Crude OR	ORadj	95% CI	P-value
Access health information						< 0.05
Excellent	174	27.01	1	1	1	
Sufficient	217	32.26	1.28	1.21	0.70 - 2.10	
Problematic	493	49.29	2.62	1.60	0.96 - 2.65	
Inadequate	279	69.18	6.06	2.05	1.16 - 3.60	
Understand health information						<0.001
Excellent	202	29.70	1	1	1	
Sufficient	348	33.33	1.18	0.99	0.61 - 1.62	
Problematic	395	51.14	2.47	1.67	0.97 - 2.85	
Inadequate	218	80.28	9.63	2.81	1.46 - 5.43	
Appraise health information						<0.001
Excellent	164	31.10	1	1	1	
Sufficient	191	32.46	1.06	1.00	0.60 - 1.66	
Problematic	410	38.54	1.38	1.11	0.69 - 1.80	
Inadequate	398	70.85	5.38	2.35	1.38 - 3.99	
Apply health information						<0.001
Excellent	318	30.82	1	1	1	
Sufficient	278	35.97	1.26	0.77	0.49 - 1.19	
Problematic	400	53.25	2.55	1.45	0.90 - 2.34	
Inadequate	167	85.03	12.75	4.32	2.24 - 8.35	
Gender						<0.05
Female	632	38.29	1	1	1	
Male	531	58.57	2.27	1.50	1.11 - 2.03	
Occupation						<0.05
Own business & State ent.	169	28.40	1	1	1	
Unemployed & Farmer & Labor	994	50.80	2.60	2.03	1.31-3.12	
Income of family/Month (Thai Bath)						<0.05
> 10,000	272	40.81	1	1	1	
5,001-10,000	372	49.46	1.41	1.62	1.09-2.41	
≤ 5,000	519	49.71	1.43	1.57	1.09-2.28	

Factors	Number	% Consumption	Crude OR	ORadj	95% CI	P-value
Drinking Alcohol/Year						< 0.001
No	614	34.85	1	1	1	
Yes	549	61.75	3.01	1.92	1.42 - 2.61	
Using Praziquantel						< 0.001
No	700	37.14	1	1	1	
Yes	463	63.28	2.91	2.21	1.64 - 2.98	
Feeding dog and cat with raw fish						< 0.001
No	814	37.35	1	1	1	
Yes	349	71.35	4.17	4.94	3.48 - 7.00	

Discussions

HL represents the cognitive skills and social skills, a concept of healthcare, disease prevention, and health promotion settings, serving as an approach to promote and maintain good health.⁹ This HL is in need of more understanding, particularly regarding *O. viverrini* infection among the population living in the endemic areas especially in the Northeastern region of Thailand which has reported with the highest prevalence of cholangiocarcinoma incident.¹² This new finding demonstrated that HL was associated with raw cyprinoid fish consumption. Previously studies indicated that raw cyprinoid fish consumption serves as an essential factor in reinfection and chronic infection of *O. viverrini* which would develop further to be cholangiocarcinoma, the cause of morbidity and mortality in the Northeast, Thailand and Laos PDR.^{3,4,7} These findings showed that HL, namely the inadequate of access health information, understand health information, appraise health information, and apply health information, was significantly associated with raw cyprinoid fish consumption. That population group is prone to *O. viverrini* infection. Consistent with the health literacy, The low level of HL induced the poor self-management abilities in a wide range of older adults.¹³ Meanwhile, people with the high level of HL can prevent liver fluke infection owing to have low prevalence in the endemic areas.¹⁴ Cultivating and instilling high levels of literacy among a population not only is a vital development goal but will also produce substantial public health benefits.¹⁵

In addition, the present study found that feeding dogs and cats with raw cyprinoid fish was significantly associated with raw fish consumption. This result is in line with the prior study in that there was the association between *O. viverrini* infection in dogs, cats and their

owners.¹⁶ The cats that consumed raw fish were significantly more likely to be infected than those that consumed other foods.¹⁷ These findings indicated that dogs and cats are the main reservoir host of *O. viverrini* that closely habituate with human and assumed that humans and their pets are also infection. Moreover, raw cyprinoid fish consumption was associated with used praziquantel among this population. This finding was consistent with previous studies that the factor as in previous use of praziquantel was related to *O. viverrini* infection.^{3,8} Prevention and control of *O. viverrini* in the population at risk in endemic areas should also focus on the previous use of praziquantel. Furthermore, in respect of association between raw fish consumption and alcohol consumption, alcohol drinking serves as the risk factor of an increasing chance of suffering or acquiring *O. viverrini* infection.¹⁸ Unfortunately, many people in the Northeastern region of Thailand misunderstand and assume that alcohol consumption can help eradicate *O. viverrini* during their raw cyprinoid fish consumption.¹⁹ Health education for improving this risk group's HL is needed.

Demographic data including gender, occupations, family/monthly incomes and raw fish consumption were analyzed and found that males, occupation (unemployed, farmer and a laborer), family/monthly incomes (less than 5,000 baht) and (5,001 to 10,000 baht) were statistically significant. This result is in sync with other studies in that common infection was found in males, occupation (agricultural workers)^{7,20} and income (<5,000 baht/month).^{3,21} This study indicates that family/monthly incomes were less than 10,000 baht.

Conclusions

This study showed HL was associated with raw

fish consumption, access health information about *O. viverrini* infection, understand health information about *O. viverrini* infection, appraise health information about *O. viverrini* infection and apply health information about *O. viverrini* infection. Furthermore, HL may serve as a desirable strategy for informing and modifying health behavior regarding *O. viverrini* infection in community health prevention, disease prevention, and health promotion among the risk group in Northeastern Thailand.

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Ethical Clearance: This study was approved by the Ethics Committee in Human Research of Khon Kaen University, Khon Kaen, Thailand (Reference no. HE622072).

Conflict of Interest: The authors declare that there is no conflict of interest.

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