

A STUDY OF LIVER FLUKE INFECTION IN SUKHOTHAI, THAILAND

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Abstract. A cross sectional survey on opisthorchiasis was conducted from August to September 1993 in Tambon Nai Muang, Sawankhalok district, Sukhothai Province. The 1,964 villagers were stool examined and it was found that 384 of them had liver fluke infection. Of these 1,608, who were older than 12 years, were interviewed in order to detect potential risk factors of liver fluke infection. The study found that the population at risk were those older than 24 years of age ($p < 0.05$) and the possible risk factor was eating incomplete cooked fresh water fish ($p < 0.05$). The food prepared from incomplete cooked fish which was harmful to the villagers were pickle fish so called pla ra ($p < 0.05$) and papaya salad with pickle fish so called som tam pla ra ($p < 0.05$).

INTRODUCTION

Liver fluke infection is a public health problem in the tropical region. The causative helminths are *Opisthorchis viverrini*, *O. felineus*, *O. sinensis* and the dominant species in Thailand is *O. viverrini*.

The severe liver fluke infection problem in Thailand is in Northeast region (Sudan, 1954). The disease is found associated with jaundice, pancreatitis, cirrhosis and cholangiocarcinoma (Sonakul, 1987).

There have been campaigns in order to reduce liver fluke prevalence, such as health education through television and radio to warn about the harm of eating incompletely cooked fish. And another campaign was the training of villagers to be able to use microscopes to detect liver fluke ova in stools.

It is well known that humans become infected by liver flukes due to eating incompletely cooked pickled fish such as pla ra, pla som, pla jom and koi pla. In the north eastern part of Thailand the pickled fish that proved to be the reason why the people got infected was koi pla. However the people in other regions do not prefer to eat this kind of pickled fish. So it was interesting to know what kind of pickled fish potentially cause people became infected there.

In 1992, a survey was performed in four villages in Sawankhalok district. The prevalence of liver fluke infection was 21%, but only a few person preferred to eat koi pla. Consequently this study was performed to find the prevalence of liver fluke infection and the possible types of pickled fish that cause the people to became infected.

MATERIALS AND METHODS

Sawankhalok district was selected as the study area. It is governed by Sukhothai Province and about 470 km north from Bangkok. The descriptive point prevalence survey on opisthorchiasis was performed from August till September 1993. The relevant data was collected from 11 villages from totaling 12 villages in Tambon Nai Muang.

Data collection

The villagers in the study area were drawn by stratified random sampling from each villages. There were 1,964 persons included in stool examination and 1,608 villagers who were more than 12 years of age were interviewed about the behavior of eating pickled fish by means of a questionnaire. The results of stool examination were matched to the recorded data from interview then coded for micro-computer, analysis.

Analysis

The coded data was analyzed to determine the association between the prevalence and the variables using chi-square. In order to control the confounders the data were analyzed by stratified analysis and logistic regression. The statistics software used in the analysis was Epi Info and MultiLR.

RESULTS

Prevalence

The study found that there were 384 of 1,964 villagers who had liver fluke infection, so the

Table 1
The prevalence of liver fluke infection of the villagers in the specific age groups.

Age group (years)	Positive	Total examination	Prevalence (%)
0-4	1	58	1.72
5-9	4	167	2.40
10-14	17	227	7.49
15-19	16	128	12.50
20-24	22	128	17.19
25-29	41	172	23.84
30-34	42	178	23.60
35-39	55	206	26.70
40-44	41	148	27.70
45-49	29	126	23.02
50-54	37	129	28.68
55-59	32	112	28.57
60-64	19	79	24.05
65+	27	106	25.47
Overall	383	1,964	19.50

Table 2
The prevalence of liver fluke infection versus community latrine rate.

Latrine rate (%)	Positive	Total examined	Prevalence (%)
74.0 - 79.9	33	140	23.6
80.0 - 89.9	55	324	17.0
90.9 - 94.9	186	964	19.3
95.0 - 100	109	536	20.3
Overall	383	1,964	19.6

prevalence of liver fluke infection in Tambon Nai Muang, Sawaskhalok was 19.6%.

The prevalence among the specific age groups of the villagers.

The prevalence of the liver fluke infection in the specific age groups is given in Table 1, Fig1. These were few infections in the lower age groups (0-4 years and 5-9 years) but a significantly increase in the older age groups (10-14 years and 15-19 years) and finally the infection reached a plateau line in the age groups > 24 years old.

The prevalence compared with latrine rate in the community

The villagers were arranged into 4 categories regarding to the coverage of septic latrines in their

Table 3
Shown the prevalence of liver fluke infection of the villagers versus education level.

Education level	Positive	Total examination	Prevalence (%)
Non-educated	28	86	32.6
P.1-4	259	1,037	25.0
P.5-7	62	318	19.5
M.1-3	17	118	14.4
Over M.3	7	49	14.3
Overall	373	1,608	23.2

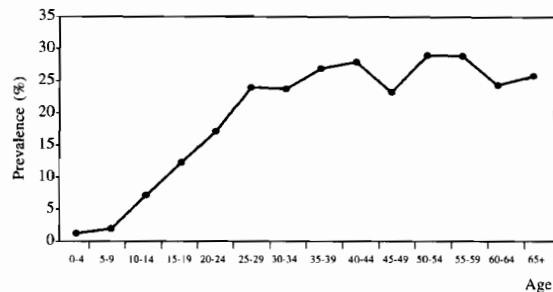


Fig 1-The prevalence of liver fluke infection of the villagers stratified by specific age group.

community (Table 2) *ie* communities with 74-79.9 % coverage, 80-89.9 % coverage, 90-94.9 % coverage and 95-100 % coverage. The prevalence among these 4 categories was not significantly different ($p > 0.05$).

The prevalence versus education level of the villagers

The villagers were classified by education level into 5 groups: non-educated, low primary school (P.1-4), high primary school (P. 5-6,7), secondary school (M.1-3) and higher than secondary school. The prevalence of liver fluke infection in specific groups were 32.6%, 25.0%, 19.5%, 14.4% and 14.3% respectively. Analysis by chi-square revealed that there was a correlation with education level ($p < 0.05$) (Table 3).

The association between prevalence and other variables

In Table 4, by chi-square analysis, the study found that among the villagers who were older than 24 years of age the infection rate was 25.7% and

Table 4

The association between the prevalence of liver fluke infection of the villagers and some variables.

Variables		Total	+ ve	P (%)	PR	95% CI	p-value
Age	≥ 24 yrs	1,256	323	25.7	1.81	1.38-2.38	< 0.0001
	< 24 yrs	352	50	14.2			
Gender	Male	749	189	25.2	1.18	0.99-1.41	0.0805
	Female	859	184	21.4			
Latrine usage	Non	40	9	22.5	0.98	0.55-1.76	0.8988
	Pit	120	32	26.7	1.16	0.85-1.59	0.4124
	Septic	1,448	332	22.9	1.00		
Incomplete cooked fish	Like	585	191	32.6	1.84	1.54-2.19	< 0.0001
	Dislike	1,023	182	17.8			
Alcohol drinking	Frequent	407	141	34.6	1.89	1.57-2.27	< 0.0001
	Occasion	134	36	26.9	1.46	1.08-1.99	0.0256
	Never	1,067	196	18.4	1.00		

Table 5

Shown the association between the prevalence of liver fluke infection of the villagers and kind of pickle fish.

Variables		Total	+ ve	P (%)	PR	95% CI	p-value
Koi pla eating	Yes	145	38	26.2	1.14	0.8-1.53	0.4325
	No	1,463	335	22.9			
Pla ra eating	Yes	993	266	26.8	1.54	1.26-1.88	< 0.0001
	No	615	107	17.4			
Pla som eating	Yes	311	93	29.9	1.39	1.13-1.69	0.0023
	No	1,297	280	21.3			
Pla jom eating	Yes	586	165	28.2	1.38	1.16-1.65	0.0005
	No	1,022	208	20.4			

among the villagers who were less than 24 years old the infection rate was 14.2%. So the villagers who were older than 24 years of age got infected 1.8 times higher than the other age group. (95% CI. 1.28-2.65, $p < 0.0001$).

Gender of the villagers did not show a significant effect on the risk of infection, since 25.2 % of male and 21.4 % of female were infected, a prevalence ratio of 1.12 (95% CI. 0.99-1.26, $p > 0.05$).

The prevalence of disease among the villagers who use septic latrines, use pit latrines and did not use latrines was 22.9%, 26.7% and 22.5% respectively, *ie* no significant different was observed ($p > 0.05$).

The villagers were grouped in to 2 groups by their answer whether they liked to eat fish or not. The prevalence of liver fluke of the villagers who like to eat fish was 32.6 % while the prevalence in the other group was 17.8%. So the prevalence of

the disease of those who liked to eat fish was 1.84 higher than those who disliked eating fish (95% CI. 1.24-2.77, $p < 0.05$).

Alcohol intake was considered to be related to liver fluke infection, since of those who never drink the infection rate was 18.4 %, while those who drink occasionally and those who drink frequently had rates 26.9% and 34.6% respectively. There was a significant different between those who frequently drink and those who never drink ($p < 0.001$) as well as between those occasionally drink and those who never drink ($p < 0.05$).

The association between the prevalence and variables concerning pickled fish

In Table 5, a simple analysis was done to determined the association between the prevalence of liver fluke infection and the kind of pickle fish eaten by the villagers. The villagers who ate koi pla had an infection rate of 26.2 % and the villagers who

Table 6
Shown the association between the prevalence of liver fluke infection in the villagers and kind of som tam.

Variables	Total	+ ve	P (%)	PR	95% CI	p-value
Som tam Thai eating	Yes	175	749	23.4	1.09	0.91-1.31
	No	189	885	21.4		
Som tam pu eating	Yes	184	723	25.4	1.19	1.00-1.42
	No	189	885	21.4		
Som tam pla ra eating	Yes	183	581	31.5	1.70	< 0.0001
	No	190	1,027	18.5		

Table 7
The prevalence of liver fluke infection of the villagers and preferring to eat incomplete cooked fish by controlling age group.

Variables	Control	PR	95% CI	p-value
Preferring to eat incomplete cooked fish	Crude	1.84	1.54-2.14	< 0.0001
	Age > 24 yrs	1.78	1.50-2.12	< 0.0001

did not eat koi pla had an infection rate of 22.9 %. The difference was not significant ($p > 0.05$).

The prevalence of disease in villagers who ate pla ra was 26.8% and the prevalence of disease in villagers who did not eat pla ra was 17.4%, *ie* the prevalence in the villagers who ate pla ra was 1.54 times higher than those who did not (95%CI = 1.26 - 1.88, $p < 0.05$).

The prevalence of disease of villagers who ate pla som was 29.9% and the prevalence of disease of villagers who did not eat pla ra was 21.3%, *ie* the prevalence of the villagers who ate pla ra was 1.39 times higher than those who did not (95%CI = 1.13 - 1.69, $p < 0.05$).

The prevalence of disease of villagers who ate pla jom was 28.2% and the prevalence of disease of villagers who did not eat pla ra was 20.4%, *ie* the prevalence of the villagers who ate pla ra was 1.38 times higher than those who did not (95%CI = 1.16 - 1.65, $p < 0.05$).

The association between the prevalence and some kinds of som tam

Papaya sour spicy salad, so called som tam, is a flavored light food of the people in many regions in Thailand. There are 3 kinds of som tam: Som tam pla ra referred to as som tam including pla ra, som tam Thai referring to som tam including pea-

nuts and som tam pu referring to som tam including pickle salted crab. The association between the fluke prevalence and kind of som tam is shown in Table 6.

The liver fluke prevalence among the 2 groups of the villagers who ate som tam Thai and who did not was 23.4% and 21.4% respectively, but this was not significant different ($p > 0.05$).

The liver fluke prevalence among the 2 groups of villagers who ate som tam pu and who did not was 25.4% and 21.4% respectively, not significant different ($p > 0.05$).

The liver fluke prevalence among the villagers who ate som tam pla ra and who did not was 31.5% and 18.5% respectively, *ie* the liver fluke prevalence of the villagers who ate pla ra was 1.7 time higher than the other group (95% CI. 1.43-2.03, $p < 0.0001$).

Multivariate analysis

Multivariate analysis was preformed in order to control the confounding effect. The significant potential variables such as age of the villagers, preferring to eat incomplete cooked fish, kind of pickled fish eaten, and type of som tam were analyzed by stratified analysis and logistic regression. But even through alcohol drinking had shown statistical association with liver fluke infection, it was not con-

Table 8

The association between the prevalence of liver fluke infection of the villagers and kind of pickle fish.

Variables	Coefficient	SE	p-value	Odds ratio	95% CI
Constant	-2.203	0.178	0.000	-	-
Pla ra	0.432	0.134	0.001	1.541	1.185-2.003
Pla som	0.254	0.150	0.082	1.298	0.967-1.742
Pla jom	0.237	0.131	0.072	1.267	0.979-1.639
Age > 24 yrs	0.707	0.167	0.000	2.027	1.462-2.812

Table 9

Shown the association between the prevalence of liver fluke infection of the villagers and som tam pla ra.

Som tam Pla ra	Eat pla ra				Not eat pla ra			
	Total	+VE	PR	p-value	Total	+VE	PR	p-value
Eat	520	153	0.94	0.0583	61	30	3.05	< 0.0001
Not eat	360	113	-	-	477	77	-	-

sidered as a possible risk factor, because regarding biological possibility, *ie* life cycle of the liver fluke which includes *Bithynia* snails and Cyprinoid fish, man could not get metacercaria from alcohol.

Effect of preferring to eat incompletely cooked fish

The effect of preferring to eat incomplete cooked fish was studied by controlling age group as a confounder by stratified analysis. The villagers who preferred to eat incompletely cooked fish had liver fluke infection 1.78 time higher than the villagers who did not ($p < 0.05$) as shown in Table 7.

Effect of eating some kind of pickle fish

In Table 8, the effect of eating pla ra, pla som, pla jom and age group of the villagers were studied by logistic regression. There was a significant effect on liver fluke by eating pla ra and according to age group of the villagers. The villagers who ate pla ra got infected 1.54 time higher than the villagers who did not ($p < 0.05$). Those who were older than 24 years old got infection 2.027 times more than those who were younger.

Effect of eating som tam pla ra

The effect of eating som tam pla ra was studied by controlling the effect of eating pla ra. Among the villagers who ate pla ra, those who ate som tam pla ra got liver fluke infection 1.23 time higher than those who did not ($p = 0.058$). And among the villagers who did not eat pla ra, those who ate som

tam pla ra got liver fluke infection 3.54 time higher than those who did not ($p < 0.05$).

DISCUSSION

The prevalence of liver fluke infection in this study was 19.5% and found to be lower in younger villagers and higher in older villagers which agrees with another studies (Harinasuta, 1959 : Upatham *et al*, 1983 : Luong Dinh Gaip *et al*, 1983 : Zhuravlev *et al*, 1989 : Noojoy *et al*, 1992).

The latrine coverage rate did not play an important role in the prevalence of liver fluke infection in this study. So this study did not agree with some previous studies (Preuksaraj, 1984 : Sornmani *et al*, 1987 : Gorbunova *et al*, 1989) which found a positive correlation with latrine rate. It may be due to the fact that the lowest latrine coverage rate in this study area was 74 % which is sufficient to prevent the distribution of liver fluke ova; in addition that there was no big water reservoir in the study area for maintaining the life cycle of liver fluke.

Then the variables considered to relate to liver fluke infection were age of the villagers, preferring to eat incompletely cooked fish such as pla ra and som tam pla ra. Then to apply the outcome of this study to control liver fluke infection should be aware the people to avoid eating not only koi pla but also raw pla ra. The appropriate target population to be educated about liver fluke for controlling should be

those who are you not more than 24 years. And those who are older than 24 years should be controled by stool examination and radical treatment.

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