RESEARCH ARTICLE

Prevalence and Risk Factors for *Opisthorchis viverrini* Infections in Upper Northeast Thailand

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Abstract

***Opisthorchis viverrini* is an ongoing public health problem in Northeast Thailand. Despite continuous efforts for decades by healthcare organizations to overcome this problem, infection rates remain high. To enable related personnel to identify and address the various issues effectively, a cross-sectional study was performed to investigate prevalence and risk factors for opisthorchiasis. The target group was 3,916 Thai residents of Northeast Thailand who were 15 or over. Participants were recruited using the 30 clusters sampling technique. The data were gathered through questionnaires, focus group discussions, in-depth interviews, and stool examinations for parasite eggs (using the Modified Kato Katz method). The data were analyzed using descriptive and inference statistics; in order to ascertain the risk factors and test them using the odds ratio and multiple logistic regressions. The prevalence of opisthorchiasis was 22.7% (95%CI: 0.26 to 0.24). The province with the highest prevalence was Nakhorn Phanom (40.9%; female to male ratio =1:1.2). The age group with the highest prevalence was 40-49 year olds. All age groups had a prevalence >20%. Four of seven provinces had a prevalence >20%. The factors related to opisthorchiasis were (a) sex, (b) age (especially > 50), (c) proximity and duration living near a water body, and (d) eating raw and/or fermented fish. In order to reduce the prevalence of opisthorchiasis, the focus in populations living in upper Northeast Thailand should be changing their eating behaviors as appropriate to their tradition and context.**

Keywords: Prevalence - *Opisthorchis viverrini* - risk factors - North East Thailand

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Introduction

Between 8-10 million people in Asia are infected with the *Opisthorchis viverrini* (Ov). Sripa et al. (2010) reported that eating raw carp (Cyprinoid fish) infested with Opisthorchis metacercaria the parasite to the gall bladder, resulting in irritation, inflammation and blockages of the biliary system. After decades of chronic inflammation, cholangiocarcinogenesis occurs in subset of infected persons.

Opisthorchis infection among Northeastern directly stems from the habit of eating uncooked infested Cyprinoid fish and fermented fish (rich in nitrosamines a known carcinogen) (Jongsuksuntigul and Imsomboon, 2003).The high incidence and wide-spread prevalence of Opisthorchiasis will persist (Vatanasapt et al., 1990) unless these eating habits are changed and/or the infestations are eliminated (Rangsin et al., 2009).

The respective prevalence of opisthorchiasis in Thailand in 1991, 1996, 2001 and 2009 was 15.2, 11.8, 9.6 and18.6 (Wongsaroj et al., 2009). Rather than curbing consumption of infested fish, rising infection rates suggest the opposite. Interestingly, the variation in prevalence by sub-area was between 19.4 and 41.9%. Sithithaworn et al. (2012) found that in Thailand prevalence was highest up country and in low-lying areas. Wattanayingcharoenchai et al. (2011) confirmed that those at highest risk ate raw fish and uncooked fermented fish and lived near wetlands and canals. Male socialization patterns have men eating raw fish more than females: consequently, an infection rate in males is higher than females (Kaewpitoon et al., 2012a; 2012b). The age group with the highest prevalence was between 20 and 35, possibly as this group resists changes to patterned socialization (Saengsawang et al., 2012). An important fact was that after eating risky food people could take praziquantel, they return to eating cultural dishes which are likely to lead to a further ov infection. (Wongba et al., 2011). Therefore, the cycle is perpetuated. Previous studied found that the past use of praziquantel associated with OV infection (Saengsawang et al., 2013) and in hamsters infected with ov reported repeated infection and drug treatment can increase the risk of CCA (Charoensuk et al., 2011). Contrast with study of supot kamsa-ard et al. (2013) found that praziquantel treatment and CCA was

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not statistical significant with a pooled OR of 1.8 (95%CI; 0.81 to 4.16).

The Ministry of Public Health set up a campaign to prevent opisthorchiasis. It did so by providing knowledge to people and cathartic treatment to those diagnosed as having parasite eggs (Jongsuksuntigul and Imsomboon T, 2003). A follow-up is, therefore, needed to determine whether opisthorchiasis remains a problem and if so what the current prevalence is by area (having different traditions, environments and local considerations). We set out to(a) investigate (i) the prevalence and (ii) risk factors of those living in upper northeast Thailand and (b) -discover area-specific prevention strategies.

Materials and Methods

This was a cross-sectional study. The study period was between February and October, 2013. The target provinces were Nakhonphanom, Sakonnakhon, Udonthani, Nongkhai, Bungkan, Nongbualamphu and Loei with a total of 4,568,900 inhabitants. The target group comprised 3,916 people, living in the target area for at least 6 months, and over 15 years of age. All were willing participants.

The subjects were chosen by using 30 Clusters Sampling Technique from 7 provinces which represent the whole population in upper northeast. Modified Kato Katz technique was applied to identify the prevalence of opisthorchiasis. Most of the participants were farmers, living in a variety of geographic locations: plain, plateau and mountains. The Mekong River was not far from some provinces such as Loei, Nongkhai, and Nakhonphanom. Some provinces have natural water resources—i.e., the Songkram canal, Gum canal and Eun canal in Sakonnakhon and Nakhonphanom Provinces and the Nhonghan swamp and some other lakes and canals in Udonthani Province.

The research tools included interviews, focus groups, in-depth interviews and stool testing (Modified Kato Katz method). The research team started the survey after the research protocols had been considered and approved by the Human Research Ethics Committee at Khon Kaen Hospital (21/10/2013). The descriptive statistics and analytical statistics were introduced to explain the relationship of involved factors related to Opisthrochiasis using the chi-square test, Odd ratio, and Multiple Logistic Regression Analysis.

Results

Stool testing was done on 3,916 persons in the target group. The prevalence of opisthorchiasis was 22.7% (95%CI, 0.26 to 0.24): the highest prevalence was in Nakhonphanom (40.9%). In four of the seven provinces, the prevalence was >20% (Figure 1).

The top 10 villages among the 210 surveyed, which had the highest prevalence of opisthochiasis are presented in Table 1. Ankam village, Tao Ngoi had the highest at 80%.

The highest prevalence was among those between 40 and 49 years of age, representing49.6% and each age group had a prevalence> 20% (Figure 2).

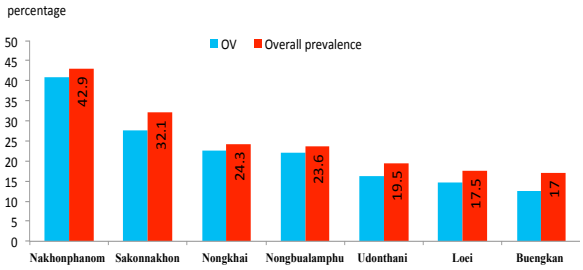

Figure 1. Prevalence of Opisthorchiasis by Area

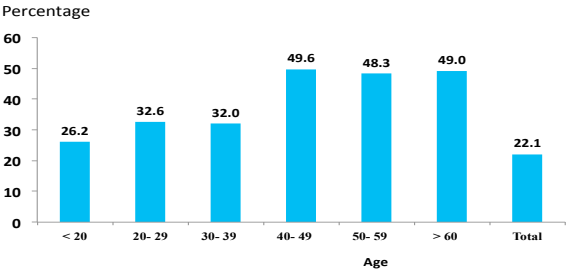

Figure 2. Prevalence of Ophisthochiasis by Age Group

Table 1. Top 10 Villages with the Highest Prevalence of Opisthochiasis in Upper Isaan

Village	District	Province	No. stool	Overall (%)	OV (%)
Ankam	Tao Ngoi	Sakonnakhon	25	84	80
Kongswang	Banphang	Nakhonphanom	23	78.3	78.3
Donpang	Banphang	Nakhonphanom	12	75	75
Thai sammakee	Muang	Nakhonphanom	18	72.2	72.2
Maijampa	Tart Phanom	Nakhonphanom	29	72.4	68.9
Nhongbuakam	Faorai	Nongkhai	16	62.5	62.5
Hamhakngaew	Ponsawan	Nakhonphanom	23	65.2	60.9
Nonmunpla	Faorai	Nongkhai	17	58.8	58.8
Huaihai	Ponsawan	Nakhonphanom	29	62.1	58.6
Pukratae	Srisongkam	Nakhonphanom	29	58.6	58.6

Table 2. Prevalence of Ophisthochiasis in Upper Isaan

Prevalence of ophisthochiasis (%)	n=210	%
61-80	7	3.3
40-60	34	16.2
21-40	55	26.2
1-19	93	44.3
0	21	10
Total	210	100

Prevalence can be classified as level of infection in each area. The area where has percentage of prevalence between 1-20% covers 44.3%. The minor position is prevalence's percentage between 21-40% which covers 26.2%. However, the area with has 0% of prevalence covers 10 % (Table 2).

Factors related to infection with ophisthochis

After doing the univariate analysis of ophisthochis infection, the factors related to infection were (a) sex 1.5(1.29 to 1.73), (b) age over 40 2.1 (1.56 to 2.84), (c) career 1.6 (1.3. to 1.55), (d) water resource habitat 1.6(1.38 to 1.90), (e) time lived in that area 1.5(1.25 to 1.67), (f) alcohol consumption 1.4 (1.16 to 1.56), (g) having ophisthochis infection 2.1 (1.59 to 2.73), (h) eating

Table 3. Relationship among Factors in Opisthorchis Infection when Variables Controlled

Factors	Total number	Infected %	Crude OR (95%CI)	Adjusted OR(95% CI)
Sex				
Female	2,134	21.6	ref	ref
Male	1,782	29.2	1.5 (1.29-1.73)	1.2 (1.01-1.44)
Age (years)				
<20	455	14.3	ref	ref
20-29	500	18.8	1.3 (0.93-1.84)	1.2 (0.80-1.67)
30-39	665	22.6	1.8 (1.34-2.51)	1.4 (0.96-1.95)
40-49	881	26.2	2.1 (1.56-2.84)	1.4 (0.97-2.00)
50-59	750	32.1	2.5 (1.84-3.38)	1.6 (1.09-2.28)
>60	665	29.9	2.5 (1.82-3.36)	1.5 (1.05-2.27)
Water Resource Habitat				
No	1,324	19.6	ref	ref
Yes	2,592	27.8	1.6 (1.35-1.86)	1.5 (1.26-1.73)
Having used to take medicine for Opisthorchis				
No	3,505	25.4	ref	ref
Yes	411	21.4	0.79 (0.62-1.02)	1.4 (1.06-1.80)
Having Opisthorchis infection record				
No	3,682	24.1	ref	ref
Yes	234	40.2	2.08 (1.59-2.73)	1.8 (1.31-2.39)
Eating raw fish				
No	1,834	15.2	ref	ref
Yes	2,082	33.7	2.86 (2.44-3.34)	2.2 (1.78-2.59)
Eating fermented fish				
No	520	1.9	ref	ref
Yes	3,396	27	2.73 (2.07-3.60)	2.0 (1.45-2.63)

raw fish 2.9(2.44 to 3.34) and (i) eating unripe papaya salad with fermented fish 2.7(2.07 to 3.60). Multiple logistic Regression Analysis was the used to investigate Ophisthorchis infection factors. The remaining 6 variables were: *i*) sex; *ii*) age; *iii*) water resource habitat; *iv*) having used to take medicine for Ophisthochis infection; *v*) having an Ophisthochis infection record and *vi*) eating raw fish, raw fish salad or fermented fish (Table 3).

Discussion

We tested the stool of 3,916 subjects for Opisthorchis (using Modified Kato Katz). The respective sensitivity and specificity of this method is 85.5% and 68.7% (Stensvold et al., 2006). We discovered that the prevalence of Opisthorchis was 22.7% while the highest prevalence in one village was 80%-these numbers are comparable to the 0-80% found in other studies (Sriamporn et al., 2004; Rangsin et al., 2009; Saengsawang et al., 2012). Infected patients under 20 represented 26.2% of the total. In areas where prevalence was 0, villagers took medicine a few times a year. Saengsawang et al. (2013) discovered that 60% of people took praziquantel for opisthorchiasis and yet the prevalence in upper Isaan has not been significantly reduced, which seems paradoxical since overall the infection rate in Thailand as a whole has fallen (Wongsaroj et al., 2009) and the number of liver cancer patients and cholangiocarcinoma patients has been stable (Sriamporn et al., 2004).

The highest prevalence was among those between 50 and 59 years of age (31.5%) (29.2% more males than females); similar to the studies by other studied (kaewpitoon et al., 2012a; 2012b). By contrast, Sangsawang et al. (2013) discovered that OV infection was highest in the 20-35 year age group. Men drink alcohol in groups and 'prove' themselves by eating anything, cooked or uncooked. As Rangsin et al (2009). The study revealed that people in 50-60 year were still eating foods at risk of causing infection.

People who lived near canal, lake or river were 1.5 times more at risk of Opisthorchis infection than those who lived several kilometers away; due to disease vectors such as snails, their metacercania and the cyprinoid fish that they infect (Forrer et al., 2012). By contrast, Tesana et al. (1991) discovered that even villages relatively from a river had higher infection(52.2%) than those nearer (24.7) ($p<0.005$). Eating raw freshwater scaly fish (Cyprinids) and fermented fish paste (wherever it is made or by whom) increases the risk for Opisthorchis infection (Rangsin et al., 2009). Northeast people enjoy the flavor of this fish and believe that fluke infestations can be eliminated thereby removing any risk of cancer (Wongba et al., 2011), so they do not change their behavior and repeatedly re-infect themselves. In this study found that having used to take praziquantel drug associated with OV infection; similar to the studies by Sangsawang et al. (2013).

A solution for infection prevention needs to be quickly investigated especially for middle-aged males. When people engage in less risky behaviors, the need and consumption of anti-anthelminthic treatment will be reduced. A health education campaign needs to be organized in areas adjacent to rivers and lakes. The respective outreach must match the environmental context, the population demographics and cultural sensitivities. Above all, the youth need to be educated to be the new eating habit role models.

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