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The Prevalence of *Opisthochis viverrini* Infection and Behavior of Cyprinid Fish Consumption in Lam Nam Oon Wetland, Sakon Nakhon Province, Thailand

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Abstract.

Opisthorchiasis remains a significant public-health problem in northern and northeastern Thailand. Sakon Nakhon Province is endemic for *Opisthorchis viverrini*, and the infection's link to cholangiocarcinoma is well established. This study aimed to estimate the prevalence of *O. viverrini* and to identify factors associated with *O. viverrini* infection in the Lam Nam Oon wetland area of Sakon Nakhon. A total of 248 residents were enrolled. Stool specimens were examined using the Kato–Katz thick smear technique, and structured questionnaires assessed knowledge, attitudes, and fish-consumption behaviors related to opisthorchiasis.

Results showed that 9.68% of participants had helminth infections, with *O. viverrini* being the most common (5.24%). Mixed infections involving *O. viverrini* and other species occurred in 2.0% of participants. Knowledge scores were high, and attitudes and preventive behaviors regarding liver fluke were generally good. A prior history of *O. viverrini* infection, eating undercooked fish, and knowledge, attitude, and behavior scores were significantly associated with opisthorchiasis ($p < 0.05$). These findings suggest that the traditional practice of eating undercooked cyprinid fish still exists. Therefore, community participation together with targeted intervention programs should be implemented in this area.

Keywords: *Opisthorchis viverrini*, opisthorchiasis, cholangiocarcinoma, cyprinid fish consumption, Northeast Thailand

1. Introduction

Opisthorchis viverrine infection remains a major neglected tropical disease in Southeast Asia, with >40 million people infected and >340 million at risk—especially in Lao, Cambodia, southern Vietnam, and Thailand (WHO, 2025; Sripa et al., 2021). Chronic infection is strongly linked to cholangiocarcinoma (CCA), a lethal bile-duct cancer with poor outcomes (Khuntikeo et al., 2015). In Thailand, the burden persists: a 2024 meta-analysis estimated a pooled prevalence of 18.19%, while northeastern estimates range from 13.1% by stool examination to 50.2% by urine antigen assay (Kopolrat et al., 2025). CCA incidence mirrors this exposure, with an age-standardized rate of 8.9 per 100,000 nationwide and 13.4 per 100,000 in the Northeast, a recognized hotspot (~32 per 100,000) (Sithithaworn & Andrews, 2023).

In Sakon Nakhon, community data show rising *O. viverrini* prevalence (3.6% to 7.0% during 2018–2020), driven by raw cyprinid fish consumption; domestic dogs and cats likely sustain transmission as reservoir hosts (Perakanya et al., 2022; Aunpromma et al., 2012). Given these challenges and the lack of updated data from wetland communities along the Lam Nam Oon wetland, this study aims to investigate the prevalence of *O. viverrini* infection and fish consumption behaviors among residents of Sakon Nakhon Province. The findings will provide crucial evidence to guide surveillance and develop targeted health promotion strategies for opisthorchiasis and CCA prevention.

1.1 Research Objective

1. To investigate the prevalence of *O. viverrini* infection among populations residing in communities adjacent to the Lam Nam Oon wetland, Sakon Nakhon Province, Thailand
2. To assess the knowledge, attitudes, and fish consumption behaviors related to the risk of *O. viverrini* infection among residents in the Lam Nam Oon wetland, Sakon Nakhon Province, Thailand
3. To exam factors associated with *O. viverrini* infection among residents living in the Lam Nam Oon wetland communities, Sakon Nakhon Province, Thailand

2. Literature review

Opisthorchiasis is caused by three liver flukes—*O. viverrini*, *Clonorchis sinensis*, and *O. felineus*—with *O. viverrini* predominating in Thailand and the Mekong region (WHO, 2025; Sithithaworn & Andrews, 2023). Its tri-host life cycle involves *Bithynia* snails (first intermediate host) and cyprinid fish (second intermediate host); humans acquire infection by eating raw or undercooked infected fish, and dogs/cats act as reservoirs (Sripa & Tangkawattana, 2020; WHO, 2025).

Transmission persists where raw/undercooked cyprinid dishes are culturally favored, sanitation is suboptimal, and competent snail and fish hosts co-occur; improper disposal of raw fish waste further sustains environmental contamination (WHO, 2025; Sripa & Tangkawattana, 2020). Chronic biliary inflammation and fibrosis from long-standing infection constitute a Group 1 carcinogenic exposure and drive cholangiocarcinoma risk (Sripa & Tangkawattana, 2020).

Field diagnosis relies on stool microscopy: direct smears are rapid but less sensitive; concentration methods (FECT) and standardized Kato/Kato–Katz thick smears improve detection and enable egg quantification. Immunodiagnosics (e.g., ELISA, antigen assays) complement microscopy, particularly in low-intensity or obstructive disease, provided specimens are collected and preserved appropriately (Ritchie, 1948; Kato & Miura, 1954; Katz et al., 1972; Sripa & Tangkawattana, 2020).

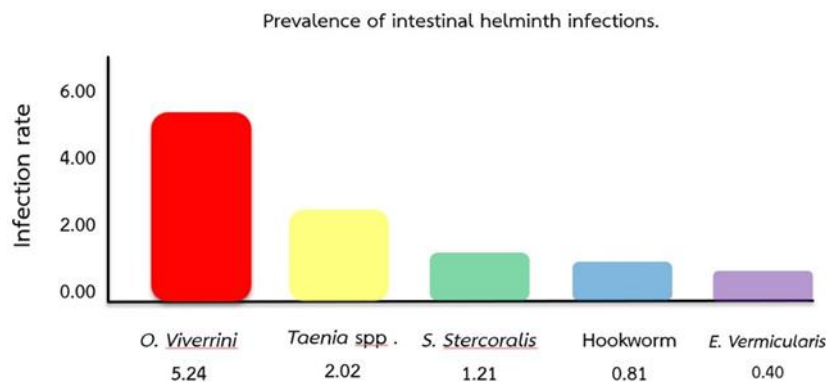
3. Methodology

3.1 Study design

We conducted a community-based cross-sectional study to estimate the prevalence of *O. viverrini* infection and to assess knowledge, attitudes, and risk-related fish-consumption practices among residents living around the Lam Nam Oon, Sakon Nakhon Province, Thailand. Fieldwork was carried out from March to December 2023.

3.2 Data Collection

Data were collected in communities surrounding the Lam Nam Oon wetland, Sakon Nakhon Province, Thailand. 248 adults (18–60 years; residency ≥ 6 months) after obtaining written informed consent. Each participant was assigned a unique study ID linking the questionnaire and laboratory records. Interviewers administered a structured instrument covering knowledge of opisthorchiasis, attitudes toward prevention, and fish-consumption practices. Participants received a labeled, leak-proof container with pictorial instructions and were asked to submit a fresh morning stool specimen at the village collection point. Specimens were transported in insulated carriers to the field laboratory and examined for *O. viverrini* eggs using the Kato–Katz thick-smear technique (two smears per specimen). Participants with positive results were counseled on safe fish preparation and referred for treatment guidelines.



3.3 Statistical analysis.

Data were analyzed in Stata 17. Descriptive statistics summarized participant characteristics, KAP scores, and infection prevalence. Chi-square tests assessed associations between infection status and covariates; statistical significance was set at $\alpha = 0.05$.

4. Results

4.1 Characteristics of participants

A total of 248 residents participated; 51.2% were female and the mean age was 46.3 ± 9.8 years. Most had primary education (60.5%), were married/partnered (88.3%), worked in agriculture (64.1%), and reported monthly income $< 5,000$ THB (75.8%). Ever consumption of raw/undercooked freshwater fish was 73.8%; prior stool examination 45.6%; prior deworming 48.8%; alcohol use 55.6%; and households with reservoir pets 60.0%. Most had received information on liver fluke (89.1%).

4.2 Parasite prevalence

Overall intestinal helminth prevalence was 9.68%. *O. viverrini* was most frequent 5.24% (A), followed by *Taenia* spp. 2.02% (B), hookworm 1.21% (D), *Strongyloides stercoralis* 0.81% (C), and *Enterobius vermicularis* 0.40% (E).

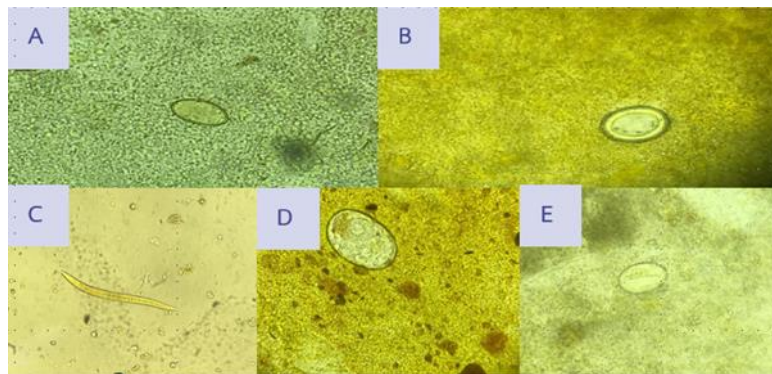
Figure 1. Prevalence of intestinal helminth infections among residents living near the Lam Nam Oon wetland, Sakon Nakhon Province, Thailand, as determined by the Kato–Katz thick-smear technique.

4.3 Knowledge, attitudes, and practices (KAP)

Knowledge scores were predominantly high (50.8%). Attitudes were good overall (55.65%). Risk-related consumption practices were also classified as good (68.95%). Common misconceptions persisted (e.g., believing fresh raw fish is safe, or that post-consumption deworming prevents infection).

4.4 Factors associated with infection

In bivariable analyses, family history of opisthorchiasis ($p=0.003$) and family history of cholangiocarcinoma ($p=0.002$) were significantly associated with *O. viverrini* infection. Consumption of several raw/undercooked cyprinid species showed positive associations (e.g., spotted barb, back-spine fish, white gut-eye fish, dove-minnow, etc.; all $p<0.05$). Specific knowledge items correlated with infection, including recognition of liver flukes in scaled freshwater fish ($p=0.04$), life-cycle linkage to fish ($p=0.01$), and the (incorrect) belief that eating raw fish followed by deworming is protective ($p=0.006$); agreement that raw fermented fish/meat products can co-contribute to CCA also showed an association ($p=0.009$). One attitude item—perceiving that cooking fish “takes too much time”—was associated with infection ($p=0.02$). The raw dish “Lu” was the only consumption behavior with a statistically significant association ($p=0.003$).



5. Conclusion

O. viverrini prevalence was ~5% (overall helminths ~10%) in Lam Nam Oon communities. Despite generally good knowledge, persistent misconceptions and raw cyprinid fish practices sustain transmission, with household histories of opisthorchiasis/CCA indicating shared risks. Control should prioritize culturally tailored behavior change targeting high-risk dishes, integrate One Health measures (pet deworming, sanitation, safe fish-waste disposal), expand screening and timely treatment, and adopt more sensitive diagnostics; longitudinal or intervention studies are warranted to demonstrate sustained impact.

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