

CURRENT STATUS OF FOOD-BORNE PARASITIC ZOOSES IN LAOS

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Abstract. Stool samples from a total of 1,008 persons were examined for intestinal parasites during a comprehensive study on the epidemiology of small fluke infections in Laos. The prevalence of small fluke eggs in the stool was seen to peak at age 20 years, particularly in men from villages (90.4%). Three quarters of infections belong to the category of light infections and only 0.6% to the category of very heavy according to eggs per gram of feces (EPG). The highest EPG was in the 11-15 year age group. In addition, the following parasites were diagnosed: *Sarcocystis hominis* (prevalence more than 10% in the group over 20 years of age), *Taenia* sp. (12.4% for the village people over 20 years), *Fasciolopsis buski* (3.8% for the same group). The habit of Laos people to eat raw fish, beef and pork flesh, is reflected in significant epidemiological consequences.

Cercariae of *Opisthorchis viverrini* occurred in 0.5% of *Bithynia siamensis goniomphalus* examined, *Haplorchis* sp. cercariae were found in 0.9% of *Tarebia granifera* snails.

Metacercariae of *O. viverrini* were found in flesh of 7 species of cyprinid fish. *Haplorchis taichui* in 4 species of these fish, and *H. pumilio* of two cyprinid species. *Hampala macrolepidota* harbored larvae of all above mentioned species. *Stellantchasmus falcatus* was recovered in fins of belonid fish *Xenentodon canila*.

Adults of *O. viverrini* were found in 36% of domestic and stray cats, Heterophyid flukes were found in 24% cats. The most frequent species were *H. taichui* and *H. yokogawai*. Eight Laotian students were treated in Czechoslovakia with praziquantel to determine fluke infection. Three were infected only by *O. viverrini*, four only by *H. taichui* and one by both *O. viverrini* and *H. taichui*.

These results demonstrate the problem of correct differential diagnosis of food-borne small fluke infections and the need to assess the clinical course and public health aspects of infections.

INTRODUCTION

There are only a few out-dated records on food-borne parasitic zoonoses in Laos (Segal *et al*, 1968; Sornmani *et al*, 1974; Sicard *et al*, 1977). Our interest in this topic has been initiated by the results of parasitological surveys in Laotian students in Czechoslovakia. Among examined students of the same age (18-30 years) from Cambodia, Laos and Vietnam, those from Laos had the highest prevalence of small fluke infections, a prevalence of 51.4% of 224 examined students (from Cambodia, 2.6% of 114 examined; from

Vietnam, 0.2% of 1,554 examined). During the microscopical stool examination, different patterns of small fluke eggs were found. Subsequent study of the small fluke eggs from Laotian students, eggs of *O. viverrini* from Thailand, eggs of *O. felineus* from the Soviet Union and from Egypt, was carried out using scanning electron microscopy. A comprehensive study of the epidemiology of human small fluke infection in Laos was performed from May till September 1989. Separated data from this field study are given elsewhere (Ditrich *et al*, 1990a; Giboda *et al*, 1990, 1991; Scholz 1991).

MATERIALS AND METHODS

Study area

Vientiane Province was selected for the study due to access by available transport and because a large 420 square kilometer man-made lake on the Nam Ngum River is located in its territory. Vientiane and its municipality, Keoudom and Thoulakhon districts were main areas of activities (Ditrich *et al.*, 1990b; Giboda *et al.*, 1991).

Population survey

A total of 1,008 persons were examined for intestinal parasites. Single stool specimens from 147 families in the camps of the electric power station (EPS) were examined by MIFC. Altogether 85% of the total population of EPS camps were examined. Stools from 232 volunteers, mostly over 20 years old, from the villages on the banks of the Nam Ngum reservoir were also examined by the Kato-Katz method. The intensity of infection was calculated from two slides by the Kato-Katz technique and expressed as eggs per gram of feces (EPG) (Giboda *et al.*, 1991).

Eight Laotian students (18-22 years of age) studying in Czechoslovakia were treated with praziquantel (single dose of 40 mg/kg) after the eggs of small flukes were found in stool. The drug was given at 12 p.m. followed by purging with magnesium sulphate (40 ml of 50% solution) two hours later. All post treatment stools were collected routinely for up to 3 days. Fecal EPG values were determined before treatment by the Kato-Katz technique. Stool examination for expelled worms was carried out according to the method of Radomyos *et al.* (1983). Efficacy of the treatment was assessed by repeated stool examinations for 3 months after treatment.

Malacological survey

A total of 6,520 water snails collected in Vientiane municipality, Keoudom and Thoulakhon districts were examined for the larval stages of trematodes. Cercaria shedding was observed 24 hours after snails were placed in individual test tubes. Afterwards the snails were dissected and the final prevalence determined (for details see Giboda *et al.*, 1991).

Fish survey

Fish were caught in irrigation canals of the paddy-fields in the Vientiane Province, the Mekong River in Vientiane, and the Nam Ngum reservoir. The flesh of 782 fish of 44 species were examined for metacercariae by the compression method, and the fins of 202 fish were examined (Scholz *et al.*, 1991).

Cat survey (animal definitive host)

A total of 55 domestic and stray cats (*Felis catus*, *F. domestica*), 28 from the Vientiane capital and 27 from Keoudom district were examined for helminth infections. Additionally, one wild cat (*Prionailurus bengalensis*) from the area of Nam Ngum Dam was examined.

RESULTS

Population survey

Three species of food-borne parasites and eggs of small flukes *O. viverrini* and Heterophyidae were diagnosed in examined groups (Table 1). Small fluke infection has the predominant position among them with the higher prevalence in the village people. The same cohort demonstrated higher frequency of the other three parasites in comparison with the cohort from EPS. The age-related prevalence of all species tends to reach its maximum at 20 years of age. *Sarcocystis hominis* and *Taenia* sp. demonstrated high frequency as well. Kato-Katz technique demonstrated good diagnostic feasibility for oocysts and sporocysts of *Sarcocystis hominis*. Intensity of 445 small fluke infection pattern demonstrates the 76.2% proportion of light infection (1,000 EPG) and a low frequency (0.6%) of very heavy intensity (Fig 1). The intensity of *O. viverrini* infection reach its peak in the 10-14 age group followed by the 20-29 and 30-39 years old. Three of 8 Laotian students treated in Czechoslovakia were infected by *O. viverrini* only, four by *Haplorchis taichui* only and one by both *O. viverrini* and *H. taichui*. The most *H. taichui* flukes were expelled in the first stool sample after purgative application. The *O. viverrini* flukes are expelled mostly in the second and subsequent fecal samples.

Snails

Only *Bithynia siamensis goniomphalus* was

Table 1

Prevalence of food-borne parasites in Nam Ngum Dam camps and village people, Keoudom District, Vientiane Province, 1989.

Parasites	Nam Ngum Dam camps* n = 535			Village people** n = 232		
	15 years n = 123	16-19 years n = 92	20 years n = 320	15 years n = 6	16-19 years n = 16	20 years n = 210
<i>Sarcocystis hominis</i>	3 (2.4%)	2 (2.2%)	32 (10.0%)	0	1 (6.3%)	23 (10.9%)
<i>Fasciolopsis buski</i>	0	0	3 (2.4%)	0	1 (6.3%)	8 (3.8%)
<i>Opisthorchis viverrini</i> and Heterophyidae	72 (58.5%)	26 (28.3%)	181 (56.6%)	4 (66.7%)	10 (62.5%)	180 (85.7%)
<i>Taenia</i> sp.	2 (2.2%)	4 (4.4%)	13 (4.0%)	0	1 (6.3%)	26 (12.4%)

Stool examined using: *MIFC method
**KATO-KATZ method

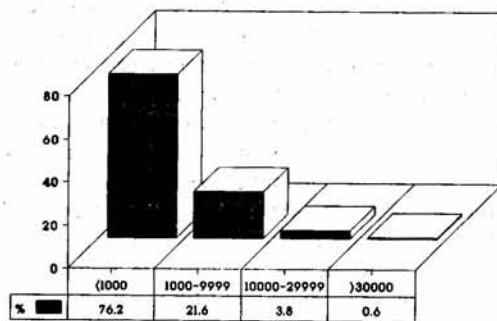


Fig 1—Eggs per gram level proportion among the persons infected with small flukes.

found to be shedding cercariae of *O. viverrini*, a 0.6% positivity rate (Table 2). *H. taichui* cercariae were shed by 0.1% *Tarebia granifera* snails from Nam Ngum Dam Lake. *Helicorbis umbilicalis* snails were identified as intermediate host of *Fasciolopsis buski* and *Radix auricularia rubiginosa* of *Fasciola gigantica*. The cercariae shed by *Indoplanarbis exustus* were identified as *Schistosoma spindale*. In the feces of a patient from Mahosot Hos-

pital in Vientiane a single *Schistosoma* egg resembling those of *S. spindale* was found. Many of the molluscan species frequently consumed by Laotians (in Table 2 indicated with asteriks) can serve as an intermediate host of human food-borne parasites.

Fish

Opisthorchis viverrini metacercariae were found in the flesh of seven species of cyprinid fish of which *Cyclocheilichthys repasson* was the most frequently infected (63% on Table 3). However, at the Nam Ngum water reservoir only four species of these fish harbored metacercaria; most frequently in *Hampala dispar*, consumed mostly in Laos. No metacercariae were found in fish species caught directly in flooded-paddy fields but only in species caught in ditches between paddy-fields. Metacercariae of *H. taichui* were present in the muscles of four species of fish from Nam Ngum water reservoir and the Mekong River in the capital, Vientiane, whereas metacercariae of *H. pumilio* were found in two species from the Nam Ngum reservoir. One species of cyprinid fish can serve as intermediate host for metacercariae of two or

Table 2
Snail species examined for larval stages of Trematoda

Snail species	No. examined	Human trematodes found (%)
<i>Filopaludina martensi</i> *	48	
<i>Filopaludina polygrana</i> *	21	
<i>Idioma umbilicata</i>	32	
<i>Pila ampullacea</i> *	8	
<i>Pila scutata</i> *	21	
<i>Pila polita</i> *	30	
<i>Bithynia siamensis siamensis</i>	354	
<i>Bithynia siamensis goniomphalus</i>	3,913	<i>O.v.</i> (0.6)
<i>Bithynia siamensis laevis</i>	159	
<i>Hydrobioides nassa</i>	281	
<i>Adamietta housei</i>	1	
<i>Paracrostoma pseudosulcospira</i> *	20	
<i>Tarebia granifera</i>	212	<i>H.t.</i> (0.1)
<i>Thiara scabra</i>	162	
<i>Melanooides tuberculata</i>	69	
<i>Trochotaia trochoides</i>	52	
<i>Clea helena</i>	6	
<i>Radix auricularia rubiginosa</i>	373	<i>F.g.</i> (0.8)
<i>Camptoceras jiraponi</i>	35	
<i>Gyraulus convexiusculus</i>	86	
<i>Helicorbis umbilicalis</i>	162	<i>F.b.</i> (0.6)
<i>Indoplanorbis exustus</i>	475	<i>S.s.</i> (0.2)
Total	6520	

O.v. = *Opisthorchis viverrini*

F.g. = *Fasciola gigantica*

S. = *Schistosoma spindale*

H.t. = *Haplorchis taichui*

F.b. = *Fasciolopsis buski*

* Snail species frequently consumed by inhabitants

three different fluke species. *Stelantchasmus falcatulus* larvae were found in fins of *Xenentodon cancila*.

Cat

Helminths found in autopsied cats are listed in Table 4. Fifteen percent of cats from households in Vientiane were infected with *O. viverrini*, compared to 25% of cats found in the fishing villages on the banks of the Nam Ngum reservoir. Small intestinal flukes (mostly *H. taichui* and *H. yokogawai*), were found only in cats from the Nam Ngum reservoir.

DISCUSSION

The predominant position of the small fluke infection, among the other intestinal parasites in cohorts examined by us, is in conformity with the previous reports from Laos (Sornmani *et al.*, 1974; Sicard *et al.*, 1977). Our epidemiological study indicated simultaneous occurrence of the small liver fluke, *O. viverrini*, and intestinal heterophyid flukes of the genus *Haplorchis* in animals and humans in the studied area. Multiple etiology of intestinal and liver fluke infections in man in Laos was confirmed by the identification worms expelled after praziquantel treatment.

Table 3
Infection rate (%) of Trematode metacercariae in positive fish from Laos.

Fish species	Examined	<i>Opisthorchis viverrini</i>	<i>Haplorchis taichui</i>	<i>Haplorchis pumilio</i>	<i>Stellantchasmus falcatus</i>
<i>Hampala dispar</i>	111	14	4	-	-
<i>Hampala macrolepidota</i>	34	9	6	3	-
<i>Cyclocheilichthys repasson</i>	27	63	-	-	-
<i>Barbodes gonionotus</i>	45	2	2	-	-
<i>Puntius brevis</i>	22	14	-	-	-
<i>Puntius</i> sp.1	13	15	-	-	-
<i>Puntius</i> sp.2	39	3	28	-	-
<i>Esomus longimana</i>	153	-	-	1	-
<i>Xenentodon cancila</i>	2	-	-	-	50

Table 4
Survey of helminths from cats.

Species	No.cats infected	Prevalence (%)
Cestoda		
1. <i>Diphyllobothrium</i> sp.	6	11
2. <i>Dipylidium caninum</i>	13	23
3. <i>Hydatigera taeniformis</i> *	10	18
Trematoda		
4. <i>Opisthorchis viverrini</i>	11	20
5. <i>Haplorchis taichui</i>	11	20
6. <i>Haplorchis pumilio</i>	5	9
7. <i>Haplorchis yokogawai</i>	10	18
8. <i>Stellantchasmus falcatus</i>	4	7
9. <i>Trematoda</i> gen.sp.	1	2
Nematoda		
10. <i>Gnathostoma spinigerum</i>	2	4
11. + 12. <i>Taxocaridae</i> spp.	21	38
13. <i>Spirurata</i> sp.*	16	29
14. <i>Capillaria</i> sp.*	1	2
15. <i>Ancylostoma</i> sp.*	39	70
Acanthocephala		
16. <i>Acanthocephala</i> gen.sp.*	1	2

*) finding in *Prionailurus bengalensis*
Potential human parasites underlined

The presence of infected snails, the intermediate host of *O. viverrini* in the Dam Nam Ngum reservoir near the human settlements, the high frequency of fish harboring metacercariae of liver

and intestinal flukes, and the high positivity rates in cats from the banks of the Nam Ngum Dam Lake, compared to cats from Vientiane were documented. It indicates the impact of the water reservoirs in this part of the world on health, with special emphasis on human small fluke infections. This is similar to the experience in Thailand (Sornmani and Harinasuta, 1986). The high frequency of *S. hominis* and *Taenia* spp. in humans, confirmed the epidemiological consequences of the habit of Laotian people eating raw beef and pork.

Considering the previous reports of Segal *et al* (1968) and Fontan *et al* (1975), and including our results, the current list of food-borne parasitic species diagnosed in humans in Laos is as follows:

Protozoa: *Sarcocystis hominis*

Trematoda: *Fasciolopsis buski*, *Opisthorchis viverrini*, *Haplorchis taichui*, *Paragonimus westermani*, *Paragonimus heterotremus*

Cestoda: *Taenia* sp.

Nematoda: *Gnathostoma spinigerum*, *Trichinella spiralis*, *Angiostrongylus cantonensis*

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