

# AN EPIDEMIOLOGICAL SURVEY ON INTESTINAL PARASITE INFECTION IN KHAMMOUANE PROVINCE, LAO PDR, WITH SPECIAL REFERENCE TO *STRONGYLOIDES* INFECTION

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**Abstract.** To estimate the current prevalence of intestinal helminth infection in Lao PDR, a parasitological survey was conducted in three villages in Khammouane Province in December 1996, with special reference to *Strongyloides* infection. A total of 669 fecal samples were collected in the villages and examined by agar-plate culture method and Kato-Katz thick smear method. Intestinal helminths were demonstrated in 82% of the samples as follows: *Ascaris lumbricoides* (30.5%), *Trichuris trichiura* (23.7%), hookworm (28.8%), *Strongyloides stercoralis* (19.0%), *Enterobius vermicularis* (3.4%), *Opisthorchis viverrini* (56.7%) and *Taenia* sp (3.0%). The infection rates of *S.stercoralis* were 27.5% and 18.4% in two rural villages, but only 9.4% in an urban village. The highest prevalence rate of *Strongyloides* infection was obtained in the age group from 20 to 29 years old, although the infection rate already reached 10% in the age group under 10 years old. The prevalence was consistently higher in male subject than females in almost all age groups

## INTRODUCTION

Lao People's Democratic Republic (Lao PDR) is a landlocked country surrounded by five countries in Southeast Asia. Its economical situation is relatively low as compared to the neighboring countries. Intestinal parasitic diseases, as well as malaria, seem to be a serious public health problem to prevent an economical development in this country because of its high prevalence among the inhabitants (Sornmani *et al*, 1974; Giboda *et al*, 1991a,b; Pholsena *et al*, 1991; Kobayashi *et al*, 1996; Chai and Bouasy, 1998). Among the intestinal parasitic diseases, strongyloidiasis is also one of the public health and clinical problems due to its unique parasitological and pathological features. Strongyloidiasis is a nematode parasitic disease resulting from an infection with *Strongyloides stercoralis* which is relatively common in tropical and subtropical areas. The parasite is usually non-pathogenic in an immunocompetent host, but due to the internal autoinfection, the infection often progresses to the fatal disseminated hyperinfection under immunosuppressed condition (Scowden *et al*, 1978). Therefore, it is important to know the prevalence of the parasitic infection to prevent a serious disease. However, there has been no exact report on the

prevalence of *Strongyloides* infection in this country. This survey was carried out to inform current status of intestinal parasite infections, with special reference to *Strongyloides* infection in Lao PDR.

## MATERIALS AND METHODS

### Survey areas

Khammouane Province, where Lao-Japan Primary Health Care Project is implementing since 1992, is located at about 350 km southeast from Vientiane municipality (Fig 1). In the province, three villages were selected as survey area. One survey village was Thakhek Neua villages located inside of Thakhek City, the provincial capital city, where the sanitary condition is not so poor because the village is belonging to urban area. The other two villages, namely Sisomsouen and Phavang villages, are located in Hinboon district (Fig 1) about 55 km north from Thakhek City. Both villages are belonging to rural areas surrounded by rice field and its sanitary condition is quite poor. Especially, it is hard to access to Phavang village in rainy season even by car. Almost of the villagers in both villages make their living by farming and gardening.

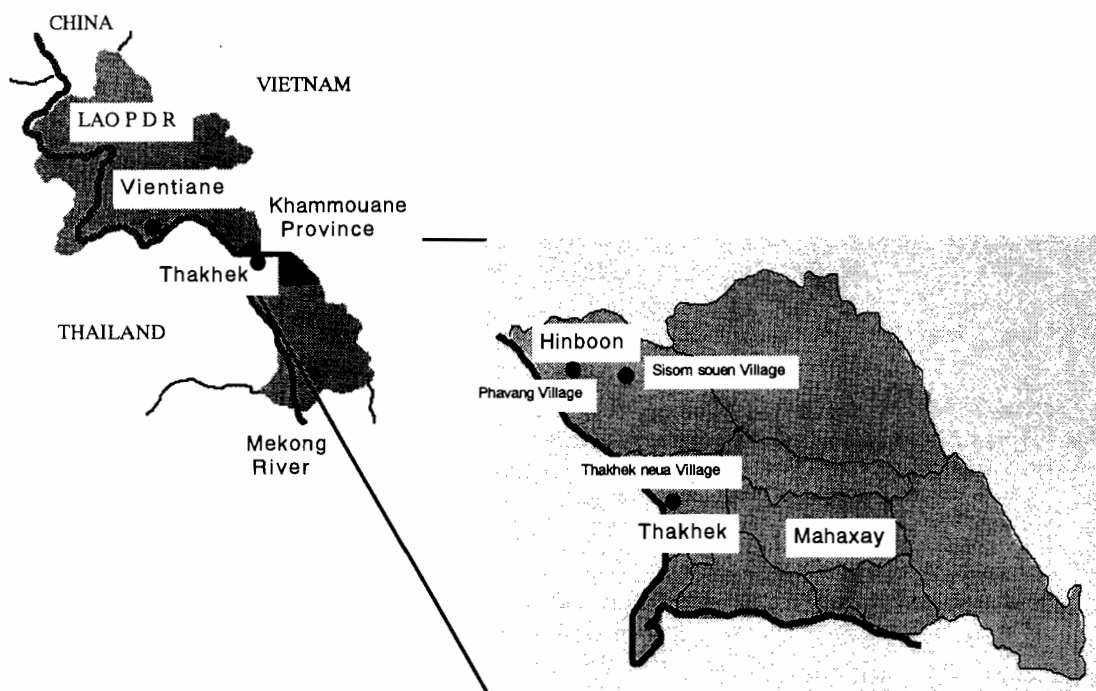


Fig 1—Map of survey areas.

Table 1

Number of subjects examined.

| Village      | Sex   | No. inhabitants examined (by age group) |     |     |     |     |     |     |     |     | Total |
|--------------|-------|---|-----|-----|-----|-----|-----|-----|-----|-----|-------|
|              |       | -9                                      | 10- | 20- | 30- | 40- | 50- | 60- | 70- | 80- |       |
| Sisomsouen   | M     | 26                                      | 19  | 8   | 10  | 10  | 11  | 7   | 4   | 1   | 96    |
|              | F     | 30                                      | 18  | 17  | 4   | 11  | 8   | 4   | 2   | 0   | 94    |
|              | Total | 56                                      | 37  | 25  | 14  | 21  | 19  | 11  | 6   | 1   | 190   |
| Phavang      | M     | 40                                      | 36  | 9   | 15  | 7   | 11  | 9   | 2   | 1   | 130   |
|              | F     | 43                                      | 14  | 18  | 18  | 15  | 12  | 8   | 0   | 0   | 128   |
|              | Total | 83                                      | 50  | 27  | 33  | 22  | 23  | 17  | 2   | 1   | 258   |
| Thakhek Neua | M     | 47                                      | 17  | 2   | 5   | 2   | 1   | 1   | 1   | 1   | 77    |
|              | F     | 53                                      | 33  | 23  | 11  | 13  | 6   | 7   | 1   | 0   | 147   |
|              | Total | 100                                     | 50  | 25  | 16  | 15  | 7   | 8   | 2   | 1   | 224   |

### Subjects

The age and sex distributions of subjects examined in the present survey are shown Table 1. More than half of the subjects were children and young

adults under 20 years old. Female subjects occupied 54.1% of the subjects. The ethnic group of the villagers in the survey areas is almost Lao loun, majority people in Lao PDR.

Table 2

Prevalence of parasitic helminths among the subjects examined.

| Village  | Sisomsouen<br>(n = 190) | Phavang<br>(n = 258) | Thakhek Neua<br>(n = 244) | Total<br>(n = 669) |
|--|-------------------------|----------------------|---------------------------|--------------------|
| <i>Strongyloides stercoralis</i><br>for helminth infection | 160 (84.0)              | 224 (86.8)           | 164 (73.2)                | 548 (81.9)         |
| Type of infection  |                         |                      |                           |                    |
| <i>Strongyloides stercoralis</i>                           | 35 (18.4)               | 71 (27.5)            | 21 (9.4)                  | 127 (19.0)         |
| <i>Ascaris lumbricoides</i>                                | 49 (25.8)               | 144 (55.8)           | 11 (5.0)                  | 204 (30.5)         |
| <i>Trichuris trichiura</i>                                 | 65 (34.2)               | 47 (18.2)            | 47 (21.0)                 | 159 (23.8)         |
| Hookworm   | 40 (21.0)               | 124 (48.0)           | 29 (13.1)                 | 193 (28.8)         |
| <i>Enterobius vermicularis</i>                             | 5 (2.6)                 | 5 (2.0)              | 0 (0)                     | 2 (0.3)            |
| <i>Opisthorchis viverrini</i>                              | 101 (53.1)              | 142 (55.0)           | 136 (60.7)                | 379 (56.7)         |
| <i>Fasciola</i> / Fasciolopsis                             | 0 (0)                   | 2 (0.8)              | 0 (0)                     | 2 (0.3)            |
| <i>Taenia</i> sp   | 8 (4.2)                 | 9 (3.5)              | 3 (1.3)                   | 20 (3.0)           |

No. positive (%)

### Fecal examination

A single stool sample was collected from each of 669 villagers and examined by two different methods. One of them was the agar plate culture method for *Strongyloides* and hookworm infections in which about three grams of feces was placed on the center of normal agar plate for bacterial culture and incubated for 3 days at room temperature (Arakaki *et al.*, 1988). The larvae emerged from fecal masses during the incubation were examined under a dissection microscope. In this method, unique alignments of bacterial colonies along the tracks of wandering larvae developed on the surface of the agar plate and it allowed us to suppose the presence of larvae. Another method for fecal examination was an ordinary Kato-Katz thick smear method for detection of other helminth eggs.

### RESULTS

The positive rates of parasitic infection demonstrated are summarized in Table 2. The infection with any helminth parasite was demonstrated in as high as 86.8% of the subjects in Phavang village, followed by 84.0% in Sisomsouen village and 73.2%

in Thakhek Neua village; the overall positive rate was 81.9%. Six species of intestinal helminths were demonstrated among the subjects. The most common parasite was *Opisthorchis viverrini*; more than half of the villagers harbored the parasite. The high positive rates over 20% were also obtained in *Ascaris lumbricoides* (30.5%), hookworm (28.8%) and *Trichuris trichiura* (23.8%) infections. As an interesting finding, the positive rate of *O. viverrini*, a food-borne parasite, was higher in an urban area (Thakhek Neua village) than the other two rural village, although other soil-transmitted helminths were generally higher in their positive in two rural villages than in Thakhek Neua village.

As to *Strongyloides* infection, the mean prevalence rate was estimated as 19.0% among the subjects. The highest prevalence was obtained in Phavang village, showing 27.5% of positive rate. The positive rate as high as 18.4% was also obtained in Sisomsouen village but only 9.4% in Thakhek Neua village.

The prevalences of *S. stercoralis* by age group and sex are shown in Fig 2. The infection was demonstrated in all age groups. The highest infection rate of 30.3% was obtained in age group of 20-29 years old. The infection rate as high as 10.8% was already demonstrated in age group under 10

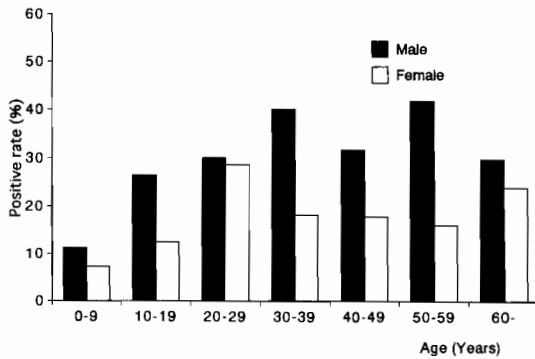


Fig 2—Incidence of *Strongyloides* infection among inhabitants by age group and sex.

years old. The youngest subject who was positive for the parasite was 2 years old. The infection rate in the young generation, however, was significantly different between rural and urban areas. The positive rate in children under 15 years old was only 4.2% in Thakhek Neua village, which increased to 18.5% in the age group over 14 years old. On the other hand, in two rural areas, the positive rate in the young generation under 15 years old were not different from those in generation over 14 years old, showing 14.5% and 20.7% in Sisomsouen village and 21.2% and 26.9% in Phavang village, respectively. The positive rate in male subjects were consistently higher than those in female subjects, although the rates were almost the same in the age groups under 10 years old and over 50 years old.

## DISCUSSION

The results in the present study showed that intestinal helminths are still highly prevalent among villagers in both urban and rural villages of Khammouane Province, Lao PDR. Inadequate general sanitation and sewage disposal systems are probably blamed as a major factors for the high spread of the soil-transmitted helminths. Especially in rural and sub rural areas, the villagers are not supplied tap water, play bare-foot and evacuate around their houses.

Liver fluke infection with *O.viverrini* was found to be the most prevalent parasitic infection among the villagers, showing that more than half (53-60%) of the villagers harbored the parasite. Similar prevalence of the parasitic infection has also been re-

ported in several areas of Lao PDR (Giboda *et al*, 1991a; Pholsena *et al*, 1992; Chai *et al*, 1998). An interesting finding was that the highest positive rate of *O.viverrini* (60.7%) was obtained in Thakhek Neua village where other soil-transmitted helminth infections were significantly low, as compared to those in the other two rural villages. An explanation could be given is that the habit of eating raw infected fish salad (Koipa, Larppa, and Somp) is frequent among villagers in urban area as their normal meal, as well as particular social and festival events of Lao tradition. In the previous survey, the authors have also examined the prevalence of liver fluke infection among 128 children under 16 years old in the other two villages in the same province. The results in the previous survey showed that *O.viverrini* infection has already occurred in about 25% of the children under 5 years old and the prevalence rate then increased to 40% in the following 5 years (Kobayashi *et al*, 1996). The prevalence of *O.viverrini* infection was similar to that in the neighboring northeast Thailand (Sithithaworn *et al*, 1991; Maleewong *et al*, 1992). The high prevalence of *O.viverrini* infection in the young generation (25% in children under 5 years old) was also demonstrated in the present survey. High incidence of *O.viverrini* infection in the children may be a risk factor to produce serious liver dysfunction after long-standing infection. (Elkins *et al*, 1990; Mairiang *et al*, 1992).

Soil-transmitted helminths, such as *A.lumbricoides*, *T.trichuira* and hookworm, were also common parasite among the villagers. The positive rate of *A.lumbricoides*, however, was significantly low in urban area (5% in Thakhek Neua village). The positive rate of *A.lumbricoides*, was also lower than that of *T.trichuira* in Sisomsouen village where the sanitary conditions are relatively good as compared to Phavang village. The prevalence of *A.lumbricoides* may reflect the sanitary and socioeconomic conditions in the respective area.

*Strongyloides* infection was detected in 19% of the villagers in the present study. The prevalence rate was relatively higher than those in the past studies. In 1974, more than twenty years ago, Sornmani *et al* has reported positive rate of 13.7% among the inhabitants in Vientiane Municipality. Most recently, only 3.3% of positive rate was reported in Pakse by Chai *et al* (1998). The prevalence rates in the previous studies might underestimate true prevalence of the parasite because the examination methods, direct fecal smear and Harada-Mori fecal culture method applied in the

previous studies, are not effective for detection of larvae in chronic *Strongyloides* infection. On the other hand, the agar plate fecal culture method in the present study is known to be 2-3 times more effective for the correct diagnosis than the methods in the past study (Sato *et al*, 1995). Therefore, the results in the present study are considered to show true prevalence of the parasite.

In the neighboring countries, *Strongyloides* infection is also known to be highly prevalent. The positive rate as high as 19% were detected among children of 1-7 years old in Thai-Cambodian border (Boyajian, 1992). In northeast Thailand, Leungbudnak *et al* (1996) were reported 20.6% and 16.5% of positive rates again with *S.stercoralis* infection among primary school children. Similar result of 24.5% in positive rate was also reported in the northern Thailand (Sukhavat *et al*, 1994).

The parasitic infection is also suspected to be prevalent in neighboring Vietnam and Myanmar because many refugees and repatriated service men from these countries have been known to be infected with the parasite with positive rates of 3-14% (Tateno *et al*, 1981; Asato *et al*, 1984). The recent exact situation of the parasitic infection, however, is not well known in these countries.

In the present study, it has been also demonstrated that young children have already been highly affected with the parasite. The age distribution of *Strongyloides* infection in the present survey was quite different to that Okinawa, Japan, where *Strongyloides* infection is still prevalent at present time. One of characteristic epidemiological feature of *Strongyloides* in Okinawa, however, is an age inclination of persons with *Strongyloides* infection. Almost all persons (more than 95%) infected with *Strongyloides* were detected in middle and upper aged groups over 40 years old in Okinawa (Sato, 1986). The epidemiological feature suggests that the opportunity to acquire new infection from environment is almost negligible, according to the improvement of sanitary condition in recent Okinawa. On the other hand, the high prevalence in children in the present survey indicates that the parasitic infection is currently endemic in Lao PDR.

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