AN EPIDEMIOLOGICAL SURVEY OF HUMAN INTESTINAL PARASITES IN VIENTIANE, LAOS

SANTASIRI SORNMANI, OUNHUAN PATHAMMAVONG, THANONGSAK BUNNAG, PAISAL IMPAND, CHALOR INTARAKHAO and SANAM THIRACHANTRA

Department of Tropical Medicine, Faculty of Tropical Medicine, Mahidol University, Bangkok, Thailand and National Public Health Laboratory, Ministry of Public Health, Vientiane, Laos.

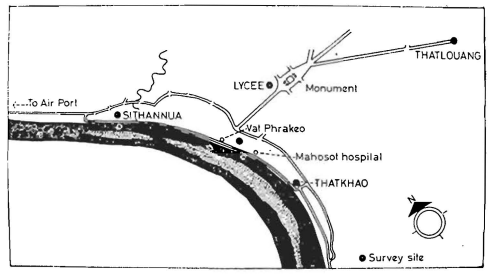
INTRODUCTION

The prevalence of intestinal parasites in countries of Southeast Asia is of interest since it can be used as an indicator for the health status of the people and also as the base-line data for further development in the region. Aware of this, the SEAMEO-TROPMED Project proposed to explore, if possible, the prevalence of human intestinal parasites in all of the member countries. In this connection, the following work was carried out as a co-operative study between the Thai and Lao National Centres for Tropical Medicine.

In Laos, as far as the current literature were concerned the prevalence rates of human intestinal parasites could only be derived from hospital records (Pathammavong, 1970), which were unlikely to represent the true general situation. This present investigation, which was conducted in April 1971, was initially planned to survey all the provinces of Laos but the war situation prevented this, hence, the survey had to be limited only to Vientiane and its vicinity.

DESCRIPTION OF THE AREA

Vientiane, the largest city of Laos is between 17°-18° N latitude and 102° to 103° E longitude, on the bank of the Mekong River. The city itself is flat and surrounded mostly by rice fields except on the eastern edge which is bordered by the Mekong River (see map).



Map — Showing the selected areas for epidemiological study of intestinal parasitic infection in Vientiane, April 1971.

Laos has a tropical climate with two distinct seasons; a rainy season from May to September, and the dry season during the rest of the year. The average temperature varies from 24° to 32°C.

Due to the geographical location and the rainfall, Vientiane is subjected to frequent flooding which usually occurs in September or October. Since the drainage and sewage disposal are inadequate the floods may play an important role in the transmission of parasitic diseases.

Population : The population of Vientiane and its vicinity was 132,253 in the census of 1970; this figure included male - Lao 50,348 and female - Lao 45,768 while other nationalities were 18,518 males and 17,619 females.

Lhis study was supported by a research grant No. L-70-01 from SEAMEO-TROPMED Project.

Sanitation : Piped water is generally available in the city. However, in sub-urban areas people have to depend on well water for drinking and river water for domestic purposes.

Latrines are widely used in the city but less used in the suburbs.

Food Habits : Glutinous rice, halfcooked meat and fresh vegetables are the most common dishes of the Lao. "Koi pla" which is prepared from uncooked or half-cooked fish or prawn and spices is a favourite among the local people.

METHODS OF THE SURVEY

Vientiane can be divided into three major areas; (1) the city centre; (2) the northern part, along Route 13; and (3) the southern part along the Mekong River. The survey was organized by using the schools in each of the areas as centres for collection of stool specimens (Table 1).

Table 1

Names of Schools which were used as centres for collection of stool specimens.

Areas	Name of Schools
1. City centre:	That Louang, Sithannua, Na Hai Dieo, Mu thayom Suksa. (Lycee)
2. North of the city:	Si Khai, Kao Lieo.
3. South of the city:	Ban Bo-O, Ban Hom, Ban Chai Fong, Ban Tha Khek, Sithantai.

Each student was given three wax-paper containers, one for himself and the other two for any other two members of his family. With the assistance of their teachers the students were advised to correctly label each container with the sex and age of the person whose specimen was collected.

Most of the stool specimens were examined on the day of collection. Otherwise, they were kept in an ice box for examination the next morning.

Two mg of specimen were examined using the direct fecal smear technique (Beaver 1961; two cover slides, one in normal saline solution the other in 1% Lugol's iodine). Estimation of egg output was done by Stoll's technique with 25% of the total number of specimens collected (Stoll, 1923). Of the stool samples which were positive for hookworm 10% were cultured for identification of the species using a modification of Harada's techniques (Sasa *et al.*, 1958).

RESULTS

A total of 2,493 stool specimens were examined including 1,277 from males and 1,216 from females. The results appear in Tables 2 and 3.

The overall prevalence rate of all intestinal parasites was 88.6%; 86.4% were infected with one or more helminths and 30.5% were infected with intestinal protozoa. Differences of the prevalence among the sexes was not apparent but a high prevalence of soil transmitted helminths was found among children under 14 years of age.

The predominant helminth infections were *Trichiuris trichiura* (49.9%), *Ascaris lumbricoides* (49.3%) *Opisthorchis viverrini* (46.5%), and hookworms (30.6%). Estimation of egg output indicated that the majority of people had mild infections, except for ascariasis which showed (38.1%) high intensity of infection (Table 4).

From the cultures of 120 stool samples for the identification of hookworm species revealed that 41.6% were infected with *Ancylostoma* sp., 29.2% with *Necator americanus*, and 29.2% with mixed infections (Table 5).

The most common intestinal protozoal infections were *Entamoeba coli* (18.7%) *Giardia lamblia* (8.3%), *Trichomonas hominis* (6.1%) and *Entamoeba histolytica* (1.1%).

Table 2

Results of stool examination among 2493 people in Vientiane, Laos, April 1971.

Age group	No. exam.	Helminth									Protozoa					
		O.v.	H.w.	S.s.	T.t.	E.v.	T.sp.	H.n.	A.l.	Ech.sp.	Eh.c.	Eh.t.	E.c.	E.n.	Gl.c.	T.h.
0 - 4	350	40 (11.4%)	37 (10.6%)	10 (2.8%)	119 (34.0%)	-	4 (1.1%)	4 (1.1%)	186 (53.1%)	2 (0.6%)	1 (0.3%)	1 (0.3%)	26 (7.4%)	-	42 (12.0%)	17 (4.8%)
5 - 9	483	147 (30.4%)	146 (30.2%)	80 (16.6%)	307 (63.6%)	2 (0.4%)	5 (1.0%)	24 (4.9%)	307 (63.6%)	5 (1.0%)	7 (1.4%)	3 (0.6%)	97 (20.1%)	1 (0.2%)	57 (11.8%)	37 (7.7%)
10 - 14	489	243 (49.7%)	217 (44.4%)	92 (18.8%)	307 (62.8%)	-	25 (5.1%)	22 (4.5%)	264 (53.9%)	5 (1.0%)	3 (0.6%)	2 (0.4%)	101 (20.6%)	1 (0.2%)	50 (10.2%)	29 (5.9%)
15 - 19	243	115 (47.3%)	94 (38.7%)	43 (17.7%)	111 (45.7%)	2 (0.8%)	11 (4.5%)	8 (3.3%)	114 (46.9%)	1 (0.4%)	-	-	58 (23.9%)	-	19 (7.8%)	12 (4.9%)
20 - 29	232	137 (59.0%)	80 (34.5%)	42 (18.1%)	111 (47.8%)	-	6 (2.6%)	6 (2.6%)	107 (46.1%)	2 (0.8%)	1 (0.4%)	1 (0.4%)	60 (25.9%)	-	16 (6.9%)	17 (7.3%)
30+	696	477 (68.5%)	188 (27.0%)	74 (10.6%)	289 (41.5%)	1 (0.1%)	41 (5.9%)	7 (1.0%)	250 (35.9%)	13 (1.9%)	6 (0.9%)	2 (0.3%)	125 (17.9%)	-	22 (3.2%)	40 (5.7%)
Total*	2493	1159 (46.5%)	762 (30.6%)	341 (13.7%)	1244 (49.9%)	5 (0.2%)	92 (3.7%)	71 (2.9%)	1228 (49.3%)	28 (1.1%)	18 (0.7%)	9 (0.4%)	467 (18.7%)	2 (0.1%)	206 (8.3%)	152 (6.1%)

O.v. = *Opisthorchis viverrini*
H.w. = Hookworm
S.s. = *Strongyloides stercoralis*
T.t. = *Trichuris trichiura*
E.v. = *Enterobius vermicularis*
T.sp. = *Taenia* sp.
H.n. = *Hymenolepis nana*
A.l. = *Ascaris lumbricoides*
Ech. = *Echinostome* sp.

Eh.c. = *Entamoeba histolytica* cyst
Eh.t. = *Entamoeba histolytica* trophozoite
E.c. = *E. coli*
Gl.c. = *Giardia lamblia* cyst
T.h. = *Trichomonas hominis*

* Of a total 2,493 samples examined, 2,210 (88.6%) were infected with one or other type of parasite.

Table 3

Prevalence of intestinal helminthic and protozoan infections by age groups and sex in Vientiane, Laos, April 1971.

Age group yr.	No. exam.	Helminth								Protozoa						
		O.v.	H.w.	S.s.	T.t.	E.v.	T.sp.	H.n.	A.l.	E.ch.	Eh.c.	Eh.t.	E.c.	E.n.	Gl.c.	T.h.
Male																
0 - 4	197	18 (9.1%)	24 (12.2%)	5 (2.5%)	60 (30.5%)	-	2 (1.0%)	2 (1.0%)	104 (52.8%)	-	-	-	18 (9.1%)	-	24 (12.2%)	7 (3.5%)
5 - 9	251	66 (26.3%)	79 (31.5%)	45 (17.9%)	161 (64.1%)	1 (0.4%)	4 (1.6%)	12 (4.8%)	155 (61.7%)	2 (0.8%)	1 (0.4%)	1 (0.4%)	46 (18.3%)	1 (0.4%)	25 (10.4%)	22 (8.8%)
10 - 14	290	142 (48.9%)	135 (46.5%)	57 (19.7%)	187 (64.5%)	-	18 (6.2%)	8 (2.8%)	146 (50.3%)	2 (0.7%)	2 (0.7%)	1 (0.3%)	58 (20.0%)	-	30 (10.3%)	13 (4.5%)
15 - 19	132	72 (54.5%)	60 (45.4%)	26 (19.7%)	61 (46.2%)	1 (0.8%)	7 (5.3%)	4 (3.0%)	59 (44.6%)	1 (0.8%)	-	-	32 (24.2%)	-	8 (6.0%)	7 (5.3%)
20 - 29	88	52 (59.1%)	27 (30.7%)	15 (17.0%)	37 (42.0%)	-	3 (3.4%)	2 (2.3%)	32 (36.4%)	1 (1.1%)	1 (1.1%)	-	15 (17.0%)	-	4 (4.5%)	5 (5.7%)
30+	319	214 (67.1%)	100 (31.3%)	42 (13.2%)	135 (42.3%)	1 (0.3%)	15 (4.7%)	6 (1.9%)	94 (29.5%)	2 (0.6%)	4 (1.2%)	1 (0.3%)	46 (14.4%)	-	20 (6.3%)	13 (4.1%)
Total	1277	564 (44.1%)	425 (33.3%)	190 (17.6%)	641 (50.2%)	3 (0.2%)	49 (3.8%)	34 (2.7%)	590 (46.2%)	8 (0.6%)	8 (0.6%)	3 (0.2%)	215 (16.8%)	1 (0.1%)	112 (8.8%)	67 (5.2%)
Female																
0 - 4	153	22 (14.4%)	13 (8.5%)	5 (3.3%)	59 (38.6%)	-	2 (1.3%)	2 (1.3%)	82 (53.6%)	2 (1.3%)	1 (0.6%)	1 (0.6%)	8 (5.2%)	-	18 (11.8%)	10 (6.5%)
5 - 9	232	81 (34.9%)	67 (22.9%)	35 (15.1%)	146 (62.9%)	1 (0.4%)	1 (0.4%)	12 (5.2%)	152 (65.5%)	3 (1.3%)	6 (2.6%)	2 (0.9%)	51 (21.9%)	-	31 (13.4%)	15 (6.5%)
10 - 14	199	101 (50.7%)	82 (41.2%)	35 (17.6%)	120 (60.3%)	-	7 (3.5%)	14 (7.0%)	118 (59.3%)	3 (1.5%)	1 (0.5%)	1 (0.5%)	43 (21.6%)	1 (0.5%)	20 (10.0%)	16 (8.0%)
15 - 19	111	43 (38.7%)	34 (30.6%)	17 (15.3%)	50 (45.0%)	1 (0.9%)	4 (3.6%)	4 (3.6%)	55 (49.5%)	-	-	-	26 (23.4%)	-	11 (9.9%)	5 (4.5%)
20 - 29	144	85 (59.0%)	53 (36.8%)	27 (18.7%)	74 (51.4%)	-	3 (2.1%)	4 (2.9%)	75 (52.1%)	1 (0.7%)	-	1 (0.7%)	45 (31.2%)	-	12 (8.3%)	12 (8.3%)
30+	377	263 (69.8%)	88 (23.3%)	32 (8.5%)	154 (40.8%)	-	26 (6.9%)	1 (0.3%)	156 (41.4%)	11 (2.9%)	2 (0.5%)	1 (0.3%)	79 (20.9%)	-	2 (0.5%)	27 (7.2%)
Total	1216	595 (48.9%)	337 (27.7%)	151 (12.4%)	603 (49.6%)	2 (0.2%)	43 (3.5%)	37 (3.0%)	638 (52.5%)	20 (1.6%)	10 (0.8%)	6 (0.5%)	252 (20.7%)	1 (0.1%)	94 (7.7%)	85 (6.9%)

Table 4

Intensity of common human intestinal helminthic infections in Vientiane, April 1971.

	Intensity (eggs/gm.)	Male	Female	Total
Opisthorchis viverrini	0 - 5,000	158 (49.7%)	160 (50.3%)	318 (69.9%)
	5,000+-20,000	44 (51.2%)	42 (45.8%)	85 (18.9%)
	20,000+	28 (54.9%)	23 (45.1%)	51 (11.2%)
Hookworm	0- 5,000	175 (60.1%)	116 (38.9%)	291 (96.4%)
	5,000+-20,000	6 (54.5%)	5 (45.5%)	11 (3.6%)
	20,000+	-	-	-
Trichuris trichiura	0-10,000	204 (52.8%)	182 (47.2%)	386 (97.5%)
	10,000+-20,000	3 (42.8%)	4 (57.2%)	7 (1.8%)
	20,000+	1 (33.3%)	2 (66.7%)	3 (0.7%)
Ascaris lumbricoides	0- 5,000	65 (55.1%)	53 (44.9%)	118 (31.5%)
	5,000+-20,000	59 (51.8%)	55 (48.2%)	114 (30.4%)
	20,000+	65 (45.4%)	78 (54.5%)	143 (38.1%)

Table 5

Results of hookworm culture from 120 specimens. (Modified Harada's technique).

No. of Stool samples	*Ancylostoma* sp.	*Necator americanus*	Mixed
120	50 41.6%	35 29.2%	35 29.2%

DISCUSSION

In so far as, the culture, custom, tradition and food habits of the people are concerned Laos and Northeast Thailand have close similarities. They are only separated geographically by the Mekong River. Thus, it can be seen from the present study that the people of Vientiane and Northeast Thailand suffer from similar parasitic diseases.

However, the culture of hookworm revealed some distinction. The majority of Vientiane cases (41.6%) were infected with *Ancylostoma* sp. whereas in Thailand most of hookworm cases are of *N. americanus* (Bunnag and Harinasuta, 1968; Radomyos and Saovakontha, 1968). Since it has been demonstrated that *Ancylostoma* infection could be mainly acquired via oral route (Okamoto 1961) the source of hookworm infection in the Vientiane people could possibly be from the contaminated raw vegetables which evidently is a side dish in every Laotian meal. Further investigations to clarify this situation is necessary so that the major source of hookworm infection can be confirmed and controlled.

It is also interesting to see from this study that *Taenia* and *Enterobius* infections were detected by simple smear stool examination, which usually does not show with such a technique. Should techniques such as examination of the whole stool mass for *Taenia* proglottides or perianal swabs for *Enterobius* eggs be applied, the prevalence rates of these two infections would be much higher than the present data shown.

This study has disclosed an interesting data on the prevalence of intestinal parasites

among the Vientiane people. The predominant parasites were liver fluke and other soil-transmitted helminths. The habit of eating raw fish, meat and fresh vegetables as well as inadequate general sanitation and sewage disposal systems, especially in the sub-urban areas should probably be blamed as major factors in the spread of these parasitic infections. Opisthorchiasis is highly prevalent, however, chemotherapy and other methods of control of this infection are still not yet practicable, but other intestinal parasites such as *Ascaris*, hookworm and intestinal protozoa could possibly be reduced and controlled by the implementation of modern chemotherapy and improvement of general sanitation of the environment as well as health education.

SUMMARY

An epidemiological survey for intestinal parasites in Vientiane was conducted in April 1971. A total of 2,493 stool samples were collected from 3 areas of Vientiane and examined for protozoa and intestinal helminths by direct faecal smear, Stoll count, and culture for hookworm larvae.

The overall prevalence rate of intestinal parasite infection was 88.8%; 86.4% were infected with one or more helminths and 30.5% were infected with intestinal protozoa.

The predominant helminthic infections were *T. trichiura* (49.9%) *A. lumbricoides* (49.3%) *O. viverrini* (46.5%), and hookworm (30.6%). The predominant protozoan infections were *E. coli* (18.7%), *G. lamblia* (8.3%) and *T. hominis* (6.1%).

It is suggested that the high prevalence of the soil transmitted and protozoan infections can efficiently be controlled by the implementation of modern chemotherapy and improvement of general sanitation of the environment as well as health education.

ACKNOWLEDGEMENTS

The authors wished to thank the Ministry of Health, Loas, the various schools and their teaching staffs for their kind co-operation. They would also like to extend sincere thanks to Prof. Chamlong Harinasuta, Secretary General of SEAMEO-TROPMED Project for his advice and support of this study, and Dr. D.C. Reynolds for reviewing this paper.

REFERENCES

BUNNAG, D. and HARINASUTA, T., (1968). Clinical trial of Jonit (Hoechst 16,842) in the treatment of *Necator americanus* in Thailand. *Ann. Trop. Med. Parasit., 63* : 416.

OKAMOTO, K., (1961). An experimental study of the migration route and development of *A. duodenale* in pups after oral infection. *J. Kyoto Pref. Med. Univ., 70* : 135.

PATHAMMAVONG, O., (1971). Gastrointestinal infections in Laos. *Proc. 7th SEAMEO-TROPMED Seminar on Infectious Diseases of the Gastrointestinal System in Southeast Asia and the Far East*, Taipei, Ed. John H. Cross, pp. 165-166.

RADOMYOS, P. and SAOVAKONTHA, S., (1968). The preliminary report on hookworm species in Thailand (Abstract). *J. Med. Ass. Thailand, 51* : 158.

STOLL, N.R., (1923). Investigation on the control of hookworm disease. XV. An effective method of counting hookworm eggs in faeces. *Amer. J. Hyg., 3* : 59