

SURVEY FOR SOIL-TRANSMITTED HELMINTHS IN ASAHAN REGENCY, NORTH SUMATRA, INDONESIA

JUN-ICHI IMAI, OSAMU SAKAMOTO*, F. EZRA MUNTHE**
and SUDI SINULINGGA***

Department of Parasitology, Miyazaki Medical College, Kiyotake, Miyazaki, 889-16.

*Yokohama Education College, Shinohara-dai, Kohoku-ku, Yokohama, 222, Japan.

Division of Communicable Disease Control and *Regional Health Laboratory,
Medan, Indonesia.

INTRODUCTION

The survey on soil-transmitted helminthiasis in Asahan Regency of the North Sumatra Province has been performed as the part of the activities in "The project for the promotion of health in North Sumatra", the international cooperation programme between the Republic of Indonesia and Japan.

The aim of this survey was to determine the current status and epidemiological characteristics of soil-transmitted helminth infections in this area and also to provide a guide-line for planning the parasite control programme by mass treatment with anthelmintic drugs.

MATERIALS AND METHODS

Three villages, Aek Nauli, Medang Deras; Tanjung Kasau, Air Putih; Simpang Gambus, Lima Puluh, in Asahan Regency (Fig. 1) were selected to obtain basic data on the prevalence of soil-transmitted helminthiasis. A total of 977 stool specimens were obtained from inhabitants of the three villages during the rainy season from October to December 1981. After the basic survey study in these three areas, Lorong 13 (one of the hamlet) of Simpang Gambus village was chosen as a model community for detailed studies and the survey was continued to December 1982.

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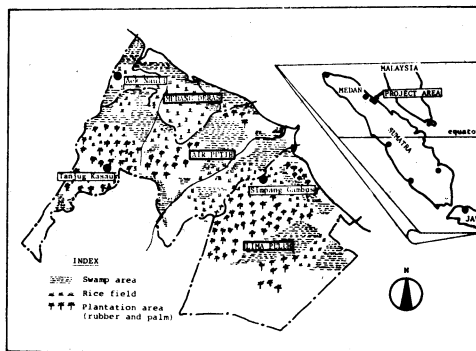


Fig. 1—Location of the project area in Asahan.

In Lorong 13, stool examinations were performed five times during the period of the survey; before 1st mass-treatment, one and ten months after the 1st treatment, and one and four months after the 2nd treatment (at ten month after the 1st treatment). Stool samples were examined by a combination of cellophane thick smear and brine flotation technique. The filter paper culture technique was also applied for the differentiation of two hookworm species, *Necator americanus* and *Ancylostoma duodenale*. The examination of protozoa infection was not done in the present survey.

The efficacy of the treatment with two broad-spectrum anthelmintics, pyrantel pamoate (Combantrin, Pfizer) and a compound tablet containing 150 mg mebendazole and 100 mg pyrantel pamoate (Trivexan, Mecosin) against *Ascaris lumbricoides*, *Trichuris trichiura* and hookworm were compared. For this

purpose, 360 population in Lorong 13 of Simpang Gambus was arbitrarily divided into two groups (groups A and B). Group A was given Combantrin at the recommended dose; 10 mg/kg body weight in a single dose as a syrup for children below 14 years of age and as a tablet for adults above 15 years. Group B was given Trivexan one tablet per day for 3 consecutive days, irrespective of age and body weight. Immediately after initial stool samples were obtained, both groups were treated with drugs before the results of the stool examinations were obtained. Both drugs were given under the supervision of authors on the first day, while Trivexan tablets for remaining two consecutive days was by self-medication. Blood samples were taken to determine the haemoglobin(Hb) levels of the inhabitants and to investigate the relationship between

hookworm infections and anemia. Hb was measured photometrically as methemoglobinazide(HiAz).

RESULTS

Prevalence in three villages: The results of stool examinations in the three villages are shown in Table 1. The overall positive rate was 97.5% and the most common helminth eggs detected were *T. trichiura*, *A. lumbricoides* and hookworm. Other less frequent helminths found were *Strongyloides stercoralis* (1.2%), *Trichostrongylus* sp. (0.1%), *Rhabditis* sp. (2.1%) and *Hymenolepis* sp. (0.8%). There were no apparent age or sex differences in the overall infection rate. However, *A. lumbricoides* infection was most prevalent in school children and gradually decreased with age.

Table 1
Prevalence of intestinal helminths in three villages in Asahan, Sumatra.

Subject	Village			Sex		Age			Total
	Aek Nauli	Tanjung Kasau	Simpang Gambus	Male	Female	0-5	6-14	15 +	
No. examined	259	305	413	466	511	195	407	375	977
Overall infection	98*	96	98	97	98	90	99	99	97.5
<i>Ascaris lumbricoides</i>	83*	82	90	83	87	83	93	78	85.4
<i>Trichuris trichiura</i>	96	86	96	93	93	85	97	93	93.0
Hookworm	78	85	86	83	84	63	87	90	83.5
Others	11	2	3	5	4	3	5	5	4.8
Type of infections									
Single	6	7	4	5	5	8	2	7	5.4
Double	25	19	20	23	19	28	17	22	21.1
Triple	59	68	73	65	70	54	76	67	68.0
Tetra +	7	1	1	3	2	0	4	3	3.0
No. culture	214	268	353	392	443	158	355	322	835
<i>Ancylostoma duodenale</i>	33	7	21	22	18	18	21	19	19.7
<i>Necator americanus</i>	6	53	24	25	32	21	31	30	28.6
Mixed infections	34	23	39	32	32	15	34	39	32.5

* Percentages to the nearest whole number.

More than 90% harboured multiple parasites and the highest prevalence was triple infections with the common three helminths.

For identification of hookworm sp., from 835 out of 977 fecal samples (Table 1). 19.7% were *Ancylostoma duodenale*, 28.6% *Necator americanus* and 32.5% mixed infections. Although the positive rate of hookworm was almost the same in the three villages, the distribution of the hookworm species was different, *A. duodenale* and *N. americanus* were the predominant species in Aek Nauli and Tanjung Kasau respectively, whereas both species were almost equally prevalent in Simpang Gambus.

Mass treatment with anthelmintics: The efficacy of Combantrin or Trivexan was compared in mass treatment of 425 patients with single or mixed infections of *A. lumbricoides*, *T. trichiura* and hookworm. Stool examination follow-up done one month post treatment is shown in Table 2. After two phases of mass treatment, the mean cure rates of the both drugs were essentially the same against *A. lumbricoides* and hookworm.

However, the effect of Combantrin against *T. trichiura* was far less than that of Trivexan ($X^2 = 90.2$, $p < 0.001$).

The dynamics of helminthiasis after mass treatment: The blanket mass treatment was performed to examine the kinetics of parasite infections in an entire community before and after treatment. Out of 359 residents (Lorong 13) 264 persons were treated with Trivexan or Combantrin and the follow-up of stool examinations covered 96% of the treated persons during this study. Fig. 2 shows the kinetics of three helminth infections in Group B treated with Trivexan.

The pre-treatment prevalence in Group B were 92.4% for *A. lumbricoides*, 97.5% for *T. trichiura* and 90.8% for hookworm. The rates at one month after the 1st mass treatment reduced dramatically to 1.2%, 28.2% and 1.2% respectively. This remaining *T. trichiura* positive cases were concentrated in the low age children of under 9 years (Fig. 2-B). The incidence of *A. lumbricoides* and *T. trichiura* infections after the 1st mass treatment reverted nearly to pre-treatment level at ten

Table 2

Anthelmintic efficacy of Combantrin and Trivexan against *Ascaris lumbricoides*, *Trichuris trichiura* and hookworm.

Anthelmintics and helminthiasis	1st treatment		2nd treatment		Total	
	No. treated	Cure rate	No. treated	Cure rate	No. treated	Cure rate
Combantrin						
Ascariasis	94	91.5	120	98.3	214	95.3
Trichuriasis	98	22.4	127	13.4	225	17.3
Hookworm	87	96.6	51	54.9	138	81.2
Trivexan						
Ascariasis	77	98.7	98	98.0	175	98.3
Trichuriasis	83	71.1	87	66.7	170	68.8
Hookworm	78	98.7	22	86.4	100	96.0

month later. Hookworm infection rate remained significantly low, 23.0%. The incidences of these helminth infections at four month after the 2nd mass treatment increased again to 36.1% for *A. lumbricoides* 38.9% for *T. trichiura* and 19.4% for hookworm.

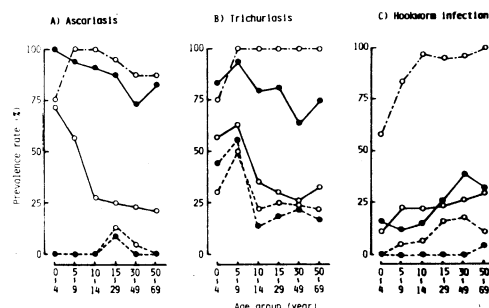


Fig. 2—Kinetics and distribution of helminth infections in Lorong 13 (Group-B), Simpang Gambus village. (O - - - O): Pre-treatment, (● - - - ●) and (●—●): At one month and 10 month after 1st mass treatment respectively, (O - - - O) and (O—O): At one month and 4 month after 2nd mass treatment respectively.

Four month after the second treatment, the reinfection rate of three parasites in those who were rendered negative at one month after the treatment was 30.3%, 18.8% and 15.4% respectively. In addition, *A. lumbricoides* reinfection rate at the same period was significantly higher in the children (41.3%) below 14 years than the older age group (5.0%) above 15 years. The reinfection rate of *T. trichiura* was 25.0% in the children and 6.3% in the adults. On the contrary, hookworm reinfection rate was more prevalent in adults (31.0%) than children (13.6%). This tendency became clear at ten month after the mass treatment.

The kinetics of reinfections with *A. lumbricoides* or hookworm in Group A, treated with Combantrin, was essentially similar to that in Group B. In case of trichuriasis, cure

rate with Combantrin was so poor that reinfection rate could not be evaluated.

Hemoglobin(Hb) and hookworm infections: Mean Hb values of 55 infants or preschoolers (1-5 years), 95 schoolchildren (6-14 years), 52 adult men and 63 adult women (15 years or more) examined were 9.2 gm%, 10.0 gm%, 12.7 gm% and 10.9 gm% respectively. When these Hb values were classified according to WHO criteria (1968) for anemia, the prevalence rate of anemia was found to be 87.3%, 86.3%, 48.1% and 68.3% in corresponding age or sex groups. Although mean Hb values of hookworm carriers was slightly lower than those of non-carriers in all age groups, this difference was not statistically significant (Fig. 3).

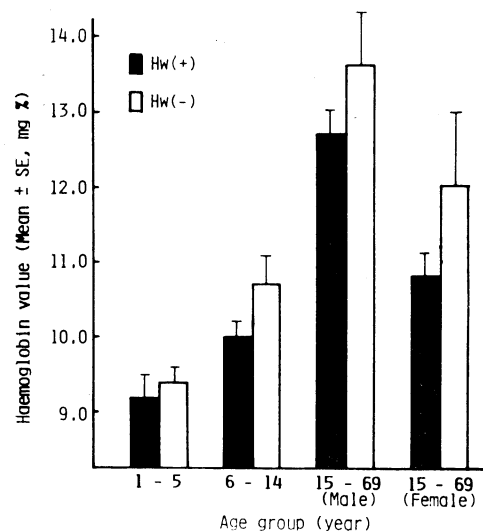


Fig. 3—Correlation between hemoglobin values and hookworm infection by age and sex. (■): Hookworm positive, (□): Hookworm negative cases.

DISCUSSION

The results of the basic survey were similar to those of previous surveys conducted elsewhere in Sumatra (Cross *et al.*, 1976; Stafford *et al.*, 1976; Kumazawa *et al.*, 1984) and other rural areas in Indonesia in

showing a high prevalence of soil-transmitted helminths. This high endemicity is considered to be the result of active transmission of parasite source caused by indiscriminate defecation on the ground in the bushes near the houses of the villagers and by favorable environmental conditions for eggs or larval development.

In comparison of the efficacy of Trivexan (compound of pyrantel pamoate and mebendazole) and Combantrin (pyrantel pamoate alone) against three major helminthiasis, the former drug was apparently more effective than the latter. Trivexan do not induce erratic migration of *Ascaris*, which is the drawback of mebendazole (Abidin *et al.*, 1980; Purnomo *et al.*, 1981). Since *T. trichiura* positive cases after Trivexan treatment were children under 9 years, it may be due to an incomplete medication at home.

When the fluctuation of infection in an entire community after the 1st mass treatment were examined, the speed of reinfection was the fastest in ascariasis followed by trichuriasis and hookworm infection. However, Cabrera and Valeza (1977) reported that the occurrence of *T. trichiura* and hookworm reinfections were faster than that of *A. lumbricoides* reinfection in an endemic area in the Philippines. This is probably due to differences in the infection intensities and in the environmental conditions or the socioeconomic factors in the respective countries.

In the short period after the mass treatment, the kinetics of reinfection rate in ascariasis was significantly faster in young children than adults, but such an age difference was not obvious in trichuriasis. The reinfection pattern and the speed of reinfection depends on the intensity of infective eggs in the soil based on the egg reproductive potential of a female worm (*Ascaris*: about 240000 eggs/day, *Trichuris*: about 1000 eggs/day). Ismid *et al.*,

(1978) showed that *Ascaris* eggs were found in 43% of soil samples collected around nine farmers' houses in a community of West Sumatra, Indonesia, although they did not note about *Trichuris* eggs. The age difference of reinfection may also depend on the protective immunity acquired by frequent repeated infections, especially in ascariasis (WHO, 1981). Moreover, the difference of the human behavior in daily life between children and adults may be related to the age distribution of the parasitic reinfections.

In the present study, the reinfection rate of *A. lumbricoides* in children (63.6%) was about six times higher than that in adults (10.4%) at four month after the mass therapy in whole community (Lorong 13). The four month interval mass treatment scheme has been applied for parasite control in North Sumatra when the prevalence is above 30%. Therefore, based on our findings Trivexan treatment at two month intervals for children and four month intervals for adults seemed to be required for the effective helminth control scheme in highly endemic areas of North Sumatra.

The prevalence of anemia was more than 80% in the children under 14 years of age. Since hookworm infection as an anemia-producing factor is not clear, nutritional iron deficiency appears to be the major contributing factor for anemia in this community.

SUMMARY

The survey on soil-transmitted helminthiasis was carried out in the three villages of Asahan Regency, North Sumatra, Indonesia, between October 1981 and December 1982. The prevalence rates of geohelminthiasis proved to be extremely high (average 97%) in the three villages and more than 70% harboured three or more helminths, especially *Ascaris lumbricoides*, *Trichuris trichiura* and hookworm. *Necator americanus* and *Ancylos-*

toma duodenale were detected in 61.1% and 52.2% of 835 fecal specimens, respectively. The effects of two anthelmintics, Combantrin and Trivexan, were essentially the same against *A. lumbricoides* and hookworm, although Trivexan was better than Combantrin against *T. trichiura*. The kinetic changes of parasitic infection in community after mass treatment were examined. Ten months after the first drug treatment, the incidence of Ascariasis or trichuriasis reverted nearly to pre-treatment level, while hookworm infection rate remained significantly low. Four month after the second mass treatment, the reinfection rate of *A. lumbricoides* was most prevalent followed by trichuriasis and hookworm infection. The reinfection rate (63.6%) of *A. lumbricoides* in children was about six times higher than that (10.4%) in adults at four month after the mass treatment. This study indicates that mass treatment with Trivexan at two month intervals for children and four month intervals for adults is necessary for the effective helminth control scheme in highly endemic areas of North Sumatra.

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