

REINFECTION AND INFECTION RATES OF SOIL-TRANSMITTED-HELMINTHS IN KEMIRI SEWU, YOGYAKARTA, INDONESIA

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Abstract. A study on the reinfection and infection rates of soil-transmitted helminths was conducted in Kemiri Sewu, Godean District, Sleman Regency, Yogyakarta Special Province, Indonesia, from August 1988 to June 1990.

A total 61 individuals rendered *Ascaris lumbricoides* egg-negative by drug treatment were used in the reinfection study and 412 individuals found negative for *Ascaris* eggs in the pretreatment stool examination were used for the infection rate study. In both groups, children had higher and faster reinfection and infection rates than adults. The start of reinfection was 4 months after treatment, and the start of infection was at the 1st month. At 20 months after treatment, the reinfection rate of ascariasis was 14.8% and the infection rate was 11.4% among both children and adults.

There were 140 subjects rendered *Trichuris trichiura* egg-negative by drug treatment, and 317 *Trichuris* egg-negative at the pretreatment stool examination which were used in the reinfection and infection rates studies. In general, the reinfection rates of *T. trichiura* among adults were higher than those among children. The start of reinfection was 4 months after treatment, and the infection was at the 1st month. At the end of 20 months, the reinfection rate was 36.4% and the infection rate was 21.8% among both children and adults.

A total 83 subjects rendered *Necator americanus* egg-negative by drug treatment and 365 *N. americanus* egg-negative at pretreatment stool examination were used in the reinfection and infection rate studies. Throughout the study, adults had always higher reinfection and infection rates than children, while adults males had higher reinfection rates than adults females. The start of reinfection was 4 months after treatment, and the start of infection was at the 1st month; they were 25.3% and 9.3% respectively. At the end of 20 months, the reinfection rate was 65.1%, and the infection rate was 47.9% among both children and adults.

INTRODUCTION

In Indonesia, a number of studies have been done regarding reduction in the prevalence rates of soil-transmitted helminths after mass treatment was given to the people in the community (Soeripto *et al.* 1985; Soeripto, 1989; Sutoto and Indriono, 1989).

In Java, most people with parasitism had triple infection. *Ascaris lumbricoides*, *Trichuris trichiura*, and *Necator americanus* were common; *Ancylostoma duodenale* was not observed (Higgins *et al.* 1984; Soeripto *et al.* 1989).

Studies were done in order to determine the frequency of treatments and the length of time required for the repeated treatment to control

these helminthic diseases. Hence, in the control of soil-transmitted helminthiasis in Indonesia, the frequency of mass treatment was three times a year if the prevalence rate of infection was 30% or greater, twice a year if 20% to less than 30%, and once a year if 10% to less than 20% (Sutoto and Indriono, 1989).

Insofar as reinfection and infection rates in relation to soil-transmitted helminths in rural area are concerned, no long term longitudinal studies have been done. Thus, this study was started in the hope that, with knowledge of the pattern of reinfection and infection rates of these helminths, the treatment schedule could be modified so as to coincide with the months of highest reinfection and infection after the previous mass treatment was given.

MATERIALS AND METHOD

The study was conducted in Kemiri Sewu village, Godean District, Sleman Regency, Yogyakarta Special Province, Indonesia, from August 1988 to June 1990. People from Kemiri Sewu were examined for the presence of *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworm eggs in their stools by using Kato's thick smear technique (Katz *et al*, 1972; Kobayashi, 1974). Modified Harada Mori culture technique (Hsieh, 1962; Sasa, 1974) was used for identifying the hookworm species.

A total of 680 people of Kemiri Sewu were blanket treated using mebendazole 400 mg single dose, except children less than one year old, people who were ill, such as those suffering from fever, and pregnant women. Approximately one month after treatment, stool examinations were done, and all those found soil-transmitted helminth egg-negative were placed in group I. Cases found egg-negative for these helminths before treatment were placed in group II.

Stool specimens from these two groups of subjects were collected every four months for 20 months, and examined using the same methods: Kato's thick smear and modified Harada Mori culture techniques.

For group I, we tried to observe the appearance of soil-transmitted helminths eggs, such as *A. lumbricoides*, *T. trichiura*, and hookworm, every four months, during the study; and those found positive were considered as "reinfection". We did the same procedure for group II, and positive cases were considered as "infection". Hence, the reinfection and infection rate studies were categorized by species of parasites *per se*, rather than by individual subject.

RESULTS

A. lumbricoides

The result of the reinfection rates of treated cases of ascariasis per four months by age and sex, can be seen in Table 1 and Fig 1. The reinfection rates of ascariasis among children and adults of both sexes during the study were relatively very low. At the end of 20 months, it was only 14.8%.

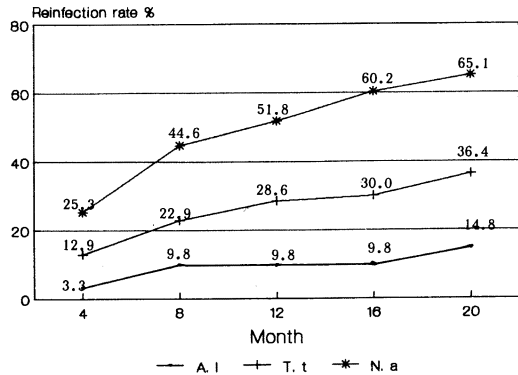


Fig 1—Reinfection rates of soil-transmitted helminths in Kemiri Sewu, Godean, Yogyakarta, Indonesia. A.l = *Ascaris lumbricoides*; T.t = *Trichuris trichiura*; N.a = *Necator americanus*. (August 1988-June 1990).

It can be seen that children started to be reinfected as early as 4 months, while adult males started to be reinfected 8 months, and adult females 20 months after treatment. The reinfection rates among children throughout the study were always higher than those among adults, both females and males. After 20 months, the reinfection rate among children was 38.9% and among adult females 3.8%. The difference was highly significant ($X^2 = 8.780$; $p < 0.01$). The reinfection rate among adults males was 5.9%; it was significantly lower then those among children ($X^2 = 5.402$; $p < 0.05$)

The result of the infection rates of *A. lumbricoides* is shown in Table 2 and Fig 2. It can be noted that among children, infection started much earlier than among adults females and adults males; they were at 1 month, 4 months, and 8 months respectively. Hence, at the end of 20 months, the infection rates were 13.7%, 11.0%, and 10.2%, among children, adult females, and adult males respectively. The differences were not statistically significant.

T. trichiura

The result of the reinfection rate of successfully treated cases of trichuriasis can be seen in Table 3 and Fig 1. The reinfection of *T. trichiura* started 4 months after treatment both among children and adults females and males. They were 12.9%, 11.1%, and 15.2% respectively. After 8 months and later, the reinfection rates among adults were always higher than those among children. At the end of 20

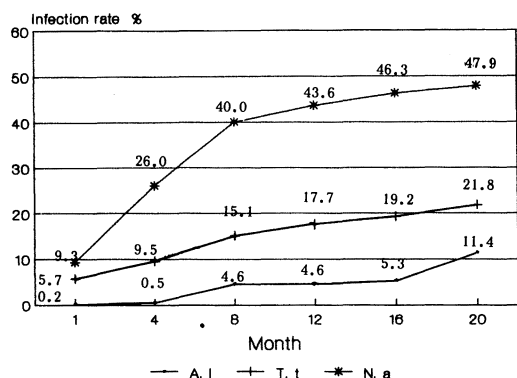


Fig 2—Infection rates of soil-transmitted helminths in Kemiri Sewu, Godean, Yogyakarta, Indonesia. A.l = *Ascaris lumbricoides*; T.t = *Trichuris trichiura*; N.a = *Necator americanus*. (August 1988-June 1990).

months, it was 25.8% among children, 36.5% among adult females and 43.5% adult males, but they were not significantly different. Among both children and adults at the end of the study, the reinfection rate of *T. trichiura* was 36.4%.

The infection rates of *T. trichiura* by age and sex are shown in Table 4 and Fig 2. The infection rates started very early among both children and adults. A total of 5.9% among children, 7.5% among adult females, and 3.0% adult males became infected in the first month. At the 20th month, the infection rates were 24.7%, 21.8%, and 19.2% among children, adult females, and adult males, respectively. The differences were not statistically significant. It was found that after 20th month, the infection rate of *T. trichiura* among both children and adults was 21.8%.

Table 1

Reinfection rate of treated cases of *Ascaris lumbricoides* by age and sex, in Kemiri Sewu, Yogyakarta, Indonesia, August, 1988- June 1990.

Age group and sex	No. examined*	Period of examination									
		I (4 months)		II (8 months)		III (12 months)		IV (16 months)		V (20 months)	
		No. pos	%	No. pos	%	No. pos	%	No. pos	%	No. pos **	%
Children (1-12 years)	18	2	11.1	5	27.8	5	27.8	5	27.8	7	38.9
Adults (> 12 years)											
Female	26	0	0	0	0	0	0	0	0	1	3.8
Male	17	0	0	1	5.9	1	5.9	1	5.9	1	5.9
Total	61	2	3.3	6	9.8	6	9.8	6	9.8	9	14.8

* Number of persons cured after treatment.

** Number of cumulative persons positive after treatment.

Table 2

Infection rate of *Ascaris lumbricoides* by age and sex, at Kemiri Sewu, Yogyakarta, Indonesia, August, 1988 - June 1990.

Age group and sex	No. examined*	Period of examination											
		I (1 month)		II (4 months)		III (8 months)		IV (12 months)		V (16 months)		VI (20 months)	
		No. pos	%	No. pos	%	No. pos	%	No. pos	%	No. pos	%	No. pos **	%
Children (1-12 years)	102	1	1.0	1	1.0	7	6.9	7	6.9	7	6.9	14	13.7
Adults (> 12 years)													
Female	173	0	0	1	0.6	6	3.5	6	3.5	8	4.6	19	11.0
Male	137	0	0	0	0	6	4.4	6	4.4	7	5.1	14	10.2
Total	412	1	0.2	2	0.5	19	4.6	19	4.6	22	5.3	47	11.4

* Number of persons negative before treatment.

** Number of cumulative persons positive after treatment.

SOIL TRANSMITTED HELMINTHS IN INDONESIA

Table 3

Reinfection rate of treated cases of *Trichuris trichiura* by age and sex, in Kemiri Sewu, Yogyakarta, Indonesia, August, 1988 - June 1990.

Age group and sex	No. examined*	Period of examination									
		I (4 months)		II (8 months)		III (12 months)		IV (16 months)		V (20 months)	
		No. pos	%	No. pos	%	No. pos	%	No. pos	%	No. pos **	%
Children (1-12 years)	31	4	12.9	5	16.1	6	19.4	6	19.4	8	25.8
Adults (> 12 years)											
Female	63	7	11.1	15	23.8	19	30.2	20	31.7	23	36.5
Male	46	7	15.2	12	26.1	15	32.6	16	34.8	20	43.5
Total	140	18	12.9	32	22.9	40	28.6	42	30.0	51	36.4

* Number of persons cured after treatment.

** Number of cumulative persons positive after treatment.

Table 4

Infection rate of *Trichuris Trichiura* by age and sex, at Kemiri Sewu, Yogyakarta, Indonesia, August, 1988 - June 1990.

Age group and sex	No. examined*	Period of examination											
		I (1 month)		II (4 months)		III (8 months)		IV (12 months)		V (16 months)		VI (20 months)	
		No. pos	%	No. pos	%	No. pos	%	No. pos	%	No. pos	%	No. pos **	%
Children (1-12 years)	85	5	5.9	11	12.9	14	16.5	18	21.2	19	22.4	21	24.7
Adults (> 12 years)													
Female	133	10	7.5	13	9.8	22	16.5	24	18.0	25	18.8	29	21.8
Male	99	3	3.0	6	6.1	12	12.1	14	14.1	17	17.2	19	19.2
Total	317	18	5.7	30	9.5	48	15.1	56	17.7	61	19.2	69	21.8

* Number of persons negative before treatment.

** Number of cumulative persons positive after treatment.

Hookworm

The result of stool examinations using modified Harada Mori culture technique showed that only *Necator americanus* was observed.

The reinfection rates of treated cases of *N. americanus* infection are shown in Table 5 and Fig 1. It can be seen that the reinfection rates started on the 4th month both among children and adults. They were 41.7% among children, 22.9% among adults females, and 22.2% among males. At the end of 20 months, the reinfection rates among both children and adults were 65.1%. They were 58.3% among children, 60.0% among adult females, and 72.2% among adult males. The differences were not statistically significant.

The infection rates of *N. americanus* can be seen in Table 6 and Fig 2. Children and adults got infected on the 1st month; adult males had higher infection rates than females and children; they were 14.4%, 7.2%, and 7.4%, respectively. At the

end of 20 months, the infection rate among both children and adults was 47.9%; they were 31.5%, 54.9%, and 54.8%, among children, adult females, and adult males respectively. The differences were not significant.

DISCUSSION

When one observes the result of the study in Kemiri Sewu, it would appear that in general, reinfection of soil-transmitted helminths started at 4 months after treatment, and infection started at the 1st month; and the reinfection and infection rates tended to follow the same trend. One will also note that during 20 months of study, the reinfection and infection rates of *N. americanus* were always higher than those of *T. trichiura* and *A. lumbricoides*.

In Juban, Sorsogon, Philippines Cabrera (1978) found that the start of reinfection and

Table 5

Reinfection rate of treated cases of *Necator americanus* by age and sex, in Kemiri Sewu, Yogyakarta, Indonesia, August, 1988 - June 1990.

Age group and sex	No. examined*	Period of examination									
		I (4 months)		II (8 months)		III (12 months)		IV (16 months)		V (20 months)	
		No. pos	%	No. pos	%	No. pos	%	No. pos	%	No. pos**	%
Children (1-12 years)	12	5	41.7	5	41.7	5	41.7	5	41.7	7	58.3
Adults (> 12 years)											
Female	35	8	22.9	14	40.0	17	48.6	20	57.1	21	60.0
Male	36	8	22.2	18	50.0	21	58.3	25	69.4	26	72.2
Total	83	21	25.3	37	44.6	43	51.8	50	60.2	54	65.1

* Number of persons cured after treatment.

** Number of cumulative persons positive after treatment.

Table 6

Infection rate of *Necator americanus* by age and sex, at Kemiri Sewu, Yogyakarta, Indonesia, August, 1988 - June 1990.

Age group and sex	No. examined*	Period of examination											
		I (1 month)		II (4 months)		III (8 months)		IV (12 months)		V (16 months)		VI (20 months)	
		No. pos	%	No. pos	%	No. pos	%	No. pos	%	No. pos	%	No. pos**	%
Children (1-12 years)	108	8	7.4	23	21.3	32	29.6	33	30.6	33	30.6	34	31.5
Adults (> 12 years)													
Female	153	11	7.2	38	24.8	66	43.1	75	49.0	81	52.9	84	54.9
Male	104	15	14.4	34	32.7	48	46.2	51	49.0	55	52.9	57	54.8
Total	365	34	9.3	95	26.0	146	40.0	159	43.6	169	46.3	175	47.9

* Number of persons negative before treatment.

** Number of cumulative persons positive after treatment.

infection rates of ascariasis was also at 4 months, but the start of infection of *T. trichiura* was earlier (1 month) than reinfection (2 months). The start of reinfection and infection of hookworm was at the first month. The species of hookworm was not identified.

In Kemiri Sewu, children had higher and faster reinfection and infection rates of ascariasis than adults. For *T. trichiura*, adults had higher reinfection rates than children during the study. For *N. americanus*, adults had always higher reinfection and infection rates than children. These results appear to be similar to those of Cabrera (1978), in Juban.

In this study, at the end of 20 months, the reinfection rate of ascariasis among both children and adults was only 14.8%; while the infection rate was 11.4%. This was relatively low compared with the results in Juban, where the reinfection rates at 12 months after treatment were 95.7%-97.7%; and the infection rates were 77.4%-100%. It seemed that

the low transmission of *A. lumbricoides* in Kemiri Sewu might be due to the low contamination of soil with ascaris eggs. Noerhajati *et al* (1989) reported that the soil positive *A. lumbricoides* eggs in Godean District, Sleman Regency, was only 2.7%; and Kemiri Sewu is located in Godean. The condition might be caused by the traditional habits on many people of Godean, including Kemiri Sewu, of defecating in the fishponds.

The reinfection and infection rates of *N. americanus* in this study were relatively high. They were 65.1% and 47.9% among children and adults after 20 months, respectively. In general, throughout the study, the reinfection rates among adult males were always higher than adult females. It should be explained that most people in this rural area defecated on the ground, such as under the bushes around their homes or in the fields. The development of *N. americanus* larvae and subsequent transmission would be occurring continuously particularly among adult males, since they work barefoot in the fields.

Ismail *et al* (1989) determined the reinfection rates of soil-transmitted helminths in Sri Lanka. A follow up stool survey was carried out 18-20 months after mebendazole treatment. It was found that the reinfection rates of *A. lumbricoides* in three villages: Borella, Rajagiriya and Pannipitiya were 47.0%, 21.3%, and 6.8%, respectively. The reinfection rates of *T. trichiura* were 32.2%, 20.8%, and 9.0% in these three villages, respectively. For *N. americanus* infection, the reinfection rate in Borella was 3.8%, Rajagiriya 3.7%, and in Pannipitiya 9.5% among both children and adults. These rates were much lower than those in Kemiri Sewu, Yogyakarta.

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REFERENCES

- Cabrera BD. Reinfection and infection rate studies of soil-transmitted helminthiasis in Juban, Sorsogon, Republic of the Philippines. Proceedings of The Fifth Conference of Asian Parasite Control Organization, Indonesia 1978; 420-41.
- Higgins DA, Jenkins DJ, Kurniawan L, Purnomo Harun S, Juwono SS. Human intestinal parasitism in three areas of Indonesia; a survey *Ann Trop Med Parasit* 1984; 78 : 637-48.
- Hsieh HC. A test tube paper method for the diagnosis of *Ancylostoma duodenale*, *Necator americanus*, and *Strongyloides stercoralis*. *Who Tech Rep Ser* 1962; 255 : 27-30.
- Ismail MM, Rajapakse AL, Suraweera MGW, Amarasinghe DKC. Some socio-economic and health-related soil-transmitted infections: 2. relationship to reinfection. Asian Parasite Control/Family Planning Conference; 11th Parasitologists Meeting, Jakarta, Indonesia, 1989.
- Katz N, Chaves A, Pellegrino J. A simple device for quantitative stool thick smear technique in *Schistosoma mansoni*. *Rev Inst Med Trop Sao Paulo* 1972; 14 : 397-400.
- Kobayashi A. Fecal examination on Kato's thick smear technique as a screening method for helminth infections (A review). SEAMEO-TROPED Technical Meeting, Tokyo, Japan, 1974.
- Sasa M. Diagnosis of hookworm and *Strongyloides stercoralis* infections by faecal culture method. SEAMEO-TROPED. Technical Meeting, Tokyo, Japan, 1974.
- Soeripto N. Impact of environmental improvement on the pattern of soil-transmitted helminths infections: The Yogyakarta Case. Asian Parasite Control/Family Planning Conference; 11th Parasitologists Meeting, Jakarta, Indonesia, 1989.
- Soeripto N, Ismail D, Supargiyono. The role of women in the control of soil-transmitted helminths. Proceedings of the Seminar on Women Issues in Water and Sanitation, Philippines 1985; 73-5.
- Soeripto N, Dulyachman, Sri Sumarni, Sutarti. Soil-transmitted helminths in Yogyakarta. Proceedings of the Indonesia-USA Conference Application of Biotechnology on the Study of Animal Parasites and their vectors, Indonesia 1989; 247-62.
- Sutoto, Indriono. The current situation of soil-transmitted helminthic infections and the control measures in Indonesia. Asian Parasite Control/Family Planning Conference; 11th Parasitologists Meeting, Jakarta, Indonesia, 1989.