

SOIL-TRANSMITTED HELMINTHS IN YOGYAKARTA

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ABSTRACT

Infections by soil-transmitted helminths is still a public health problem in Indonesia. *Ascaris lumbricoides*, *Trichuris trichiura* and the hookworms- mainly *Necator americanus*- were the most encountered.

The rural villages near Yogyakarta in Central Java, Indonesia, were studied for the endemicity of the worms. The population in the two villages were around 1200 people and regarded the same in respect of low socio-economic level and low educational level. However, different occupations were applied in the villages.

In the villages of Kasongan the main occupation was working in home industries making clay handicrafts such as ceramics and potteries, with bare hands. The materials were clay and sand, obtained from the soil surrounding the houses and from the riverbanks nearby. Environmental sanitation was very poor : most of the people had no latrines, defecation occurred in the field or in the vicinity of the river. The climate was hot and humid. The village of Godehan was inhabited mostly by farmers, who also raised fish in open fishponds in the gardens or in the ricefields. Most of the houses did not have a latrine and defecation occurred in the fishponds or in the surroundings of the river.

Faecel examinations were done by Kato's thick smear and modified Harada Mori culture technique. Soil samples were also taken from the several places and examined for *A. lumbricoides* eggs. The prevalence rates of the soil transmitted helminths in Kasongan village were significantly higher than those in Godehan village.

A. lumbricoides infections were 50.8% and 11.5%; *T. trichiura* infection were 82.6% and 36.6% and *N. americanus* infections were 76.5% and 25.3%, in Kasongan and Godehan respectively. Soil samples were found positive for *A. lumbricoides* eggs in 28.3% of 538 soil samples in Kasongan and in 2.7% of 183 samples in Godehan.

The results indicated, that perhaps occupation was a factor for the significant differences in endemicity in the two villages.

INTRODUCTION

The helminths that, as a group, have the widest and most general distribution and the highest prevalence rates are those whose infective stages are generated in soil; in a large part of the world they also cause the highest incidence of human diseases.

The most important soil-transmitted helminths are: *Ascaris lumbricoides*, *Trichuris trichiura*, *Necator americanus* and *Ancylostoma duodenale*. An additional species, less widely distributed and less restricted to soil-transmission is *Strongyloides stercoralis*.

In general it is believed that the various species of soil-transmitted nematodes are still

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cosmopolitan, and its distribution are largely determined by local habits of the people in the disposal of faeces. In the case of these nematodes under consideration, the intermediary vehicle of transference is the soil. Consequently it is the soil which constitutes the infective medium to the host. Any discussions of habits and practices of the host as a factor influencing transmission of these parasites, in regards to faeces disposal, must take into consideration three salient points:¹ the suitability of the environment for the eggs or larvae, in the actual location where the faeces are deposited;² the mode and extent of contact between soil and faeces; and³ the mode and extent of contact between soil and food, drinking water and skin.

The most important point to be stressed here is that in spite of the enormous progress which mankind has made over the past fifty years and the great modern cities which have been established in many countries, there still remain even relatively close to these cities, a vast number of human beings whose standards of living, level of education, and economic and social status have changed little, and whose habits, particularly with regard to defaecation, are still such to expose them constantly to infection with soil-transmitted nematodes¹.

In this paper, the endemicity of soil-transmitted helminths in Yogyakarta is presented, to show the differences in the prevalence rates and intensity of infections in rural areas near the city, where the conditions of the people and the traditional habits in the disposal of faeces are different.

MATERIAL AND METHODS

The study was conducted in rural areas near the city of Yogyakarta. Two villages were selected for the study:

A. Kasongan, Bantul Regency, Yogyakarta

The total population of this village was 1159, consisted of 234 families. Most of the people were farmers, and many of them were workers in home industries making clay handicrafts, such as ceramics and potteries. The educational level and the socioeconomic status of the people were relatively low, and the environmental sanitation was very poor. Most of the people did not have latrine, and they defaecated commonly in the garden or in the river.

The climate was hot and humid, and the soil consisted of clay and sand. The materials of handicrafts were clay and sand obtained from the fields surrounding their homes and from the banks of the river.

B. Godehan, Sleman Regency, Yogyakarta

The population of the study village was 1139 persons, consisted of 258 families. Most of the people were farmers with low socioeconomic level and poor environmental sanitation. The educational level was also relatively low. For their income generations, many of them raised fish in the fishponds, located in the garden or in the ricefield. Most of the people did not have latrine, and they simply defaecated in the fishponds or in the river.

The climate was hot and humid, and the soil consisted particularly of red clay.

The general household survey about age, sex, educational level, type of occupation, and the traditional habits in the disposal of faeces was done in these two villages by using questionnaires.

Faecal samples were collected from approximately 30% of the total population

selected randomly from Kasongan, and from the people of Godehan, and examined for helminthic eggs, in the laboratory of the Department of Parasitology. Kato's thick smear technique as described by Katz *et al.*² and Kobayashi³ was used for quantitative examination, and a modified Harada Mori culture technique as described by Hsieh⁴ and Sasa⁵ was used for qualitative examination to identify the hookworm species and *S.stercoralis*.

Soil samples taken from the places of about 10% of the houses in the village were examined for helminthic eggs. A simple technique as described by Rukmono *et al.*⁶ and Ismid *et al.*⁶ was used for soil examination.

RESULTS AND DISCUSSION

Table 1 shows the distribution of the population of Kasongan and Godehan, Yogyakarta, by the level of education. It can be seen that the educational level of the people in these two study villages was relatively low, but it seemed that the people of Kasongan had a higher educational level than the people of Godehan. A total of 495 persons (42.7%) in Kasongan were illiterate, and only 3 persons (0.3%) educated from an academy or university. In Godehan, a total of 159 persons (14.0%) were illiterate and 18 persons (1.6%) graduated from an academy or university.

The distribution of the population by the type of occupation is shown in Table 2. About 10.3% of the people in Kasongan were farmers, and 19.9% were day handicraft workers. Actually, most of the people in Kasongan, children and adults, always made ceramics or potteries at their homes as a traditional habit, and sold them to the people in the city. To promote this income-generating ac-

tivities, the Government had said great attention and helped the people in producing ceramics with modern creation and better quality. In Godehan, 21.3% of the people were really farmers, but most of the people always worked in the garden or in the fields during their leisure times.

The defaecation habits of the people can be seen in Table 3. Many people in Kasongan commonly defaecated in the river (40.8%) and in the garden (27.7%). Approximately 21.7% defaecated in the latrines, and 4.8% in the ponds. Most of the people in Godehan defaecated in the river (53.7%) and in the fishponds (30.4%). Only few people defaecated in the latrines (9.4%) and in the garden (1.6%).

Table 4 shows the positive findings of *Ascaris lumbricoides* eggs in the soil. The results of soil examination confirmed the traditional habits of the people in the disposal of faeces. A total a 28.3% out of 538 soil samples from Kasongan were positive with *Ascaris* eggs, mostly found near the latrines or places for defaecation (71.4%) and near the wells or washing places (43.3%). These findings confirmed the report of Indriyono *et al.*⁸ about soil pollution with human excreta in Sawahlunto west Sumatera and Serpong west Java. Constant soil pollution with human faeces around the farmer's dwelling occurred throughout the year, and the place usually were garbage pile, the shaded area under a tree, near the latrines, and near the wasiung places. Among 183 soil samples from Godehan examined for helminthic eggs only five samples were found (2.7%) *Ascaris* positive. It means that the soil contamination with human faeces in Godehan was relatively lower than those in Kasongan.

The prevalence rates and intensity of soil-transmitted helminthic infections by sex in Kasongan and Godehan were shown in

Table 1. Distribution of the population by the educational level in Kasongan and Godehan, Yogyakarta

Education	Kasongan		Godehan	
	No. of people exam.	%	No. of people exam.	%
Preschool	175	15.1	106	9.4
Primary school - 3 years	214	18.5	191	16.9
Primary school 4-6 years	180	15.5	287	25.3
Secondary school	59	5.1	129	11.4
High school	33	2.8	242	21.4
Academy/University	3	0.3	18	1.6
Illiterate	495	42.7	159	14.0
Total	1159	100.0	1132	100.0

Table 2. Distribution of the population by the type of occupation, in kasongan and Godehan, Yogyakarta

Occupation	Kasongan		Godehan	
	No. of people exam.	%	No. of people exam.	%
Preschool	175	15.1	106	9.4
School children	246	21.2	281	24.8
Employee	20	1.7	98	8.6
Businessman	90	7.8	100	8.8
Farmer	119	10.3	241	21.3
Soil handicraft worker	231	19.9	0	0
Labour	93	8.0	141	12.5
Jobless	185	16.0	165	14.6
Total	1159	100.0	1132	100.0

Table 3. The defaecation habits of the people in Kasongan and Godehan, Yogyakarta

Place of defaecation	Kasongan		Godehan	
	No. of people exam.	%	No. of people exam.	%
Latrine	199	21.7	106	9.4
Pond	44	4.8	344	30.4
River	374	40.8	606	53.7
Garden	254	27.7	18	1.6
Others	45	5.0	55	4.9
Total	916	100.0	1129	100.0

Table 4. Positive findings of *Ascaris lymbricoides* eggs in the soil according to places, in Kasongan and Godehan, Yogyakarta

Place of soil	Kasongan			Godehan		
	No. of soil exam.	No. pos.	%	No. of soil exam.	No. pos.	%
Outside the house	248	72	29.0	96	4	4.2
Inside the house	60	15	25.0	21	1	4.8
Near the well/washing places	60	26	43.3	18	0	0
Near the latrine/ place of defaecation	7	5	71.4	13	0	0
Garden	163	34	20.9	35	0	0
Total	538	152	28.3	183	5	2.7

Table 5. The prevalence rates of these nematodes in Kasongan were much higher than those in Godehan. It was found that the prevalence rates of *A.lumbricoides* were 50.8% and 11.5%; *T.trichiura* were 82.6% and 36.3% and *N.americanus* were 76.5% and 25.3% in Kasongan and Godehan respectively. The differences between the prevalence rates of these soil-transmitted helminths in the two study villages were highly significant (For *A.lumbricoides*, $X^2=216.3$, $df=1$; *T.trichiura*, $X^2=216.1$, $df=1$; *N.americanus*, $X^2=264.5$, $df=1$). This results confirmed the traditional defaecation habits of the people and the soil pollution with human faeces in Kasongan and Godehan.

Both in Kasongan and Godehan, *N.americanus* were more detected among males than females. The prevalence rates in Kasongan were 78.9% and 73.2% in male and female respectively. The difference was not significant. In Godehan, the prevalence rate of *N.americanus* in male (29.2%) was significantly higher than in female (21.0%), ($X^2=4.24$, $df=1$).

Clarke *et al.*⁹ reported the prevalence rates of soil-transmitted helminths in five villages near the city of Yogyakarta; *Ascaris* was found 76.0%, *T.trichiura* 94.7%, and hookworm was 65.3%. Noerhajati *et al.*¹⁰ reported the study in Kasihan, Bantul Regency, Yogyakarta. The prevalence rates of *A.lumbricoides* were 74.7% and 72.0%, *T.trichiura* 85.8% and 90.0%, and hookworm 46.4% and 48.0%.

The intensity of infection was estimated by the Number of Eggs Per Gram faeces per infected person (NEPG). It proved that in Kasongan, the intensity of *Ascaris* infection in male was higher than those in female, while in Godehan, in female was higher than in male. The reason of these findings can be explained that most of the men in Kasongan,

children and adults, were traditionally involved in the day handicrafts. The techniques of making ceramics are very simple; they mix clay and sand with their feet and hands, so that contamination with *Ascaris* eggs from the soil might occur continuously. In Godehan, the intensity of *Ascaris* infection in female is higher than in male, that might be due to the poor personal hygienic habits of the women. The intensity of *T.trichiura* and *N.americanus* infections in male and female, both in these two study villages were relatively low.

Table 6 and Table 7 show the distribution of soil-transmitted helminths according to age groups. All of these nematodes appeared to be acquired early in life and similarly distributed among various age groups. The highest prevalence rate and intensity of *Ascaris* infection was found in children less than 10 years of age in both study villages.

SUMMARY

A study of soil-transmitted helminths was conducted in two villages near the city of Yogyakarta: Kasongan, Bantul Regency and Godehan, Sleman Regency, where the condition of the people and the traditional habits in defaecation were different. Most of the people in Kasongan were clay handicraft workers, while most of the people in Godehan were farmers.

The prevalence rates of soil-transmitted helminths in Kasongan were significantly higher than those in Godehan. *A.lumbricoides* infections were 50.8% and 11.5%; *T.trichiura* were 82.6% and 36.6%, and *N.americanus* were 76.5% and 25.3%, in Kasongan and Godehan respectively. The intensity of *Ascaris* infection in Kasongan was higher in male than in female, while in Godehan, it was higher in female than in male.

Table 5. The prevalence rates of soil-transmitted helminths by sex, in Kasongan and Godehan, Yogyakarta

Sex	No. exam.	<i>Ascaris lumbricoides</i>			<i>Trichuris trichiura</i>			<i>Necator** americanus</i>		
		No. pos.	%	Mean NEPG	No. pos.	%	Mean NEPG	No. pos.	%	Mean* NEPG
Kasongan										
Male	163	78	47.9	4751	137	84.0	490	130	79.8	200
Female	164	88	53.7	1952	133	81.1	537	120	73.2	270
Total	327	166	50.8	3267	270	82.6	513	250	76.5	234
Godehan										
Male	428	44	10.3	728	153	35.7	121	128	29.2	91
Female	471	59	12.5	3433	173	36.7	145	99	21.0	57
Total	899	103	11.5	2277	326	36.3	139	227	25.3	76

* Mean Number of Eggs Per Gram faeces infected person.

** Faecal examination by Kato's thick smear and modified Harada Mori culture techniques.

Table 6. The prevalence rates of soil-transmitted helminths by age group and intensity of infection, in Kasongan, Yogyakarta

Age group (years)	No. exam.	<i>Ascaris lumbricoides</i>			<i>Trichuris trichiura</i>			<i>Necator** americanus</i>		
		No. pos.	%	Mean NEPG	No. pos.	%	Mean NEPG	No. pos.	%	Mean* NEPG
0 - 4	26	15	57.7	4052	13	50.0	331	11	42.3	179
5 - 9	40	28	70.0	8716	35	87.5	976	36	90.0	106
10 - 19	76	43	56.6	3148	67	88.2	511	58	76.3	108
20 - 29	58	30	51.7	1460	50	86.2	452	44	75.6	170
30 - 39	39	17	43.6	852	31	79.5	366	30	76.9	419
40 - 49	35	14	40.0	1351	28	80.0	401	30	85.7	200
50 +	53	19	35.8	1315	46	86.8	450	41	77.4	499
Total	327	166	50.8	3267	270	82.6	513	250	76.5	234

Table 7. The prevalence rates of soil-transmitted helminths by age group and intensity of infection, in Godehan, Yogyakarta

Age group (years)	No. exam.	<i>Ascaris lumbricoides</i>			<i>Trichuris trichiura</i>			<i>Necator** americanus</i>		
		No. pos.	%	Mean NEPG	No. pos.	%	Mean NEPG	No. pos.	%	Mean* NEPG
0 - 4	51	6	11.8	12326	6	11.8	133	2	3.9	75
5 - 9	89	23	25.8	4595	33	37.1	260	12	13.5	118
10 - 19	210	16	7.6	778	90	42.9	168	52	24.8	52
20 - 29	133	13	9.8	1087	41	30.8	113	25	18.8	48
30 - 39	125	16	12.8	604	43	34.4	59	33	26.4	49
40 - 49	125	14	11.2	514	41	32.8	67	37	29.6	53
50 +	166	15	9.0	766	72	43.4	232	66	39.8	126
Total	899	103	11.5	2277	326	36.6	139	227	25.3	76

* Mean Number of Eggs Per Gram faeces per infected person

** Faecal examination by Kato's thick smear and modified Harada Mori culture techniques.

In both villages the highest prevalence rate and intensity of *A.lumbricoides* infection was found in children less than 10 years of age.

ACKNOWLEDGEMENTS

This research has been made possible through the financial support of International Development Research Centre (IDRC) Canada. The authors wish to thank to Dr. Donald S. Sharp, Dr. Dae Woo Han, and Mr. Lee Kam Wing for their assistance and cooperation.

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