

HELMINTHIASES IN PENINSULAR MALAYSIA — PREVALENCE AND DENSITY OF INFESTATION OF HOOKWORM, *ASCARIS* AND *TRICHURIS* IN RURAL SCHOOL CHILDREN

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INTRODUCTION

WORM infestations are common in Malaysia, especially in the rural population. Over the past 50 years or so prevalence studies resulted in a few published papers on worm infestations, the prevalence for which tended to vary from study to study and from place to place, and in most instances worm burdens in terms either of actual worm counts or eggloads were left out. Only a few papers on mass treatment of worms of significant sample size are available locally. Consequently a number of practical questions concerning mass treatment from the viewpoint of the National Worm Control Programme could not be answered. The treatment of intestinal helminthic infestations were reviewed by Sandosham (1934). However, in recent years several anthelmintics have been introduced, thus reviving again the question of mass treatment of worm infestations, especially with the use of single dose regimens, as an integral effective measure in worm control.

Consequently this field study on helminthiases in Peninsular Malaysia was designed and imple-

mented over a period of 12 months to determine and compare under field conditions the acceptability and side effects of single doses of 4 currently available anthelmintics and their efficacies against hookworms, roundworms and whipworms in terms of egg reduction; the effects of single doses of anthelmintics on haemoglobin levels, weights and egg-loads at intervals of one, six and twelve months after treatment; and lastly, to note any problems due to mass treatment primary school children in a school environment.

The four anthelmintics included in the study were:

Pyrantel pamoate ('Combantrin'), Phenylene diiso-thiocyanate 1,4 ('Jonit'), L-Tetramisole ('Decaris'), and Bephenium hydroxynaphthoate ('Bephenate'). The placebo for the control group was vitamin C.

The study was carried out in 3 phases. For publication purpose it has to be presented in a number of papers. This paper deals with the prevalence and density of worm infestations, that is Phase I of the study which began on 24.4.72 and was completed in 4 days.

MATERIALS AND METHODS

Three primary schools in 3 rural kampongs in Teluk Datuk area some 45 miles from Kuala Lumpur City were selected after personal visit by the senior author to the kampongs, taking into account the toilet-house ratios (Kampung Bukit Changgang, 76%; Kampung Labohan Dagan, 25%; Kampung Olak Lempit, 59%), the number of school children in each school (Kampung Bukit Changgang, 296; Kampung Labohan Dagan, 358; Kampung Olak Lempit, 339), and the distances of the kampongs from the temporary field laboratory which was set up for the study in Teluk Datuk.

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Permission and co-operation were obtained from the teachers and parents for the study. Each child was given a numbered plastic sample bottle with a wooden spatula and a pictorial guide as to how to take a stool sample. It was then explained to them by one of us how and when to take the stool sample, warning them not to exchange the bottles amongst themselves, not to mix stool with urine, water or soil, and to bring their own stool samples to school the next morning. Stool samples were collected back the following morning from each child in the classroom: the child's name was called and the sample bottle returned by the child was checked to see if the index number on the bottle coincided with that for the child in the class list. A few who failed to open their bowels were given the chance to try and bring their stool samples the next day.

The stool samples were examined by Stoll's (1923) volumetric dilution method. The ova of hookworms, roundworms and whipworms were counted with tally counters. The consistency of the stool was noted as normal (N), mushy (M) or watery (W), and a correction factor of 1x, 2x and 4x was applied respectively to the calculation of eggloads which were recorded as "Eggs Per Millilitre" of stool (EPM). A small number of samples were insufficient in amount and were examined by direct smear method, but the children were excluded from the study.

Hookworm culture was done on all positive stool samples, using the method of Harada & Mori (1951) and Hsieh H.C. (1971).

Statistical significance tests used included significance test of difference between two proportions, chi square of 2 x 2 and 2 x k contingency tables with the use of tukey's t, and critical ratio, z.

RESULTS

Prevalence and Density of Worm Infestations:

Of 967 stool samples collected from school children aged 6 to 12 years, 834 samples were examined by Stoll's method and the rest by direct smears. Only the results obtained by Stoll counts were included in this study.

Table I shows the crude hookworm, roundworm and whipworm prevalence rates, as well as

the percentages of single, double and triple infestations. The species prevalence rates for hookworm, roundworm and whipworm varied from 33 - 51%, 84 - 89% and 79 - 88%, respectively. Analyses of the data showed that there was no statistical significance at 95% probability level between the various rates by sex, age and by school.

Double worm infestation was the most common occurrence, accounting for 45.1% of all infestations: roundworm + whipworm (39.6%), hookworm + whipworm (3.5%) and hookworm + roundworm (2%).

Table II shows the densities of helminthic infestations in term of Eggs Per Millilitre (EPM), by sex of host. The average eggloads for hookworm, roundworm and whipworm were 1964, 59 700, and 6 233 EPM, respectively.

DISCUSSION

The results of this study confirmed that worm infestations were common, particularly in the rural population like the one studied. The hookworm, roundworm and whipworm infestation rates were 43.2%, 86.7%, and 84.5%, respectively. The prevalence of *Enterobius vermicularis* remained unknown, since stool examination is not suitable for its detection. The densities of infestations in term of eggloads could be considered light to moderate for hookworm, and moderate to heavy for roundworm and whipworm. The range of eggloads varied widely, reflecting the variability of the helminths' egg-laying capacities, especially that for roundworms, which were similarly observed by Lie *et al.* (1971).

The subject of worm infestations in Malaysia was reviewed by Lie (1964). Russel (1934) found in the Straits Settlements (1925-1928) a prevalence rate of 5% in 0 - 5 years old, 74% in 6 - 12 years, 51% in 13 - 18 years, 74% in 19 - 40 years, and 78% in 41 - 70 years old, for hookworm infestation, the combined prevalence rate being 70.7%. It is interesting to note that the hookworm infestation rate for pre-school children then was very low, while that for primary school children aged 6 - 12 years old was much higher than rates obtained in this and other studies. Perhaps the findings of Russel for

PREVALENCE OF WORM INFESTATIONS
IN RURAL MALAY SCHOOL CHILDREN AGED 6 — 12 YEARS

Table I

SEX	TOTAL NO. OF SAMPLES EXAMINED	TOTAL NO. POSITIVE FOR ONE OR MORE WORMS	PREVALENCE RATE [%]				INFESTATION [%]			
			CRUDE	HOOK-WORMS	ROUND-WORMS	WHIP-WORMS	NONE	SINGLE	DOUBLE	TRIPLE
MALE	435	414	95.2	48.1	86.4	84.1	4.8	13.3	40.2	41.6
FEMALE	399	378	94.7	37.8	87.0	85.0	5.3	12.0	50.4	32.3
BOTH	834	792	95.0	43.2	86.7	84.5	5.0	12.7	45.1	37.2

$$\begin{aligned} \text{CRUDE WORM PREVALENCE RATE} &= \frac{\text{TOTAL NO. OF POSITIVE SAMPLES} \times 100}{\text{TOTAL NO. OF SAMPLES EXAMINED}} \\ \text{HOOKWORM PREVALENCE RATE} &= \frac{\text{TOTAL NO. OF H. W. POSITIVES} \times 100}{\text{TOTAL NO. OF SAMPLES EXAMINED}} \end{aligned}$$

Table II

INTENSITIES OF HELMINTHIC INFESTATIONS
IN RURAL MALAY SCHOOL CHILDREN AGED 6 — 12 YEARS

SEX	TOTAL NO. OF SAMPLES EXAMINED	TOTAL NO. POSITIVE FOR ONE OR MORE WORMS	EGGS PER ML. OF STOOL [STOLL'S METHOD]				WHIPWORM				
			HOOKWORM		ROUNDWORM		NO. OF	AVERAGE	NO. OF	RANGE	
			NO. OF CHILDREN	AVERAGE	RANGE	NO. OF CHILDREN	AVERAGE				
M	435	414	209	2111	100-20000	376	62252	100-447552	366	7052	100-182000
F	399	378	151	1761	200-9612	347	56934	276-756000	339	5348	182-224000
B	834	792	360	1964	100-20000	723	59700	100-756000	705	6233	100-224000

M=MALE F=FEMALE B=BOTH

hookworm infestation could be attributed to poorer environmental sanitation and socioeconomic standard at that time. Sandosham (1955) found a hookworm prevalence rate of 30.6% for 46 208 stool samples from the Straits Settlements. Lie *et al.* (1971) found that in rural infants and children near Kuala Lumpur, the hookworm infestation rate ranged from 24 - 33%, while 33 - 82% and 31 - 84% in two rural areas were infested with roundworms and whipworms, respectively. The worm burdens were generally low, ranging from less than 2 000 to 4 200 EPG for hookworm, less than 50 000 to 274 000 EPG for roundworm and less than 2 000 to 63 000 EPG for whipworm. These results were comparable with this study.

According to the worm infestation surveys in the Environmental Sanitation Pilot Project (ESPP) areas in eleven states of Peninsular Malaysia conducted at Public Health Institute in 1968 (Low, D.O. unpublished), out of 8 131 samples examined 84.4% were positive for one or more species of worms with a range of 67.1% to 95.5%. The hookworm, roundworm and whipworm infestation rates were 35.6%, 68% and 55.8% respectively, with no significant difference by sex. Prevalence by ethnic groups, namely, Malays, Indians, and Chinese was 87.3%, 72.0%, and 71.6% respectively. The infestation rate for children 6 to 12 years old ranged from 79.2% to 89.0%, with a mean of 85.1%. Some of these results were comparable with those obtained in the present study, while some tended to be slightly lower. No significant difference was found between the crude prevalence rates for ages 6 to 12 years in the ESPP survey, nor in the present study.

One important point to note as shown by the ESPP survey was that the crude infestation rates tended to fall with increasing age, e.g., for 85.1% for ages 6 to 12 years, down to 11.8% for adults. Another point of interest, perhaps worthy of further study, was the relationship between latrines and worm infestations. No significant differences were found in prevalence and worm burden amongst the schools in the three kampongs, although there were important differences in the means of human excreta disposal. For example, Kampong A had a latrine/house ratio of 76% (98% pit, 2% pour-flush latrines), compared with Kampong C and Kampong B

which had latrine/house ratios of 59% (67% pit, 33% pour-flush latrine) and 25% (94% pit and 6% pour-flush latrines) respectively. There were probably many reasons for this anomaly such as the insufficient number and/or unsuitable types of latrines, the distance of the latrine from the house, and the KAP of the people leading to the under-utilisation of the available latrines, especially by the young children, who are the main reservoir of infestation.

Environmental sanitation in the control of worm infestations is a slow process and changes in the attitude and practice of the people is even slower. There is also evidence to suggest that environmental sanitation alone cannot control worm infestations such as ascariasis (WHO Expert Committee on Control of Ascariasis 1967). A combination of methods, including mass treatment for worms and the improvement of the nutritional status of the community, supported with effective health education, is more likely to succeed.

SUMMARY

The reasons for this field study were stated. This paper presented and discussed the prevalence and density of worm infestation of hookworm, *Ascaris* and *Trichuris* in 834 rural school children aged 6 to 12 years. The crude worm prevalence rate was 95.0%, and the mean species prevalence rate for Hookworm, roundworm and whipworm was 43.2%, 86.7% and 84.5% respectively. Mixed infestations were most common, 45.1%, 37.2% and 12.7% being double, triple and single infestations respectively. The average eggloads for hookworm, roundworm and whipworm were 1964, 59 700, and 6 233 EPM respectively.

The relation of environmental sanitation in term of latrine/house ratios and the degree of infestation was highlighted, and the need for a combination of methods for worm control was stressed.

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