INTESTINAL NEMATODE INFECTIONS AND EFFICACY STUDY OF OXANTEL-PYRANTEL PAMOATE AMONG PLANTATION WORKERS

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INTRODUCTION

The prevalence of intestinal nematode infection is hign in both rural and urban slum areas of Malaysia. The incidence of *Ascaris* and *Trichuris* is particularly high and multiple infections are common. Several prevalence surveys, (Schacher and Danaraj, 1960; Lie, 1974; Dunn, 1972) have been carried out in Malaysia.

Pyrantel has been demonstrated (Bumbalo *et al.*, 1969; Desowitz *et al.*, 1970; Hsieh, 1971) to be effective for treatment of *Ascaris,* hookworm and *Enterobuis.* Oxantel has been shown (Zaman and Sabapaty, 1975; Garcia, 1976; Lee *et al.*, 1976; Rim *et al.*, 1976) to be effective against Trichuriasis. A combined Oxantel-pyrantel salts has been shown (Rim *et al.*, 1975; Lim, 1978; Dissanaike, 1978; Cabrera and Sy, 1978) to be highly effective against soil-transmitted helminthiasis, particularly *Trichuriasis.* Most of these studies were conducted on school children. The presents efficacy study of oxantel-pyrantel pamoate was among the working adult estate population of both sexes. This paper presents the results of study conducted at 4 different localities of the Dunlop Estates Group in Southern part of West Malaysia.

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MATERIALS AND METHODS

Samples were collected from 4 different Dunlop group estates in Johore, Melaka and Negri Sembilan.

Cocoa, rubber and oil palm are cultivated on large scales in all these estates. The average resident population of these estates was 1571, of which more than 40% were children, consisting mainly of Indians, Chinese and a few Malays. An average resident family consists of the parents and 2-4 dependents. Their average monthly income ranges from $300-$500 and this is considered to be relatively high. Chicken, cats and dogs are common in the vicinity of their homes. These residents live in quarters consisting of rows of two-roomed houses with good toilet, tap water and electricity supply. These estates have good medical facilities, with a medical officer making regular visits.

Subjects considered for this study were classified as resident or non-resident workers, and also according to their jobs i.e. rubber tappers, crop weeders, harvesters, factory workers and general workers or labourers. Non-resident workers come from the nearby villages fringing these estates.

300 adult workers of both sexes were randomly selected from each estate. Both resident and non-resident workers were considered, except for Nagappa estate where only 89 resident workers were chosen. Their mean age was 33 years (range: 16-67). Of the 988 workers issued with paper cups for stool sampling, 562 responded. A total of 157 stool samples of children whose ages ranged from 1-16 years were also collected from

the 4 estates in order to establish the helminthic prevalence pattern in resident population.

In the efficacy study, 131 (34 males and 87 females) of 204 persons found to be positive for any worm infestation were administered a single dose of 20ml suspension of Quantrel (R) (50mg per ml pyrantel and oxantel pamoate) each. Stool samples were collected from the treated subjects on day 14, 21 and 28 post treatment in order to study the sequential egg reduction. Those found with presisting infection on day 28 post treatment were administered a second dose of 20 ml of Quantrel (R) and their stool examined 21 days later. Subjects who were pregnant or with gastrointestinal disturbances or who had been treated with any anthelminthic drug recently were excluded from the study. Children were not considered for the efficacy study. All specimens were collected and preserved in 50% formalin solution. Both formalinether and direct smear techniques were used for the quantitative examination of samples.

RESULTS

i] Prevalence :

Table I and II show the infection rates amongst children and adults respectively. Of the 562 adults screened, 36.30% were found to be positive for at least one of the soil transmitted helminths. Infection rate of hookworm is the highest (27.76%) followed by *Trichuris* (18.51%) and *Ascaris* (14.95%). It is interesting to note that infection rates of hookworm is high among the Malays (40.46%) and Indians (26.67%) who were weeders and harvesters. High infection rates in both these groups of workers may be due to

TABLE I
INFECTION RATES AMONG CHILDREN

AGE [YRS]	NUMBER OF SAMPLES	*ASCARIS LUMBRICOIDES* NUMBER [%]	*TRICHURIS TRICHIURA* NUMBER [%]	HOOKWORM NUMBER [%]	*STRONGYLOIDES STERCORALIS* NUMBER [%]
1 - 6	21	4 (19.01%)	4 (19.05%)	1 (4.76%)	0
7 - 11	122	21(17.21%)	12(19.84%)	10(8.20%)	0
12 - 16	14	3 (21.43%)	3 (21.43%)	2 (14.29%)	1 (7.14%)

TABLE II
INFECTION RATES AMONG ADULT POPULATION

RACE	NUMBER OF SAMPLES	*ASCARIS LUMBRICOIDES* NUMBER [%]	*TRICHURIS TRICHIURA* NUMBER [%]	HOOKWORM NUMBER [%]	*STRONGYLOIDES STERCORALIS* NUMBER [%]
Malay	173	51 (29.48%)	68 (39.31%)	70 (40.46%)	1 (0.58%)
Chinese	179	7 (3.98%)	10 (5.59%)	30 (16.76%)	1 (0.56%)
Indians	210	26 (12.38%)	26 (12.38%)	56 (26.67%)	3 (1.43%)
Total	562	84 (14.95%)	104(18.51%)	156(27.76%)	5 (0.89%)

their close frequent contact with soil.

Chinese made up 31.85% of the working community sampled, of which 90.5% were rubber tappers. Their infection rates for *Ascaris* was 3.98%, 5.59% for *Trichuris* and 16.76% for hookworm. The low prevalence among the Chinese may be related to the nature of their jobs, coupled with good personal hygiene. Schacher and Danaraj (1960) found that the prevalence rates for soil-transmitted helminths were lower among the Chinese than among the Malays and Indians. The present study supports the above findings. However, Desowitz *et al.*, (1961) observed no significant differences in infection rates among ethnic groups living in the same area which suggests that there is no racial susceptibility or resistance.

Table III shows infection rates of *Ascaris, Trichuris* and hookworm among workers of various occupations. Ascariasis and Trichuriasis was high among the weeders (29.63% and 37.78%) and the harvesters (27.78% and 27.78%). Of the 17 factory workers examined for worm infestations, only 2 persons were found to be infected with *Ascaris* and *Trichuris,* and one with hookworm. Low infection rates here may be due to their lack of contact with soil. General workers and labourers include attendents, drivers, sweepers and others. Their jobs, may sometimes bring them in contact with soil. This was clearly reflected in their infection rates for *Ascaris* (5.17%), *Trichuris* (6.99%) and hook-

TABLE III
ADULTS — OCCUPATION AGAINST INFECTION RATE

Occupation	Number of samples	Population Number of samples (%)			Infection rate Number of samples (%)			
		Malay	Chinese	Indians	*A. lumbricoides*	*T. trichiura*	hookworm	*Strongyloides stercoralis*
Rubber tappers	334	50(14.97%)	162(48.05%)	122(36.53%)	34(10.18%)	41(12.28%)	72(21.56%)	2(0.60%)
Weeders	135	94(69.63%)	6(4.45%)	35(25.93%)	40(29.63%)	51(37.78%)	63(46.67%)	2(1.48%)
Harvesters	18	5(27.78%)	2(11.11%)	11(61.11%)	5(27.78%)	5(27.78%)	7(38.89%)	0
Factory Workers	17	7(41.18%)	4(23.53%)	6(35.29%)	2(11.76%)	2(11.76%)	1(5.88%)	0
General workers and labourers	58	17(29.31%)	5(8.62%)	36(62.07%)	3(5.17%)	4(6.90%)	13(22.41%)	1(1.72%)
Total:	562	173(30.78%)	179(31.85%)	210(37.37%)	84(14.95%)	104(18.51%)	156(27.76%)	5(0.89%)

TABLE IV
INFECTION RATES OF RESIDENT AND NONRESIDENT WORKERS

Estate	*Ascaris lumbricoides* Number of samples(%)		*Trichuris trichiura* Number of samples(%)		Hookworm Number of samples(%)		*Strongyloides stercoralis* Number of samples(%)	
	Resident	Nonresident	Resident	Nonresident	Resident	Nonresident	Resident	Nonresident
Sagil	$\frac{7}{53}$ (13.21%)	$\frac{6}{48}$ (12.5%)	$\frac{8}{53}$ (15.09%)	$\frac{5}{48}$ (10.42%)	$\frac{17}{53}$ (32.08%)	$\frac{13}{48}$ (27.08%)	$\frac{1}{53}$ (1.89%)	0
Jasing	$\frac{17}{188}$ (9.04%)	$\frac{39}{99}$ (39.39%)	$\frac{37}{188}$ (19.68%)	$\frac{33}{99}$ (33.33%)	$\frac{54}{188}$ (28.72%)	$\frac{54}{99}$ (54.56%)	$\frac{2}{188}$ (1.06%)	0
Regent	—	0	$\frac{13}{143}$ (9.09%)	$\frac{2}{6}$ (33.33%)	$\frac{12}{143}$ (8.39%)	0	$\frac{2}{143}$ (1.40%)	0
Nagappa	$\frac{9}{25}$ (36%)	no sample	$\frac{6}{25}$ (24%)	no sample	$\frac{6}{25}$ (24%)	no sample	0	no sample

worm (22.41%)

Table IV shows the results of infection rates among resident and non-resident workers of these estates. In Regent, the resident workers were infected whereas the non-residents were not. In other estates both groups were infected. A higher infection rate was observed amongst the non-resident workers in Jasing.

The prevalence of soil-transmitted helminths among children was 28.03% and is lower than the adults, (refer to Table I). The children of the age group 12-16 years old had a relatively higher infection rates for *Ascaris, Trichuris* and hookworm. This may be due to frequent exposures to soil. The infection rates for *Ascaris* and *Trichuris* in children were relatively higher than in adults whereas hookworm infection is higher among the latter. These observations are in agreement with the general epidemiological pattern of soil-transmitted helminthiasis as described by other workers (Sandosham, 1955; Schacher and Danaraj, 1960; Sinniah *et al.*, 1978)

In the present study, *Strongyloides stercoralis* infection rate was found to be very low in both adults and children, being 0.89% and 7.14% respectively. Schacher and Danaraj (1960) found a prevalence rate of 4 % Sandosham (1955) found 6% of 1300 stool cultures of hospital patients in Singapore to be positive for *Strongyloides stercoralis.* Sinniah *et al.*, (1978) reported a prevalence rate of 1.3% in oil palm estate population.

The types of helminth infection found in the estate population is shown in Table V.

ii] Oxantel-pyrantel pamoate efficacy trail

Table VI, VII and VIII show the results of efficacy trail with oxantel pamoate against *Ascaris, Trichuris* and hookworm. 131 subjects with a mean body weight of 52.37 kg (range: 32.27 - 66.82kg) were administered 20ml suspension of Quantrel (R) thus giving 19.10mg (range: 14.96-30. 89mg) per kilogram body weight each.

ii] a. Ascaris

The mean Eggs Per Gram (EPG) of the infected cases was 15,552.1 with a range of 66-166,534. This was considered to be light to moderate. After examining the data on sequential egg reduction it was noted that 96.0% of the

TABLE V
TYPES OF HELMINTH INFECTION AMONGST ESTATE RESIDENTS

Helminth	Adults Number of patients (% positive)	Children Number of patients (% positive)
Asscaris	10 (1.73%)	15 (9.55%)
Trichuris	26 (4.49%)	7 (4.46%)
Hookworm	64 (11.05%)	9 (5.73%)
Ascaris + Trichuris	11 (1.90%)	7 (4.46%)
Ascaris + hookworm	18 (3.11%)	1 (0.64%)
Trichuris + hookworm	29 (5.01%)	0
Trichuris + Ascaris + Hookworm	41 (7.08%)	4 (2.55%)
Strongyloides	5 (0.86%)	1 (0.64%)

TABLE VI
ADULTS: EFFICACY OF QUANTREL * AGAINST *Ascaris.*

Estate	Number of Samples	Pretreatment Mean EPG (Range)	Post Treatment (28th day)		NCR%	ERR%	Post 2nd dose treatment i.e. 21st day Number positive
			Mean EPG	Number positive			
Jasing	32	22700 (66 — 166534)	18	2	93.75	100	0
Sagil	12	3028 (66 — 12934)	0	0	100	100	0
Nagappa	4	2750 (400 — 7200)	0	0	100	100	0
Total/mean	50	15552.08 (66 — 166534)	18	2	96.0	99.99	0

Negative conversion rate (NCR) $= \frac{\text{Number of positive cases before therapy} - \text{Number of positive cases after therapy}}{\text{Number of positive cases before therapy}} \times 100$

Egg reduction rate (ERR) $= \frac{\text{Eggs/gm before therapy} - \text{Eggs/gm after therapy}}{\text{Eggs/gm before therapy}} \times 100$

infected cases were terminated by day 14-21. The Eg Reduction Rate (ERR) was 99.9%. Two persons with persisting infection on day 28 were given a second dose of the drug. Their stool samples were examined 21 days later and found to be negative for nematode eggs.

ii] b. Trichuris

The mean EPG of all the infected cases was 1,436.26, with a range 66 - 35,534. These infections were considered to be light to moderate with the majority of the infection being light. One subject had an exceptionally high infection with *Trichuris*, with an EPG of 35,543. The cure

TABLE VII
ADULTS: EFFICACY OF QUANTREL *AGAINST TRICHURIS

Estate	Number of Samples	Pretreatment mean EPG (Range)	Post Treatment (28th Day)		NCR%	ERR%	Post 2nd Treatment i.e. 21st day Number positive
			Mean EPG	Number positive			
Jasing	38	1866 (66 — 35,534)	100	6	84.21	99.15	1
Sagil	7	248 (66 — 600)	14	1	85.71	99.19	0
Nagappa	2	134 (66 — 1334)	50	1	50	81.34	0
Regent	4	84 (66 — 200)	0	0	100	100	0
Total/Mean	51	1436.26 (66 — 35,534)	83.00	8	84.31	99.09	1

rate on day 28 post treatment was 84.31% with an ERR of 99.09%. Eight persons found to have persisting infections were given a second dose of 20ml suspension of the drug. Stool samples of these persons were then examined 21 days later. One person was still infected after the second treatment and on checking it was found that this person had a pretreatment EPG of 35,534. The EPG of this subject on day 28 after the first treatment was 2800 and on day 21 after the second treatment was 300.

ii] c. Hookworm

The mean EPG for hookworm infection was 810.97 with a range of 66-5334 which was cosidered to be light. The cure rate on day 28 post treatment was 75.8%, with a ERR of 97.49%. 15 subjects remained infected 28 days post treatment and they were given a second dose of 20 ml. suspension of the drug. After the second treatment 8 remained positive for hookworm eggs on 21 days post treatment.

TABLE VIII
ADULTS: EFFICACY OF QUANTREL *AGAINST HOOKWORM

Estate	Number of Samples	Pretreatment mean EPG (Range)	Post Treatment (28th Day)		NCR%	ERR%	Post 2nd Treatment i.e. 21st day Number positive
			Mean EPG	Number positive			
Jasing	41	1014 (66 — 5334)	98	8	80.49	98.11	5
Sagil	13	490 (66 — 2334)	62	5	61.54	95.13	3
Nagappa	3	222 (134 — 534)	150	1	66.67	77.48	0
Regent	5	334 (66 — 866)	20	1	80	98.80	0
Total/Mean	62	810.97 (66 — 5334)	83.27	15	75.80	97.80	8

CONCLUSION

Dissenaike (1978) using single doses of Quantrel (R) for three consecutive days on children obtained a cure rate of 100% against *Ascaris*, 66.7% against *Trichuris* and 52.9% against hookworm. Cabrera and Sy (1978) obtained cure rates of 100% for *Ascaris*; 53% for *Trichuris* and 71% for hookworm. Rim *et al* (1975) using a single dose of 10 mg./kg. body weight of oxantel and pyrantel pamoate obtained cure rates of 100%, 73.2% and 97.1% for *Ascaris, Trichuris* and hookworm infections respectively. In another study Lim (1978) reported cure rates of 100% for *Ascaris*, 78.2% for *Trichuris* and 100% for hookworm, using a single dose of 15-20 mg./kg. body weight.

Our study of using a single dose of 20 ml. suspension of the drug has shown that it is efficacious against infections of *Ascaris* (96%) *Trichuris* (84.3%) and moderately efficacious against hookworm infections (75.8%]. These results compare very favourably with those of the above workers. Our conclusion indicated favourably towards using oxantel-pyrantel pamoate in mass treatment of intestinal nematode infections by use of a standard suspension for specific age - groups.

SUMMARY

A prevalence study for soil transmitted helminth infection was conducted at the Dunlop Estates in West Malaysia. The infection rates

among adults was 36.03% and 28.03% among children. 131 subjects found to be infected with at least one of the following parasites: *Ascaris, Trichuris* and hookworm, were treated with a single dose of 20 ml. suspension of oxantel-pyrantel pamoate. Stool samples of treated persons were examined 28 days post-treatment. The cure rates were *Ascaris* (96%), *Trichuris* (84.3%) and hookworm (75.8%).

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