

PARASITIC DISEASE AMONG FISHERMEN LIVING ON PENANG ISLAND I. HELMINTHIASES

Khairul Anuar, A.

C. P. Ramachandran

T. P. Paran

School of Biological Sciences
Universiti Sains Malaysia
Penang

INTRODUCTION

One of the problems associated with rural health in Malaysia is the problem of parasitic diseases. This includes both protozoan and helminthic infection which has undoubtedly a great bearing on the health and socio-economic level of rural people.

A few studies have been reported on the prevalence of parasitic infections in Malaysia and the neighbouring countries. In some of these countries, the climatic conditions are nearly similar but there are variations in the pattern of the distribution of the parasitic infections. These variations are probably caused by migrations of populations of various ethnic groups having different living habits and variations in the susceptibility to helminthic infections (S. M. Khan and Khairul Anuar A., 1977).

Ascaris lumbricoides, *Trichuris trichura* and Hook worm are the most important soil transmitted helminths in man in Southeast Asia (Cross *et al.*, 1970; Bisseru and Abdul Aziz Ahmad, 1970; Clarke *et al.*, 1973; Barclay, 1966; Joeco *et al.*, 1973). The pattern of prevalence of these helminths is somewhat different in Malaysia in that *Trichuris trichura* is the most common followed by *Ascaris lumbricoides* and Hook worm infections (Ow Yong, 1971).

Yap *et al.* (1968) reported on the prevalence of malaria and filariasis in Pulau Pinang and Pulau Perhentian Kecil off the east coast of West Malaysia.

Dunn, (1972) made a critical study of intestinal parasitism in the aboriginal ethnic minority group, both on protozoa and helminthes.

In Malaysia, parasitic infections, especially gastro intestinal infections, still play a major role in causing ill health among the rural populations (S. M. Khan and Khairul Anuar A., 1977). Recent studies carried out by the School of Biological Sciences have indicated that intestinal helminthic infections are still rampant (K. S. Dorkha, 1974). In further studying the prevalence of this infections, a study was conducted to determine the current status of parasitic infections among the fishermen living on the island of Penang.

Description of the area

Penang is an island close to the Peninsular Malaysia separated by the Straits of Malacca by a distance of three miles (Fig. 1). The island covers an area of 110 sq. miles with a population of 764,585.

There are no regular seasons although invariably there is more rain during the months of April to May and from August to November with a relative humidity of 65%. The temperature varies from place to place on the Island and generally falls around 78-85°F.

The area understudy is sandy being close to the sea. Vegetation consists of coconut plants, herbs and trees. Dwellings comprise attap houses with wooden walls. Sanitary conditions are not satisfactory. Disposal of human faeces is carried out by the old bucket system. Indiscriminate defecation around the houses is quite common.

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Flies flourish well and act as carriers of a variety of disease organisms including protozoan and helminthic ova.

The villages understudy are situated on coastal areas: Teluk Bahang, Batu Ferringhi, Pantai Jerejak, Batu Maung, Gertak Sanggul, Teluk Kumbar and Balik Pulau (Fig. 1).

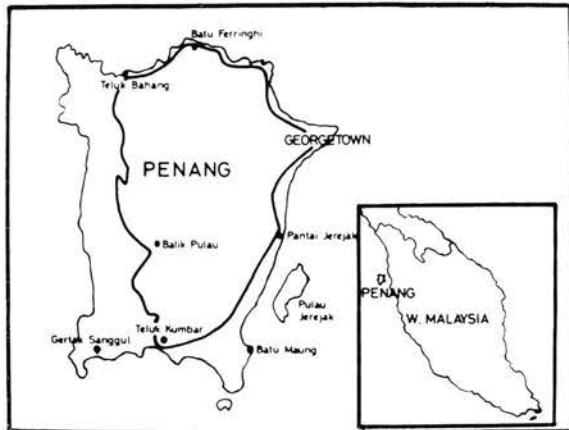


Figure 1: Showing the villages on Penang Island where the investigation was carried out.

MATERIALS AND METHODS

Samples of blood and faeces were collected over the period of one year beginning in August 1976 to December 1977. These samples were collected from a number of people not by households but at random from volunteers. Finger prick blood samples of thick and thin smear were obtained from volunteers. The blood films were allowed to dry overnight but in the case of thin smear it was fixed in methanol before it was stained with diluted Giemsa (1 drop to 3 ml of phosphate buffer) at pH 7.2 for one hour. When dried the stained films were stored in slide boxes for microscopical exami-

nation later in the laboratory (this will be reported elsewhere).

At the time when blood was taken faecal bottles were also distributed for faecal collection the following morning. The name, age, sex and ethnic group to which each person belonged was also noted. Examination of helminth eggs was made by direct smear and negative specimens were reconfirmed by using the zinc sulphate centrifugal floatation method (Faust *et al.*, 1939). In order to determine the intensity of helminthic infection specimens positive were then preserved in thiomersal-iodine-formol (TIF). The specimens were later examined by the TIF direct smear technique (TIF-DS) (Dunn, 1968).

Sasa's modified Harada muri cultures were also set up for the differential diagnosis of hookworm larvae and strongyloides larvae (Sasa *et al.*, 1965).

Egg counts were made from TIF-DS under 22 x 22 mm cover slip and values were graded as very light (1-2 eggs/3 gm smear), light (3-19 eggs/3 gm smear). Moderate (20-79 eggs/gm smear), heavy (80 or more eggs/3 gm smear) using the modified scale of Dunn (1972).

RESULTS

Faecal samples of a total of 433 fishermen, 210 males and 223 females were examined. Out of the 433, there were 303 Malays and 130 Chinese.

The species of helminths found in all villages are *Ascaris lumbricoides*, *Trichuris trichura*, Hookworm, *Strongyloides*, *Enterobius* and Tapeworm. Table I summarize our finding in different fishermen villages on Penang Island. In all the villages examined *Ascaris lumbricoides* appear to be the most commonly occurring parasite, the next being *Trichuris trichura*. Surprisingly hookworm infection is relatively low.

Table I
Helminthic infections in the various fishermen villages on Penang Island

Village	No. examined	No. positive	Percent positive	<i>Ascaris</i>	<i>Trichuris</i>	Hookworm	<i>Strongyloides</i>	Tapeworm
Teluk Bahang	163	119	73.01	99(60.74)	77(47.23)	17(10.43)	4(2.45)	1(0.61)
Pantai Jerejak	41	22	53.66	20(48.78)	10(24.39)	1(2.44)	1(2.44)	0(0.00)
Teluk Kumbar	127	113	88.98	99(77.95)	80(62.99)	14(11.02)	0(0.00)	0(0.00)
Gertak Sanggul	20	12	60.00	10(50.00)	9(45.05)	2(10.00)	0(0.00)	0(0.00)
Batu Maung	37	36	97.30	28(75.68)	35(94.59)	1(2.00)	0(0.00)	0(0.00)
Balik Pulau	25	25	100.00	24(96.00)	25(100.00)	17(68.00)	0(0.00)	0(0.00)
Batu Ferringhi	20	12	60.00	11(55.00)	4(20.00)	1(5.00)	0(0.00)	0(0.00)

The overall prevalence of *Ascaris lumbricoides* (67.21%), *Trichuris trichura* (55.45%), Hookworm (12.24%), *Strongyloides* (1.15%), *Enterobius* and Tapeworm (0.23%) for the fishermen community as well as different ethnic groups is summarised in Table II and III.

Table IV gives the prevalence of *Ascaris*, *Trichuris* and Hookworm infections among the different ethnic groups. *Ascaris lumbricoides* is higher among the females than the males in both the races, while for *Trichuris* Malay females and

Chinese males have higher infections. *Trichuris* is highly prevalent among the Malays, the percentage for males and females being 32.01% and 34.32% respectively.

The percentage prevalence of *Ascaris*, *Trichuris*, Hookworm and other helminths among different age groups with multiple infections is summarised in Table V. Age group 1–10 and 11–20 had very high prevalence of *Ascaris*, *Trichuris* infections. Then the prevalence rate declined with age. Table VI provides worm burden data of value in assessing the public health importance of principal soil-transmitted helminths in Malaysian fishermen living on Penang Island.

Other parasites found included occasional *Enterobius vermicularis*, but the infection rate for this parasite was not known and techniques used were not suitable to detect the eggs. *Strongyloides* were also found in a small number of people. There was one incidence of Tapeworm which was later identified as *Hymenolepis diminuta*. Hookworm infections were all by *Necator americanus*. The

Table II

Overall rate of Helminthic infections among Malay and Chinese fishermen examined on Penang Island

Ethnic group	No. examined	Positive		Total percentage
		No.	%	
Malays	303	270	89.11	79.65
Chinese	130	69	53.10	20.35
Total	433	339	78.29	100.00

Table III

Infection rate of *Ascaris lumbricoides*, Hookworm and *Trichuris trichura*, *Strongyloides* and Tapeworm among Malay and Chinese fishermen on Penang Island

Ethnic group	No. examined	<i>Ascaris</i>		Hookworm		<i>Trichuris</i>		<i>Strongyloides</i>		Tapeworm	
		No.	%	No.	%	No.	%	No.	%	No.	%
Malays	303	234	77.23	46	15.18	201	66.34	2	0.66	1	0.33
Chinese	130	57	43.84	7	5.38	39	30.00	3	2.30	0	0.00
Overall	433	291	67.21	53	12.24	240	55.43	5	1.15	1	0.23

The infection rate among the Malays is significantly higher than that among Chinese ($P < 0.001$ by Chi-square test).

Table IV

Infection rate of *Ascaris*, Hookworm, *Strongyloides*, *Trichuris trichura* and Tapeworm among different sexes of Chinese and Malay fishermen examined on Penang Island

Ethnic group	Sex	<i>Ascaris</i>	Hookworm	<i>Trichuris</i>	<i>Strongyloides</i>	Tapeworm	Total
Malays	M	114(37.62)	24(7.92)	97(32.01)	1(0.33)	0(0.00)	129(42.50)
	F	120(39.60)	22(7.26)	104(34.42)	1(0.33)	1(0.33)	141(46.53)
Chinese	M	25(19.23)	3(2.30)	23(16.15)	1(0.77)	0(0.00)	29(22.31)
	F	32(24.62)	4(3.07)	18(13.85)	2(1.54)	0(0.00)	40(30.77)

N.B.: Number in parenthesis indicates the percentage.

The infection rate of *Ascaris* is significantly higher than of *Trichuris* or that of hookworm ($P < 0.005$ by Chi-square test). The infection rate of *Ascaris* is significantly higher among the females than that among males ($P < 0.005$ by Chi-square test).

Table V
Percentage prevalence of *Ascaris*, Hookworm, *Trichuris*, *Strongyloides*, tapeworm among different age group and Multiple infections among fishermen living on Penang Island

Age group	No. examined	<i>Ascaris</i>	<i>Trichuris</i>	Hookworm	<i>Strongyloides</i>	Tapeworm	Multiple infections		
							Single	Double	Triple
1 - 10	136	104(76.47)	90(66.18)	13(9.56)	0(0.00)	0(0.00)	38(27.94)	65(47.80)	12(8.82)
11 - 20	104	81(77.88)	62(59.62)	13(12.50)	3(2.88)	0(0.00)	49(47.12)	29(27.80)	11(10.58)
21 - 30	50	31(62.00)	22(44.00)	6(12.00)	1(2.00)	0(0.00)	16(32.00)	17(34.00)	3(6.00)
31 - 40	49	25(51.02)	20(40.82)	7(14.29)	0(0.00)	1(2.04)	19(38.78)	11(22.45)	4(8.16)
41 - 50	47	25(53.19)	23(48.94)	10(21.28)	0(0.00)	0(0.00)	8(17.02)	16(34.04)	5(10.63)
51 - 60	36	19(52.78)	16(44.44)	2(5.56)	0(0.00)	0(0.00)	8(22.22)	9(25.00)	3(8.33)
61 - 70	9	5(55.56)	6(66.67)	2(22.22)	0(0.00)	0(0.00)	2(22.22)	2(22.22)	1(11.11)
71 - 80	1	1(100.00)	1(100.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	1(100.00)	0(0.00)
80 or more	1	0(0.00)	0(0.00)	0(0.00)	1(100.00)	0(0.00)	1(100.00)	0(0.00)	0(0.00)
Total	433	291(67.20)	242(55.03)	53(12.24)	5(1.15)	1(0.23)	141(32.56)	150(34.64)	39(9.01)

* Numbers in Parenthesis indicate the percentage.

differential diagnosis of the Hookworm was done through the Harada-Mori culture.

Table VI

Intensity of Helminthic infection among fishermen living on Penang Island

Major Helminths	433 persons	
	No. Infected	% Infection
<i>Ascaris lumbricoides</i>	291	67.20
† ^a	17	(5.84) ^b
††	112	(38.48)
†††	85	(29.22)
††††	77	(26.46)
<i>Trichuris trichura</i>	240	55.43
†	57	(23.75)
††	136	(56.67)
†††	32	(13.33)
††††	15	(6.25)
Hookworm	53	12.24
†	25	(47.17)
††	28	(52.83)
†††	0	(0.00)
††††	0	(0.00)
Persons negative for all helminths	94	21.71

a = worm burden scores based on direct smear egg counts; † = very light; †† = light; ††† = moderate; †††† = heavy infections.

b = figures in parenthesis show percentage of infected persons at each level of worm burden.

DISCUSSION

Several parasites show differing rates of prevalence in various villages surveyed. Teluk Bahang fishermen village is divided into two areas. One half occupied by Chinese and is called the Teluk Bahang New Village while the other part is left to the Malays. The conditions in the New village is fairly good and closer to the sea. The houses are well built and sanitary conditions can be considered good. In this area the relative prevalence of parasites is generally low for the new village while the other part with Malay population had had sanitary conditions and very high prevalence rate of parasitic infections.

Teluk Kumbar, Batu Maung, Gertak Sanggul and Balik Pulau have similar conditions. The prevalence rate of parasites in these areas almost nearly the same.

The prevalence rate of *Ascaris lumbricoides* in adults were lower than in children. The prevalence rate for *A. lumbricoides*, *Trichuris trichura* and hookworm were lower among Chinese than among the Malays. This findings are supported by earlier workers (Russel, 1934; Schacher and Danaraj, 1960; Lie, K. J., 1964; S. M. Khan and Khairul Anuar A., 1977). However Lie *et al.*, found that the rates were higher among communities associated with farming using night soil fertilizers. *Trichuris trichura* was prevalent in all age groups. The prevalence is second highest only next to *A. lumbricoides*. Results of examination of 1,357 faecal specimens conducted by the ICNND (1964) in West Malaysia, however, suggested that *T. trichura* to be the most common parasitic infection found, an overall rate of 88.7% was reported for all races surveyed. Figures provided by other researchers like Russel (1934), Lie (1964) and Hyneman *et al.* (1967) concur with this survey.

The fishermen population reveals a very low infection of *Necator americanus*. However, the prevalence was found to be higher among the Malays (15.18%) compared to the Chinese (5.38%). The overall prevalence of *Necator americanus* was 12.24%. Higher rates were found by Russel (1934) and more recently the ICNND (1964). There was no difference in infection rates between the males and females for the different races. Unfortunately there is no information in Malaysia correlating hookworm infections and the physical features of the area, the properties of the soil, land usage, the proportion of people using foot-wear and the predation which the hookworm may suffer. In this particular case where the fishermen have very low infection rate of hookworm could be due to the particular location of the area itself. The coastal areas are sandy, very porous, dry and exposed to direct sunlight. As such this area is generally unfavourable for the survival of the parasites. Similar results were also obtained in areas of some remote islands off the east coast of Malay Peninsular where the figures provided by Hyneman *et al.* (1967) and Balasingam *et al.* (1969) indicate the prevalence to be very low.

Among the single infections, *Ascaris* infections was most commonly encountered in all age groups. *Trichuris* was the next commonly encountered in all age groups. Among mixed infections, the commonest combinations of helminths in all age groups was mixed *Ascaris* and *Trichuris* infections usually with *Ascaris* as the predominant parasite. Thus

Ascaris appear to be the most frequently encountered helminth in this survey.

The youngest child with *Ascaris* infection was 6 months old while for *Trichuris* it was 5 months old. It appears that the intensity of infection is more influenced by the habits and repeated infection rather than age. 26.46% of the population harbouring *A. lumbricoides* showed heavy infections and 29.22% with moderate infection. It is vital to remember that the intensity is only of public health importance and that the presence of a single worm can be a threat to the life of a person. From this survey it is also clear that *T. trichura* does not pose a threat since only 6.25% had heavy infections while hookworm infection was light. The prevalence of *Strongyloides* is 1.15% and the results show that the 11–20 year old are more infected than other age groups. Cestode infections are extremely low in Malaysia, though sporadic cases have been reported among the aborigines in Malaysia (Sandosham, 1953). In the present survey one case of cestode infection which was later identified as *Hymenolepis diminuta*. This infection was probably contracted through the usage of the intermediate host, *Tribolium confusum* in Medication. *Hymenolepis diminuta* is basically a parasite of the rats and is highly frequent among the feral rats in Malaysia (Leong, T. S. Personal communication).

The study also revealed a considerable amount of differences in the degree of infections among the different ethnic groups. The reason could be due to some inherent differences in habits and personal hygiene and other socio-economic conditions among them. Most of the Chinese fishermen lived in good houses and clean environment; in Weld Quay areas they lived in houses built on the sea. The Malays lived in Kampung where the toilets are mainly of the pit latrine type and indiscriminate defecation is also common.

A goodness of fit test showed the proportion of infections to be significantly different from that predicted by a binomial ($P > 0.001$ by Chi-square test). The infections of the three types of worms are not randomly distributed. There is a greater number of people with zero and with triple infections than would be expected to occur by random. This points out that there is some external factor which influences the rate of infection. The factors could be sanitary status, mode of disposal of faecal materials, housing, mobility of the fishermen population etc.

In the context of Malaysia's socio-economic development, greater emphasis should be placed on rural health and environmental sanitation in the development programmes. Basic health education,

the proper training in sanitary and hygiene habits, treatment of infected person and mass treatment may to an extent help eradicate parasitic diseases in rural population.

SUMMARY

An investigation into the helminth parasites of fishermen population revealed high infection rates for *Ascaris lumbricoides*, *Trichuris trichura* and *Necator americanus*. The prevalence rates were *Ascaris lumbricoides* 67.21, *Trichuris trichura* 55.43, *Necator americanus* 12.24, *Strongyloides* 1.15 and *Hymenolepis diminuta* 0.23. The Malay fishermen had higher infection rate compared to the Chinese fishermen.

The prevalence of *Ascaris lumbricoides* and *Trichuris trichura* was highest in 1–20 age group and then the infection rate declined with increasing age. *Ascaris* is highest among the females but for *Trichuris* the Malay female and Chinese male had higher infection. Also here is probably the first case report of *Hymenolepis diminuta* in adult female Malay women in the Peninsular Malaysia.

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