

SCHISTOSOMIASIS MALAYENSIS-LIKE INFECTION AMONG THE PENAN AND OTHER INTERIOR TRIBES (ORANG ULU) IN UPPER REJANG RIVER BASIN SARAWAK MALAYSIA

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Abstract. A serosurvey of various indigenous interior tribes (Orang Ulu) in upper Rejang River Basin Sarawak Malaysia, the site of a multibillion Ringgit hydroelectric power project, found 6.8% of the individual surveyed were seropositive for schistosomiasis, as determined by ELISA method using the soluble egg antigen of *Schistosoma malayensis* Baling strain. In all age group, the seroprevalence rate is higher (9.5%) in males than in females (4.5%) except for the 31-40 age group. Seroprevalence of schistosomiasis was found to increase with age with the above 60 age group having the highest rate followed by the 31-40 age group. Seroprevalence rate among the tribes ranges from 4.1% among the Penan to 11.6% among the Kajang. There was no seroevidence of schistosomiasis among the Ukits. A snail survey found four snail species including *Brotia* species, the intermediate host of the lung fluke *Paragonimus westermani*, however no schistosome snail host was identified. Although schistosomiasis malayensis-like infection may be endemic in the area, its public health significance remains undetermined.

INTRODUCTION

Schistosomiasis, caused by various anthropophilic *Schistosoma* species, is estimated to cause infection in more than 200 million people in rural agricultural and peri-urban areas in tropical and subtropical developing countries particularly in Africa, South America and China (Iarotski and Davis, 1981; WHO, 1996; CUSRG, 1998). In South East Asia *S. japonicum* is prevalent in southern Philippines and central Sulawesi Indonesia, whereas *S. mekongi* is endemic in the Mekong Delta (Sornmani, 1976; Harinasuta, 1984). In Malaysia *S. malayensis* were detected among the Orang Asli in West Malaysia (Murugasu and Por, 1973; Murugasu *et al*, 1978; Greer *et al*, 1984; Anuar *et al*, 1984; Chandra and Pathmanathan, 1987), while evidence of *S. japonicum* was found in a monkey (Kuntz, 1978) and in liver and rectal biopsies of immigrants from Philippines (Kan *et al*, 1978). In Sarawak, environmental impact assessment (EIA) survey in upper Lupar River and upper Rejang River found eight individuals

who were active schistosome eggs excretors (IMR/SESCO, 1992). A serosurvey found 16.2% were seropositive for schistosomiasis, however the snail host could not be identified. In this paper we report seroevidence of schistosomiasis malayensis-like infection among the Penan and other interior tribes (Orang Ulu) in upper Rejang River Basin.

MATERIALS AND METHODS

Study area

The upper Rejang River basin was selected for this study because this area is undergoing large scale environmental changes linked to a multibillion Ringgit hydroelectric project at Bakun (Fig 1). Large scale water resources development is associated with increased risk of intestinal schistosomiasis (WHO, 1996). An EIA report noted that schistosomiasis is endemic in the area (IMR/SESCO, 1992), thus it was necessary to assess whether the infection is of potential public health significant. This is

important because *S. malayensis* has not been shown to cause public health problem in West Malaysia. Presently it undetermined whether the Upper Rejang River schistosome strain is related to *S. malayensis* or *S. japonicum*. The area under study is sparsely populated (~10,000) by various indigenous interior tribes (Orang Ulu) including the Kayans, Kenyahs, Kajangs, Punans, Badangs, Kejamans, Ukits and Penans. The sixteen villages in the area are all sited near the riverbank, however domestic water is supplied by gravity fed pipe. The villagers are farmers and hunter-gatherers who are in frequent daily contact with water. The main mode of transport are river boats. Seven villages were selected for this study based on their relative accessibility and safety by river boats (Table 1). Long Ayak was selected because it is the only Ukit village in Sarawak, whereas Lesong Laku is the only Penan village in the area.

Sampling

Stool samples for coproparasitological examination were collected from 167 males and 179 females who are mostly (70%) between 20 to 40 year of age. The samples were examined, at Central Medical Laboratory Kuching Sarawak, for schistosome eggs using the Kato thick smear method. For serum sample, 5 ml of venous blood was collected from each individual, and the serum separated by centrifugation. The samples were stored in thermo-

boxes in a -20°C freezer at Belaga clinic prior to dispatch to The Institute for Medical Research Kuala Lumpur. ELISA method using the soluble egg antigen of *S. malayensis* Baling strain was used for serodiagnosis of schistosomiasis (Annuar *et al*, 1984). Circum-oval egg precipitation (COP) test using the egg antigen of *S. malayensis* was used to diagnose active infection (Greer and Annuar, 1984). Snail samples were collected from 13 streams and rivers (Fig 1). Snail identification was done at the Institute for Medical Research Kuala Lumpur.

RESULTS

Coproparasitological analysis of 346 stool samples found one individual (30 years old Kayan female) who was an active schistosome egg excreter (Table 1). The size and shape of the egg is similar to the *S. japonicum*-complex. The low detection rate for active egg excreter is compounded by the very low eggs load being excreted and the short duration of active excretion.

Of the 356 individual surveyed, 6.8% were seropositive for schistosomiasis of which eight were definite positive and 17 were borderline cases (Table 1). Seroprevalence rate ranges from 4.1% among the Penan of Lesong Laku to 11.6% among the Lahanan of Long Panggai. There is no seroevidence of schistosomiasis among the Ukit of Long Ayak. The

Table 1
Schistosomiasis in upper Rejang River Basin Sarawak Malaysia according to villages.

Longhouse (Tribe)	Stool microscopy No. (positive)	Serum ELISA		% positive
		No. (positive)	Borderline Definite positive	
Long Murum (Kayan)	140 (0)	106 (9)	5 4	8.6
Long Linau (Kayan)	82 (1)	48 (4)	4 0	8.3
Long Sah A (Kenyah)	56 (0)	44 (2)	1 1	4.5
Long Sah B (Kayan)	7 (0)	29 (2)	1 1	6.9
Long Panggai (Lahanan)	34 (0)	43 (5)	5 0	11.6
Long Ayak (Ukit)	7 (0)	24 (0)	0 0	0
Lesong Laku (Penan)	20 (0)	73 (3)	1 2	4.1
Total	346 (1)	365 (25)	17 8	6.8

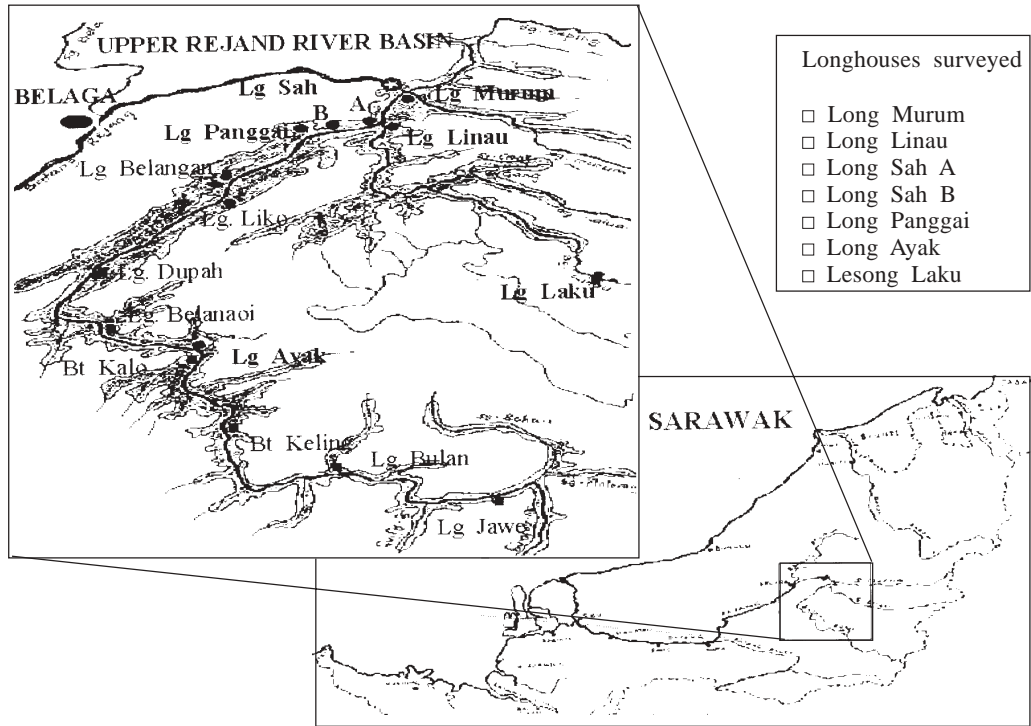


Fig 1—Map of upper Rejang River covered by this study.

Table 2
Schistosomiasis in upper Rejang River Basin Sarawak according to age and sex.

Age	Sex	No. examined	Seroevidence of schistosomiasis by ELISA		
			Positive	Borderline	% with seroevidence
<11	Male	2	0	0	0
	Female	0	0	0	0
11-20	Male	21	0	1	4.8
	Female	19	0	0	0
21-30	Male	40	1	2	7.5
	Female	61	1	0	1.6
31-40	Male	43	0	5	11.6
	Female	41	1	4	12.2
41-50	Male	19	1	0	5.3
	Female	15	0	0	0
51-60	Male	33	1	1	6.1
	Female	27	0	1	3.7
61-70	Male	19	1	2	15.8
	Female	12	0	1	8.3
>70	Male	12	2	0	16.7
	Female	1	0	0	0
Sub total	Male	189	6	11	9.0
	Female	176	2	6	4.5
Total		365	8	17	94.4

Table 3
Snail survey of streams and rivers in upper Rejang River Sarawak.

Location	Types	Species
Sg Belanum Hilir	0	
Sg Pejuan Kanan	1	<i>Brotia</i> species
Sg Pejuan Kiri	0	
Sg Jawan	2	<i>Brotia</i> and <i>Paludimus</i> species
Sg Bukau	3	<i>Paludimus</i> , <i>Brotia</i> and <i>Clea</i> species
Sg Paran	3	<i>Brotia</i> species, <i>Paludimus</i> species, <i>Clea</i> species
Sg Kabhor	3	<i>Brotia</i> , <i>Paludimu</i> and <i>Clea</i> species
Sg Ayak	0	
Sg Paip Sah A	2	<i>Clea</i> and <i>Brotia</i> species
Sg Berangan	3	<i>Paludimus</i> , <i>Clea</i> and <i>Brotia</i> species
Sg Sah B	2	<i>Paludimus</i> and <i>Brotia</i> species
Sg Belanum Ulu	1	<i>Clea</i> species
Sg Baran, Lg Laku	2	<i>Mekongia</i> and <i>Brotia</i> species

data suggest varying infection risk among the villages possibly due to varying contact with schistosome transmission site. The absence of schistosomiasis in Long Ayak may be associated with the destruction of snail population (Table 3) due to the frequent electric and bomb fishing of the nearby rivers and stream. The lower seroprevalence among the Penans may be due to their lower frequency of contact with water as they are generally more hunter-gatherer than agrarian.

Table 2 shows that the majority (64%) of seropositive individuals are males more than 21 years old, and that the seroprevalence rate is higher in males (9.5%) than in females (4.5%) except for those in the 31-40 age group. Seroprevalence rate was shown to increase with age, and that the above 60 age group have the highest rate. The data suggest that a significant number of the Orang Ulu in the area had previous exposure to schistosomiasis and that exposure increase with age. Active transmission of schistosomiasis is ongoing since COP test showed evidence of active infection in two individual (60 years old male, 79 years old male). Why active infection was only found in the older people is unclear, however they may have increased exposure besides decrease in immunological efficiency.

Snail survey of 13 streams and rivers failed to locate and identify the tiny schistosome snail host, however four snail species including *Brotia* species, *Paludimus* species, *Clea* species and *Mekongia* species were found (Table 3). *Brotia* species is the intermediate host of the lung fluke *Paragonimus westermani*, whereas the other three species could act as secondary intermediate hosts of other trematodes of medical importance (Michelson, 1990).

DISCUSSION

This study found that schistosomiasis malayensis-like infection affected significant number of Orang Ulu in upper Rejang River basin as shown by the 6.8% prevalence rate among the population surveyed. Although schistosomiasis may be endemic in the area as previously reported (IMR/SECSO, 1992), we find its prevalence is nearly three times lower than the 16.2% reported previously. This differences may however be due to seasonal variation. The public health significance of schistosomiasis in the upper Rejang River basin is presently unclear because schistosomiasis malayensis has not been shown to cause public health problem in West Malaysia (Greer *et al*, 1989).

Since all the longhouses surveyed are sited near the riverbank, it was suspected that they are at similar risk to schistosomiasis, however the present study showed that this is not so. This is not surprising as increase in infection risk is associated with the frequency and duration of contact with cercariae contaminated water. The high seroprevalence rate in Long Panggai suggests a higher frequency and increase duration of contact with cercariae contaminated water possibly at schistosome transmission sites nearby. High seroprevalence among children particularly babies and toddlers would suggest the likely presence of schistosome transmission sites near the village as children are infrequently taken far from their village. Unfortunately, in this study it was not practical to collect serum sample from babies and toddlers.

This study showed that the seroprevalence of schistosomiasis increase with age and that the highest rate was found in those greater than 60 years old. Previously, it was shown that all age groups surveyed in upper Rejang River had similar infection risk, with school children <14 years old having the highest rate (IMR/SESCO, 1992). High seroprevalence rate in children may be due to their increase frequency and duration of contact with cercariae contaminated water in the evening when peak emergence of the cercariae occur between 6-10 pm (Upatham *et al*, 1985).

Although the snail host was not identified in this study, they may be present in the streams, paddy fields and drains not surveyed. As the snail hosts are tiny (1-5 mm in length), they are difficult to detect in the field environment. It is important that they be identified and their transmission sites located to enable determination of the schistosome biology and therefore plan the appropriate control measures. It is also important to monitor domesticated and wild animal for schistosome carrier, because although the life cycle of schistosome may be maintained by infected persons, their life cycle may also be maintained by rats and buffalos (Inder Singh *et al*, 1997; D'Andrea *et al*, 2000).

Even though the upper Rejang River

schistosomiasis maybe subclinical in the local population, it may cause overt disease in outsiders with no previous exposure to the schistosome. With the multi-billion Ringgit Bakun HEP development, the area may become more accessible to outsiders and tourists who may become infected. As the villagers are now resettled elsewhere, a follow-up study should be done, in the resettlement area, to determine changes in seroprevalence. Attempt should be made to locate and identify snail foci in the resettlement area as well as the abandoned villages before it becomes impossible to do this in the near future.

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