INTESTINAL PARASITIC INFECTION AMONG FIVE INTERIOR COMMUNITIES AT UPPER REJANG RIVER, SARAWAK, MALAYSIA

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Abstract. Intestinal parasitic infection among five interior communities at Bakun Valley, upper Rejang River, Sarawak, Malaysia, was investigated as part of a public health impact assessment of the proposed US$ 3 billion Bakun Hydroelectric Project. Coproparasitological examination of 355 stool samples from 7 of 16 villages representing 5 of 7 tribes in the area revealed infection rate of 41%. A higher infection rate was found among the settled Kayans (56%) than the semi-nomadic Penans (29%). Infection rate was high (68%) among children less than 14 years old. Trichuris trichiura accounted for more than 90% of all infections; less common were Ascaris lumbricoides, hookworms and Strongyloides stercoralis. Polyparasitism was found in 8% of the individuals surveyed with dual infection due to T. trichiura and A. lumbricoides being more common than dual infection with T. trichiura and hookworm. Women had higher infection rates (57%) than men (33%).

INTRODUCTION

Intestinal parasitic infection is common with an estimated 3 billion people infected worldwide (Bundy, 1997; WHO, 2000). It is a major public health problem in Southeast Asia particularly among poor children living in urban squats and rural communities (Bundy et al, 1992; Chan, 1997). In Malaysia, intestinal parasitic infection is endemic among these groups (Sinniah, 1984; Rajeswari et al, 1994). High infection rates are associated with high human population density, low socio-economic status, inadequate supplies of clean water, insanitary disposal of feces and larger families (Rajeswari et al, 1994). Infection distribution in a community follows a negative binomial pattern: although everybody is susceptible, most individuals are uninfected or have low infection intensity, whilst only a small proportion carry a heavy parasite load (Bundy et al, 1992).

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In Sarawak, earlier studies found infection rates ranging from 65-97% among the rural Ibans, nomadic Penans and coastal Malays (Anderson, 1978; Neo et al, 1987). This study attempted to determine the prevalence and distribution of intestinal parasitic infection among the interior communities at Bakun Valley, upper Rejang River, as part of a public health impact assessment of the proposed US$3 billion Bakun Hydroelectric Project.

MATERIALS AND METHODS

The Bakun hydroelectric Project at Bakun Valley, upper Rejang River, Sarawak, Malaysia, will result in the flooding of approximately 70,000 hectares. The seven interior tribes (Kayan, Kenyah, Punan, Kajang, Badang, Ukit and Penan) from 16 villages (Murn, Linau, Sah A, Liko, Dupah, Belanoi, Sah B, Batu Kalo, Batu Keling, Bulan, Jawe, Pangai, Belangan, Ayak, Geng and Lesong Laku) inhabiting the area will need to be resettled...
(Sagin et al, 2000). Seven of the longhouses were selected for this study as they are near representation of 5 of the 7 interior tribes in the area (Sagin et al, 2001). The villages were visited and the villagers briefed on the purpose of the study: those consenting to take part in the study were told how to collect a stool sample. Samples were processed and fixed with 10% formalin; coproparasitological examination was conducted at the Central Medical Laboratory, Kuching, Sarawak, using a standard formalin-ether concentration technique.

RESULTS

Coproparasitological examination of 355 stool samples taken from a cross-section of the interior communities detected the presence of one or more intestinal parasites in 41% of the individuals surveyed (Table 1). The commonest intestinal parasite found was *T. trichiura* (>90%). Less common were *Ascaris lumbricoides*, hookworms, *Giardia lamblia* and *Hymenolepis nana*. Polyparasitism was found in 8% of infected individuals: dual infection due to *T. trichiura* and *A. lumbricoides* was more common than dual infection with *T. trichiura* and hookworm. High infection rates were found among the villagers of Long Linan (56%), Long Murun (41%) and Long Pangai (33%). Analysis of the infection data showed that the Kayan communities had the highest infection rate (56%), compared with the Kajangs (33%) and the Penans (29%).

*A. lumbricoides* was common among Penans while *T. trichiuria* was the predominant intestinal parasite among the Kayans; hookworm infection was higher among the Kajangs than among the other tribes. High infection rates were found in children (Table 2). Polyparasitism was significantly more common in pre-school children than in any other age group. Among children 6-14 years old, *A. lumbricoides* was more common than in pre-schoolers. The infection rate among women (female >14 yrs old) was greater than that among men (male >14 yrs old): 57% compared with 33%.

DISCUSSION

In a previous survey, it was reported that 68% of the interior tribes surveyed, were infected with various intestinal parasites (Lai, 1992). The present study showed that the infection rate has decreased to 41%. The ob-

<table>
<thead>
<tr>
<th>Longhouse (Tribe)</th>
<th>No. of stool samples (%) positive for intestinal parasites¹</th>
<th>T</th>
<th>A</th>
<th>H</th>
<th>Others</th>
<th>T+A</th>
<th>T+H</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murun (Kayan) (n=152)</td>
<td></td>
<td>60</td>
<td>9</td>
<td>1</td>
<td>5</td>
<td>8</td>
<td>0</td>
<td>62</td>
</tr>
<tr>
<td>Sah “A” (Kayan) (n=62)</td>
<td></td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Linau (Kayan) (n=90)</td>
<td></td>
<td>48</td>
<td>9</td>
<td>3</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Ayak (Ukit) (n=7)</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Laku (Penan) (n=24)</td>
<td></td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Sah “B” (Kenyah) (n=7)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Pangai (Kajang) (n=42)</td>
<td></td>
<td>8</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Total (N=355)</td>
<td></td>
<td>130</td>
<td>24</td>
<td>17</td>
<td>9</td>
<td>20</td>
<td>9</td>
<td>144</td>
</tr>
</tbody>
</table>

¹The common intestinal parasites are *Ascaris lumbricoides* (A), *Trichuris trichiura* (T) and hookworm (H). Polyparasitism due to *T. trichiura* and *A. lumbricoides* (T+A) was more common than infection with *T. trichiura* and hookworm (T+H).
served decrease in the infection rate is sus-
pected to be associated with the general im-
provement in the health status of the people. 
Better and more accessible health care facili-
ties are now available compared with a decade 
ago. Health care services to remote villages are 
provided by the regular flying doctor service. 
Additional improvements in basic health facili-
ties included gravity-fed piped water (80%) 
and pour-flush latrines (78%). The socio-eco-
nomic status of the local people has been 
improved by various commercial forestry 
activities, which have provided employment 
opportunities, and decreased the population 
density of the crowded villages, by housing 
workers in living quarters at the logging camps.

The infection rates in Bakun were com-
pared with those found in the more developed 
rural areas of Sarawak. A study of schoolchil-
dren in three primary and two secondary schools 
in Serian district, found an infection rate of 
33.6% (Lee et al, 1999); in contrast, a retro-
spective study in Kuching, involving five defined 
groups: in-patients (n = 7,285), out-patients (n 
= 932), soldiers (n = 253), tuberculosis pa-
tients (n = 65) and student nurses and medical 
assistants (n = 163), found an infection rate 
of 16% (Sagin, unpublished data). That the 
infection rate among the indigenous remote 
interior tribes in Bakun Valley is high is not 
surprising as high infection rates have been 
reported amongst indigenous tribes living in 
remote rural communities in Brazil and Puerto 
Rico (Hillyer et al, 1990; Ferrari et al, 1992; 
Scolari et al, 2000). 

The observation that T. trichiura is the 
commonest intestinal parasite in rural Bakun 
Valley is consistent with previous studies inKuala 
Lumpur, Malaysia, which showed that trichu-
risis is more common among rural subjects, 
while ascariasis and trichuriasis were common 
among squatters (Sinniah, 1984; Rajeswari 
et al, 1994). These data suggest that trichuriasis 
and ascariasis are associated with rural and 
urban infection respectively.

The higher infection rate among the Kayans 
of Long Linau (56%) and Long Murun (41%), 
compared with the semi-nomadic Penans of 
Lesong Laku (29%) is surprising as a previous 
study had found a 69% infection rate among 
the nomadic Penans of Mulu area, Sarawak 
(Anderson, 1978). The availability of a health 
clinic at the Penan village and at Long Linau, 
suggests that the differences in infection rates 
may be associated with the higher population 
density, and the poorer environmental sanita-
tion at Long Murum and Long Linau. Variation 
in infection rate among the villages indicates 
that although everybody is susceptible to in-
fec tion, villagers in each village have varying 
degrees of re-exposure and re-infection risk.
The present data should not be interpreted as an indication of a direct association between ethnicity and intestinal parasitic infection. High infection rates may instead be associated with population density, environmental sanitation and general lifestyle in the villages (Rajeswari et al. 1994); this possibility is supported by the differences in infection rates among the Kayans of Long Murun (41%), Long Linau (56%) and Long Sah A (18%) - Long Sah A has a much lower population density.

The high infection rate among children (65%) found in this study is consistent with various studies in other countries such as Brazil, Puerto Rico, Chile and Mali (Ferrari et al., 1992; 1994; Oberg et al., 1993; Hillyer et al., 1999; Behnke et al., 2000). The infection rate in Bakun is however much lower compared with the marginalized children of Indonesian immigrants (90%) and Orang Asli (79%) living in urban squats and rural areas in West Malaysia (Rajeswari et al., 1994). An important factor that could result in a high infection rate among children is poor environmental sanitation leading to higher re-exposure and re-infection (Ferreira et al., 1994).

Heavy intestinal parasitic infection in childhood can result in growth retardation and may compromise cognitive development (Hlaing, 1993; WHO, 2000). As *T. trichiura* caused >90% of all infection and was a co-infection in > 80% of cases and, as the high-risk groups are children < 14 years old, helminth control measures should be directed towards these children. In rural areas, effective control measures must involve active community participation particularly at the primary school level rather than at village level as there are always more schools than health centers and more teachers than health workers. It is recommended that at least 75% of all school-age children at risk of morbidity be regularly treated (WHO, 2000).

The observation that among adults, women have a higher infection rate (57%) than men (33%) suggests a correlation between sex and intestinal parasitic infection. This difference may be due to higher exposure, increased susceptibility, behavioral or occupational factors or the superimposition of several random dispersal factors or some unknown genetic, cultural or other spatial reason (Oberg et al., 1993). Considering cultural factors, women are responsible for child-rearing and are in contact with children’s feces: given that infection is high in children, transmission could have occurred from children to their mothers rather than *vice versa*. Children probably acquired the infection from other children.

The observation that the prevalence and distribution of infection is high in villages with high population density suggests that human population density is a significant factor in intestinal parasitic infection. High population density has the potential to increase the risk of environmental seeding and re-exposure, particularly in the riverside setting of the villages where environmental sanitation standards are poor.

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