ORIGINAL ARTICLE

Intestinal Helminth Infections Amongst School Children in the Serian District of Sarawak

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Summary

School children from 3 primary and 2 secondary schools in Sarawak were examined for the presence of gastrointestinal helminths. One primary school and 1 secondary school were located in a town (Serian), the other primary and secondary schools were in the countryside outside Serian. The intestinal helminths detected were *Ascaris lumbricoides, Trichuris trichiura, Enterobius vermicularis* and hookworm. Children from the rural schools had higher numbers of eggs in their faeces than those from the Serian schools. Children from the rural primary schools had higher number of eggs than those from the rural secondary school. The prevalence of *Ascaris, Trichuris* and hookworms in male and female and in primary and secondary school children was recorded.

Key Words : *Ascaris, Trichuris,* Hookworms, Helminth, Gastrointestinal nematode

Introduction

At least one-quarter of the world's population is chronically infected with parasites of the gastrointestinal tract and most of these infected people live in developing countries [1]. The design of procedures to evaluate control measures requires a clear understanding of the epidemiological characteristics of the infections to be controlled if the control measures are to be effective in terms of cost and control of the parasites of a community [2]. The important parameter for evaluating the impact of control on morbidity and transmission of parasitic worms is the intensity of infection, which can be assessed by determining the mean density of parasite eggs in faecal specimens [3]. It is well known that even moderate infections with certain parasitic worms can affect the growth, bone formation and weight gain of young animals and of children [4,5]. Significant improvements in growth have been observed in children infected with hookworms, with *Ascaris lumbricoides* and with *Trichuris trichiura* [5,6,7] and in cognitive ability of children infected with *Trichiuris trichiura*[8,9] after treatment with anthelmintics. These results suggest that even moderate infections with parasitic worms may have insidious consequences for the infected children [3,9].

Although a number of studies have been made over the years on the prevalence of intestinal helminths in school children in Malaysia[10,11,12,13,14], there are relatively few publication on the prevalence of intestinal helminths in school children in Sarawak [15]. The aim of the research described in this paper was to measure : (i) the prevalence of intestinal helminths infection, (ii) intensity of infection of soil-transmitted helminths (*Ascaris, Trichuris* and hookworm) and (iii) the association of worm burden with age and sex of the children, with the locality of their school and with day and part boarding schools in primary and secondary school children from the Serian District of Sarawak, Malaysia.

Materials and Methods

Schools in the Serian district were selected after consultation with the District Education Officer Serian District and the Education Welfare Officer Serian District. They were examples of schools in the town and in the surrounding countryside, of part boarding and day schools, and of primary and secondary schools. The schools in the survey were : SRK Sungai Menyan which is a primary school (ages 7 to 12) (65% boarding) and is in the countryside about 24 km from the town of Serian; SMK Balai Ringgin (80% boarding) and is a secondary school (ages 12 to 16) about 30 km from Serian; SRB St Patrick Tangga primary school (ages 7 to 12) (day school) and is in the countryside about 5 km from Serian; SRK Serian which is a primary school (ages 7 to 12) (day school) and is located within the town of Serian; and SMK Serian which is a secondary school (ages 12 to 16) (50% boarding) located within the town of Serian. Serian is a country town about 60 km from the city of Kuching, Sarawak.

The children were given a plastic container with a screw top lid plus a wooden spatula and asked to place a faecal sample from themselves in the container, seal it with the lid provided, and write their name on the label attached to the container. These were collected by staff in the school the following day and a list prepared of the name, age, sex and home address of each pupil. The samples were collected from the schools that same day and were kept refrigerated (4°C) until processed (usually within 6 days). Counts of helminth eggs and larvae were made following the methods used by Holland, Asaolu, Crompton, Stoddart, MacDonald and Torimo [16] in their work on the epidemiology of soil-transmitted helminths in primary school children from Nigeria; samples were processed by the formol-ether concentration technique [17] and quantitative diagnosis as eggs per gram of faeces (epg) was carried out [18]. The eggs were identified microscopically and results were recorded as eggs per gram for each sample. The survey was carried out during March 1996 at the end of the monsoon season.

Due to the small student size in all schools, attempt was made to collect the stool samples from all students in the primary schools aged from 7 and 12 year and the secondary schools aged from12 to 16 years. A total of 37 samples were eventually received from SRK Sungai Menyan, 53 samples from SRB St Patrick Tangga, 76 samples from SMK Balai Ringgin, 41 samples from SRK Serian and 57 samples from SMK Serian. The children were Bidayuh, Iban, Chinese, Indian, Javanese, Malay or Melanau.

Results

Although 400 sample containers were distributed to the schools only 264 children provided samples. Also, the number of samples varied from school to school. The commonest intestinal worm was *Trichuris trichiura* followed by *Ascaris lumbricoides* (Table I) and the commonest mixed infection was with *Trichuris* and *Ascaris*. Enterobius vermicularis has been omitted from Table I as the standard technique was not used to detect this nematode. All five schools had at least some children infected with *Ascaris* and/or *Trichuris*; hookworm eggs (only the occasional hookworm larva was found) were present in samples from some children in three of the schools. Single infections with *Ascaris* were present in 3.3%, with *Trichuris* 19.1% and with hookworm 2.1% of the children. Mixed infections (*Ascaris, Trichuris,* hookworm) were present in 33.6% of the children; 9.1% had mixed *Ascaris/Trichuris* infections; 2.1% had mixed *Trichuris*/hookworm infections; and none had mixed *Ascaris*/hookworm infections. Children from the 3 schools located in rural

Table 1
The Prevalence of *Ascaris, Trichuris* and Hookworms from 264 Samples in Five Schools, Serian District, Sarawak. Some Children had Mixed Infections

Helminths	Number of Children Infected	Prevalence (%)
Ascaris lumbricoides	31	12.8
Trichuris trichiura	67	25.4
Hookworm	19	7.2

areas outside Serian had more children infected (43.7%) (SRK Sungai Menyan 46%); SRB St Patrick Tangga 45%; SMK Balai Ringgin 34%) than those from the Serian schools (15%) (SRK Serian 7%; SMK Serian 23%) (G test = 21.2). The prevalence of mixed infections in primary schools was 12.2% and in secondary schools was 8.3%. The prevalence for Ascaris in primary school children was 14.5%, for *Trichuris* was 27.5% and for hookworm was 7.6% ($\chi 2$ = 19.7, P<0.001). For secondary schools the prevalence was 9.0% for *Ascaris*, 23.3% for *Trichuris* and 6.8% for hookworm ($\chi 2$ = 25.7, P<0.001). More male children were infected (34.6%) than female children (23.9%) with the prevalence of *Ascaris* being 11.9% in females and 15.4% in males, of *Trichuris* being 21.6% for females and 36.5% for males, and for hookworm being 2.2% for females and 14.4% for males. There were no significant difference in infection rate between male children and female children ($\chi 2$ = 0.44, P>0.1). Slightly more children in the 7 to 12 year old group at primary schools were infected (33.6%) than the children at secondary schools (29.5%). There were no significant difference among the primary school children infected with the helminths as compared to the secondary school children ($\chi 2$= 0.22, P>0.5). Slightly fewer children at the day schools had worms (28.4%) than children at mixed boarding/day schools (32.7%) (χ^2 = 1.05, P>0.20). Of the 264 children who produced samples, most (182) were uninfected and 31.1% were infected. Of the infected children 33 were producing 100 eggs or less, 18 were producing 101 to 500 eggs, 26 were producing 501 to 5000 eggs and 5 were producing more than 5000 eggs per gram of faeces. The mean epg for *Ascaris* in infected primary school children was 2370, for *Trichuris* was 540.2 and for hookworm was 222.2; for infected secondary school children the mean epg for *Ascaris* was 1578; for *Trichuris* was 163.8 and for hookworm was 247.8. The highest epg we recorded for *Ascaris* was 12,850, for *Trichuris* was 4,200 and for hookworms was 618. We were not able to use the Scotch Tape method, however, Enterobius vermicularis eggs were found in the faeces of three children.

Discussion

A number of studies on intestinal helminth infections in children in Malaysia, mainly from around Kuala Lumpur, Selangor and Northern Peninsular Malaysia have been published. For example, Mahendra, Sein, Anuar and Mustaffa [13,14] found that out of 249 early primary school children at 2 schools in North-eastern Peninsular Malaysia 73 were infected with *Ascaris*, 103 with *Trichuris* and 18 with hookworms. It was found that 5% of paediatric admissions to a general hospital in Kuala Lumpur were associated with intense *Trichuris* infection [19]. Kan [20] showed that children from eight Indian primary schools from urban and rural areas in and around Kuala Lumpur showed an overall prevalence of infection of 89.02% with *Ascaris, Trichuris* and hookworms. Bundy, Kan & Rose[22] studied the gastrointestinal helminth infection status of 1574 children living in a slum area of Kuala Lumpur and found that almost two-thirds were infected with *Trichuris*, 49.6% with *Ascaris* and 5.3% with hookworm. They found that prevalence and intensity of infection was age-dependent with prevalence rising rapidly to reach an asymptote value at about 7 years of age and remaining relatively constant thereafter. The age-intensity profiles for *Ascaris* and for *Trichuris* showed maximum values in the 5-10 year age classes. We have found that more primary school children are infected with *Ascaris* and *Trichuris* and have higher epg than secondary school children but the prevalence and epg for hookworm is about the same in both groups. We found that hookworm infection is not as common among school children as infections with *Trichuris* and *Ascaris*. A similar finding was observed by Bundy, Kan & Rose [22] in slum children in Kuala Lumpur, and by Mahendra, Sein, Anuar and Mustaffa [12,13,14] in primary schoolchildren in North-eastern Malaysia. Bundy, Kan & Rose [22] found that the pattern of infection differed markedly between different ethnic groups but that the pattern was the same for males and females. In our study we have found that slightly more males than females are infected with intestinal helminths with the largest difference being the prevalence of hookworms; it is possible that this higher prevalence of hookworms in males may reflect differences in behaviour between the sexes. Due to the limited samples collected, future study should be made to ascertain this finding. In a similar study by Ahmad, Tan, Phang & Prociv [15] also shown that more boys were infected with intestinal parasite amongst Kelabit children in two boarding schools (a primary and a secondary schools), Bario highland, Sarawak ($\chi 2$ =

1.63, P<0.01). The prevalence of *Trichuris trichiura* infections (17.3%) was higher than *Ascaris* (15.8%), followed by hookworm infections (13.7%). However, no information was provided on the rate of infections amongst the primary school and the secondary school children. In another study, Lim [23] found that rural children had a high prevalence of 81 to 95% with intestinal helminths whereas children from semi-rural locations and urban slums had rates varying from 50% to rates similar to those found in rural areas. We also found a higher prevalence in children from rural schools than from the town schools but the prevalence was much lower than found by Lim. In Gombak, Malaysia, Rajeswari, Sinniah & Hussein [11] found that 90% of the children of Indonesian immigrants were infected with gastrointestinal parasites and this was associated with socio-economic status, water supply, sanitary disposal of faeces and family size.

Kan [20] found the average egg counts of rural and urban school children infected with *Ascaris* were 10,487 eggs per gram (EPG) of faeces and 12,039 EPG respectively; rural schoolchildren infected with *Trichuris* had an average of 1,576 EPG and urban school children had an average of 2,566 EPG; rural school children infected with hookworms had an average of 298 EPG and urban school children had an average of 304 EPG. The geometric mean eggs for children from both rural and town areas in Serian district was much lower than the found in Kan's work. Only three children showed evidence of infection with *Enterobius vermicularis* in our survey but as we had not used the Scotch Tape method to detect the eggs of this parasitic nematode, which lays its eggs on the perianal skin, it is probable that many more of the children are infected with this parasitic worm. One child had an egg count of 2,990 EPG of *Enterobius* so we suspect the child used the spatula to collect faeces from its anal area instead of from deposited faeces.

We found that most children had no gastrointestinal helminths; of those that were infected about 40.2% had egg counts of 1 to 100 EPG; 22% had egg counts of 101 to 500 EPG; 31.7% had egg counts of 501 to 5000 EPG and 6.1% had egg counts greater than 5000 EPG. The severity of infection based on the WHO classes of intensity is in the range of light intensity and moderate intensity [24]. Five children, 2 from SMK Balai Ringgin, 2 from SRK Sg Menyan and 1 from SRK Serian were having *Ascaris* infection of EPG greater than 4000. This level of infection is within the light intensity category for Ascaris. There were 8 children with moderate intensity of *Trichuris trichiura* with the EPG greater than 1000, 7 of them were from the primary school. This distribution is similar to that recorded by other workers who have shown that most infected individuals have few worms while a few individuals have disproportionately large worm burdens[3]. According to Bundy, Hall, Medley and Savioli [3] heavily infected individuals are not only likely to suffer ill effects from the infections but they are also the major sources of infection in the community in which they live. Treating the most heavily infected children will reduce morbidity and transmission in the community. It is encouraging to note that most of the children involved in this survey had no or few worms, that a small number appear to have been moderately infected and an even smaller number to have been more heavily infected; these latter could have been a source of infection in the community.

Acknowledgements

We wish to thank the Divisional Education Officer for Kuching/Samarahan; Mr Peter Raig Rohai, District Education Officer Serian District; Dr Hj Junaidi Diki, Divisional Health Officer, Kota Samarahan, and Education Welfare Officer, Serian District for their invaluable assistance in arranging for us to visit the schools and collect the samples. We also wish to thank Prof Dr Syed Hassan Almashoor, Dean of the Faculty of Medicine & Health Sciences for his support, encouragement and use of facilities, and Prof C C M Lei and Mr Dominic Sagin for useful information and discussion. Finally we would like to thank the staff and especially the pupils at the five schools involved in the survey.

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