ORIGINAL ARTICLE

Some Risk Factors of *Ascaris* and *Trichuris* Infection in Malaysian Aborigine (*Orang Asli*) Children

M Norhayati, PhD, P Oothuman, PhD, M S Fatmah, Dip Med Tech, Department of Parasitology and Medical Entomology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur

Summary

A study on risk factors of soil-transmitted helminths was conducted in a highly endemic area. In all 205 children (95 boys and 110 girls) participated in this study. The overall prevalences of *Ascaris*, *Trichuris* and hookworm infection were 62.5%, 91.7 % and 28.8% respectively. Only 22.4% of the children had a single infection either by *Ascaris* or *Trichuris*; 69.3% had mixed infection and the most prevalent of mixed infection was a combination of *Ascaris* and *Trichuris*. Logistic regression analysis confirmed that low level mother's education was a risk factor for moderate and severe infection of *Ascaris* and age ≤ 6-year-old was a protective factor. In *Trichuris* infection logistic regression analysis confirmed that usage of well-water and age ≤ 6-year-old were the risk factors. Logistic regression analysis on worm scores confirmed that usage of well-water and non-usage of toilets were the risk factors from getting severe worm scores and age ≤ 6-year-old was a protective factor. Our finding suggest that socio-behavioural (related to mother's education), demographic (children age) and environmental factors (usage of well-water and non-usage of toilets) are the elements to be considered in the design of long term soil-transmitted helminths (STH) control in an endemic areas.

Key Words: Risk factors, *Ascaris*, *Trichuris*, Worm scores, *Orang asli*

Introduction

Ascaris, *Trichuris* and hookworm infection (soil - transmitted helminths, STH) continue to be a public health problem in underprivileged communities both in rural and urban areas in Malaysia [1-6]. Environmental factors, such as water supply for domestic and personal hygiene, sanitation and house condition [7-12], and other factors such as socioeconomic [10,11,13,14], demographic [6,10,11,15] and health related behaviour [10,11,14] are known to influence the prevalence and intensity of this infection.

Studies have shown that the prevalence of this infection is slowly decreasing in communities where good and safe environmental sanitation has been provided or practiced or when the resident's socio-economic status improved [7,8,13]. Studies have also proven that by moving people from unhygienic to better environmental condition without changing their economic status has significantly reduced the prevalence and intensity of STH [16,17]. Reinfection studies also clearly suggest that environmental and socio-economic factors have greater impact on the transmission of STH than the personal and health related behavioural factors [11,18].

We conducted a community-based study in an area highly endemic for STH to elucidate the demographic, socio-economic, behavioural and environmental factors that predispose children to this infection. Our objectives were to identify risk factors that might be useful in the planning of long-term strategies in controlling this infection in an endemic communities.

Methods and Materials

This community-based study was conducted in residents of 6 villages in the sub-district of Dengkil, Selangor, Malaysia situated about 50 km from Kuala Lumpur. The villages were chosen based on the criteria: the main economic activities of the villagers were agriculture, mean household income were low and worm infection was among the health problems. House or family who had children 1 to 15-years-old were identified and the families were invited to attend a health and worm infection exhibition held by the researchers in the villages. The aim of the study was explained to the parents during the exhibition day. Children who had taken some form antihelminthic two months prior to the date of faecal examination were excluded in this study. In all, 205 children aged 1 to 13-year-old (95 boys and 110 girls), were recruited in this study.

Faecal specimens collected were examined by Kato-Katz method for presence of STH eggs. Harada-Mori culture was also done on all faecal samples and examined 7 days later to identify hookworm species and also to detect *Strongyloides stercoralis* larvae. Egg counts were also done using Kato-Katz technique and results expressed as eggs per gram faeces (epg). Egg counts per gram faeces were used to determine the intensities of infection either mild moderate or severe according WHO criteria [19]. To measure the effect of mixed infection, the worm score for each patient was measured by adding the intensity of infection for each species of parasites. This was done by giving value of 1, 2 and 3 for mild, moderate and severe infection respectively. The socio-economic data of the children were obtained using a questionnaire. Data was analysed using EpiInfo [20] and SPSS for windows [21].

Results

Overall prevalence of *Ascaris*, *Trichuris* and hookworm infection was 62.9%, 91.7% and 28.8% respectively. Only 22.4% of the children had single infection either by *Ascaris* or *Trichuris*; 69.3% had mixed infection and the most prevalent of mixed infection was a combination of *Ascaris* and *Trichuris* (36.1%), followed by *Ascaris*, *Trichuris* and hookworm (25.9%) and the least prevalent *Trichuris* and hookworm (7.3%) (Table 1). About 53.3% and 85.2% of the children ≤ 6 year-old were infected by *Ascaris* and *Trichuris* respectively. Strongyloides infection was negative.

Table I
Prevalence of type of infection amongst 205 *Orang Asli* children

Type of Infection	Prevalence % (n)
Single Infection	
(either by *Ascaris, Trichuris* & Hookworm)	22.4 (46)
Mixed Infection	69.3 (142)
- *Ascaris* + *Trichuris*	36.1 (74)
- *Trichuris* + Hookworm	7.3 (15)
- *Ascaris* + *Trichuris* + Hookworm	25.9 (53)

The results of univariate analysis of intensity infection of *Ascaris* are shown in Table II. Significant risk factors were low mother's education and non-usage of toilets. Family size ≥ 8 failed to reach statistical significance at p=0.0651 and age ≤ 6 year old was a significant protective factor from getting a moderate or severe infection of *Ascaris.* Logistics regression analysis confirmed that a low mother's education was a risk factor and age ≤ 6-year-old was a protective factor for moderate and severe intensity infection of *Ascaris*.

Significant risk factors for moderate and severe intensity infection of *Trichuris* were usage of well water, household income ≤ RM250.00, low level mother's education, non-usage toilets and age 6 year old (Table III). Logistics regression analysis confirmed that usage of well water and age ≤ 6 year-old were risk factors for moderate and severe intensity infection of *Trichuris*.

When the effect of mixed infection was calculated using worm scores, usage of well water, low mother's education, non-usage of toilets and family size ≥ 8 were the significant risk factors for severe worm scores. Age ≥ 6 year-old was a significant protective factor from getting severe worm scores (Table IV). However, logistics regression analysis only confirmed the usage of well water and non usage of toilets as a significant risk factors for severe worm scores and age ≤ 6 year-old was its protective factors.

Discussion

Our findings with regard to risk factors of *Ascaris* and *Trichuris* infection were almost similar with other studies done in developing countries [4,9,10,11,13]. This present study identified that low level of mother's

Table II

Results of univariate analysis of risk factors for intensity infection of *Ascaris*

Variables	Prevalence (%) of infection: Negative + Mild (n=124)	Prevalence (%) of infection: Moderate + Severe (n=81)	Odds Ratio (95% CI)	P
Low father education	31.5	32.1	1.03 (0.54-1.96)	0.9552
Low mother education	54.0	76.5	2.78 (1.43-5.49)	0.0018
Working mother	16.9	8.6	0.46 (0.16-1.21)	0.1382
Household income ≤ RM 250.00	61.3	70.3	1.59 (0.79-2.87)	0.2372
Family size ≥ 8	71.8	84.0	2.06 (0.97-4.56)	0.0651
Usage of well-water	41.1	54.4	1.10 (0.58-2.06)	0.8777
Non-usage of toilets	51.6	66.7	1.88(1.01-3.15)	0.0468
Male	50.0	40.7	0.69 (0.37.1.26)	0.2474
Age ≤ 6-year-old	66.9	45.7	0.42 (0.22-0.77)	0.0040

Table III
Results of univariate analysis of risk factors for intensity infection of *Trichuris*

Variables	Prevalence (%) of infection Negative + Mild (n=66)	Moderate + Severe (n=139)	Odds Ratio (95% CI)	P
Low father education	22.7	36.0	1.91 (0.94-4.03)	0.0812
Low mother education	48.5	69.8	2.45 (1.28-4.69)	0.0051
Working mother	16.7	12.2	0.70 (0.29-177)	0.5179
Household income ≤ RM250.00	51.5	71.2	2.33 (1.21-4.46)	0.0091
Family size ≥ 8	69.7	79.6	1.72 (0.83-3.53)	0.1531
Usage of well-water	21.20	58.3	5.19 (2.53-11.05)	0.0000
Non-usage of toilets	43.9	64.0	2.27 (1.20-4.31)	0.0102
Male	51.5	43.8	0.74 (0.39-1.38)	0.3822
Age ≤ 6-year-old	68.1	53.9	0.55 (0.281.05)	0.0751

Table IV
Results of univariate analysis of risk factors for severe worm scores

Variables	Prevalence (%) of infection Negative + Mild (n=66)	Moderate + Severe (n=139)	Odds Ratio (95% CI)	P
Low father education	32.0	31.4	0.97 (0.52-1.82)	0.9620
Low mother education	51.5	74.5	2.76 (1.47-5.21)	0.0010
Working mother	16.5	10.7	0.61 (0.24-1.44)	0.3225
Household income ≤ RM250.00	59.2	70.5	1.65 (0.89-3.08)	0.1192
Family size ≥ 8	68.9	84.3	2.42 (1.18-5.11)	0.0148
Usage of well-water	33.9	58.8	2.78 (1.52-5.10)	0.0006
Non-usage of toilets	45.6	69.6	2.73 (1.48-5.05)	0.0008
Male	47.1	44.6	0.90 (0.48-1.70)	0.8515
Age ≤ 6 year old	64.2	46.2	0.48 (0.25-0.90)	0.0214

education was a risk factor for moderate and severe infection of *Ascaris* and usage of well water and age ≤ 6 year old were the risk factors for moderate and severe infection of *Trichuris*. Previous studies have also shown that other environmental factors such as cleanliness of living areas [10], location of toilets and non usage of toilets [9,10,12] type of drinking water [9,10,12], socio-economic factors such as overcrowding [10,12,13] and household income [10,22,23] were all related to STH infection.

The association of educational level of mothers with the prevalence of STH has been studied by only few researchers. In Sri Lanka and Malaysia, studies have shown that as the educational level of the mothers improved, the prevalence of *Ascaris* and *Trichuris* in their children declined [10,12,22]. This finding was in agreement with ours. On the other hand, a study done in Macao found that the level of education of parents was not related with the prevalence of STH in pre-school children [13]. The finding that low level of education of mothers but not of fathers was a risk factor for moderate and severe infection of *Ascaris* may reflect the greater role that mothers play in the care of children in this community. It can be surmised that removal this risk factor by educating mothers on the prevention of *Ascaris* may help in controlling of this infection in this community.

A study done in villages in rural area in Malaysia indicated that provision of both piped water and improved sanitation prevent the occurrence of *Ascaris* regardless of other socio-economic background of the community [4]. For *Trichuris* infection such observation were confirmed in this present study.

The most prevalent of mixed infection in this community was a combination of *Ascaris* and *Trichuris*. However, our regression analysis confirmed that, *Ascaris* and *Trichuris* infection in this community had different risk factors e.g. age ≤ 6-year-old was a protective factor for *Ascaris* but for *Trichuris* infection it was a risk factor. Why younger children in this community were more susceptible to Trichuris infection was difficult to explain in this study. It may reflect differences in socio-behavioural activities, susceptibility and immunity of the two aged groups towards *Ascaris* and *Trichuris* infection. Gender was not a significant risk factor for *Ascaris* and *Trichuris* in this study and this agrees with previous studies [24,25]. However, a study in India showed a significant association between gender and intensity infection of *Ascaris* [26]. Differences in the socio-behavioural and economic activities between males and females in the Indian community was the main reason for the differences.

When the effect of mixed infection was measured using worm scores, family size ≥ 8 was identified as another significant risk factor. However, logistic regression analysis confirmed that usage of well-water and non-usage toilets were the significant risk factors of severe worm scores. Other factors were not significant in this analysis. Age ≤ 6-year-old was a protective factor of severe worm scores.

Usage of well-water and non-usage of toilets were the persistent risk factors of having moderate and severe infection with *Ascaris*, *Trichuris* and severe worm scores identified in this community. A study in St. Lucia showed that sanitation and crowding are crucially important in reinfection of *Ascaris* [18]. Subsequent studies in Malaysia also showed similar finding [4,13]. Our findings suggest that socio-behavioural (related to children age, mother's education) and environmental factors (usage of well-water and non-usage of toilets) should be the elements to be considered in the design of long term STH control strategies in an endemic areas.

Acknowledgement

This study was supported by the Universiti Kebangsaan Malaysia, Research Grant No 10/92. We would like to thank the Dean of the Faculty of Medicine for his kind permission to publish this study.

References

1. Bundy DAP, Kan SP, Rose R. Age related prevalence, intensity and frequency distribution of gastrointestinal helminths infection in urban slum children from Kuala Lumpur, Malaysia. Trans R Soc Trop Med Hyg 1988; 82: 987-93.

2. Li CF. Hookworm infection and protein energy malnutrition: Transverse evidence from two Malaysian ecological groups. Trop Georgr Med 1990; 42:8-12.

3. Hanjeet K, Lai PF, Ow Yang CK, Mathias RG. Soil-transmitted helminthiases in squatter populations around Kuala Lumpur by ethnic distribution. Trop Biomed 1991; 8: 33-7.

4. Che Ghani BM, Oothuman P. Patterns of soil-transmitter helminths infection in relation to types of water supply, housing facilities and availability of latrines in rural areas of peninsular Malaysia. In: Collected Papers on the Control of Soil-Transmitted Helminthiases Vol V, (Editors) Yokogawa M, et al., APCO, Tokyo, 1991; 51-6.

5. Osman A, Zaleha MI. Nutritional status of women and children in Malaysian rural populations. Asia Pacific J Clin Nut 1995; 4: 319-24.

6. Norhayati M, Zainuddin B, Mohammod CG, Oothuman P, Azizi O, Fatmah MS. The prevalence of Trichuris, Ascaris and hookworm infection in Orang Asli children. Southeast Asian J Trop Med Public Health 1997; 28 (1): 161-8.

7. Sahba GH, Arfaa F. The effect of sanitation on ascariasis in an Iranian village. Am J Trop Med Hyg 1967; 70: 37-9.

8. Arfaa F, Sahba GH, Farahmandian I, Jalali H. Evaluation of the effect of different methods of control of soil-transmitted helminths in Khuzestan, South-west Iran. Am J Trop Med Hyg 1977; 26 (2): 230-3.

9. Henry FJ. Environmental sanitation, infection and nutritional status of infants in rural St Lucia, West Indies. Trans R Soc Trop Med Hyg 1981; 75(4): 507-13.

10. Ismail MM, Rajapakse AL, Suraweera MGW, Weerasuriya K, Amarasinghe DKC. Some socio-economic and health-related factors and soil-transmitted nematod infections: 1. Relationship to prevalence and intensity of infection. In: Collected Papers on the Control of Soil-Transmitted Helminthiases Vol IV, (Editors) Yokogawa M, et al., APCO, Toyko, 1987; 23-8.

11. Ismail MM, Rajapakse AL, Suraweera MGW, Amarasinghe DKC. Some socioeconomic and health-related factors and soil-transmitted nematod infections: 2. Relationship to reinfection. In: Collected Papers on the Control of Soil Transmitted Helminthiases Vol V, (Editors) Yokogawa M, et al., APCO, Tokyo, 1989; 22-35.

12. Kan SP, Chen ST, Chiam HK, Ng PT. Environmental, socioeconomic factors affecting distribution of soil-transmitted helminthsis among preschool children in Malaysia. In: Collected Papers on the Control of Soil-Transmitted Helminthiases Vol V, (Editors) Yokogawa M, et al., APCO, Tokyo. 1992; 98-105.

13. Chan TC, family influence on the prevalence of soil-transmitted helminthiases among Chinese children in Macao. Trop Biomed 1992; 9: 9-14.

14. Elkins DB, Haswell-Elkins MR, Anderson RM. The epidemiology and control of intestinal helminths in the Pulikat lake region of Southern India 1. Study design and pre-and post treatment observations on Ascaris lumbricoides infection. Trans R Soc Trop Med Hyg, 1986; 80: 774-92.

15. Bundy DAP, Cooper ES, Thompson PE, Anderson RM, Didier JM. Age related changes in the prevalence and intensity of Trichuris trichiura in St. Lucia community. Trans R Soc Trop Med Hyg 1987; 81: 85-89.

16. Kleevens JWL. Rehousing and infections by soil-transmitted helminths in Singapore. Singapore Med J 1966; 7 (1): 12-29.

17. Che Ghani BM, Noorhayati MI, Osman A, Mohd Hashim. Effects of rehousing and improved sanitation on the prevalence and intensity of soil-transmitted helminthiasis in urban in Kuala Lumpur. In: Collected Papers on the Control of Soil-Transmitted Helminthiases Vol IV, (Editors) Yokogawa M, et al., APCO, Tokyo, 1989; 51-6.

18. Henry FJ. Reinfection with Ascaris lumbricoides after chemotherapy: A comparative study in three villages with varying sanitation. Trans R Soc Trop Med Hyg 1988; 82: 460-4.

19. WHO. Prevention and control of intestinal parasitic infections. Technical Reports Series No :749 1987. Geneva: World Health Organisation.

20. Epi Info, version 6.02. A word processing database and Statistics Program for Public Health. Produced by The Division of Surveillance and Epidemiology, Epidemiology Program of Centres for Disease Control of Preventive and World Health Organisation 1994.

21. Statistical Package for Social Science, for Windows (Release 6.0). 1993. SPSS Inc. Chicago Illinois.

22. de Silva NR, Jayapani VPP, de Silva HJ. Socioeconomic and behavioural factors affecting the prevalence of geohelminths in pre-school children. Southeast Asian J Trop Med Public Health 1996; 27: 36-42.

23. Hagel I, Lynch NR, Perez M, Di Prisco MC, Lopez R, Rojas E. Relationship between the degree of poverty and IgE response to Ascaris infection in slum children. Trans R Soc Trop Med Hyg 1993; 87: 16-8.

24. Ferreira CS, Ferreira MU, Noguera MR. The prevalence of infection by intestinal parasites in an urban slum in Sao Paulo, Brazil. J Trop Med Hyg 1994; 97: 121-127.

25. Al-Eissa YA, Assuhaimai SA, Abdullah AMA, Abo Bakar AM, Al-Husain MA, Al-Nasser MN, Al-Borno MK. Prevalences of intestinal parasites in Saudi Arabia; a community-based study. J Trop Paed 1995; 41: 47-9.

26. Elkins DB, Haswell-Elkins MR, Anderson RM. The importance of host age and sex to patterns of reinfection with Ascaris lumbricoides following mass antihelminthic treatment in a South India fishing community. Parasitology 1988; 96: 171-84.