SOCIO-ENVIRONMENTAL PREDICTORS OF SOIL-TRANSMITTED HELMINTHIASIS IN A RURAL COMMUNITY IN MALAYSIA

Hidayah NI[1], Teoh ST[2] and Hillman E[3]

[1]Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur, Malaysia;[2]Department of Social and Preventive Medicine, Faculty of Medicine, University of Malaya, 59100, Kuala Lumpur, Malaysia; [3]Department of Medicine, University of Ottawa, 501 Smyth Ottawa Ontario, Canada, KIH 8L6

Abstract. Soil-transmitted helminthiasis is a common problem in communities with poor socio-environmental conditions. This study was undertaken to identify important socio-environmental predictors of soil-transmitted helminthiasis in Bachok, a rural community in Kelantan for the development and implementation of an effective prevention and control program. Of 363 children randomly sampled, 38.8% were infected with soil-transmitted helminthiasis. Risk predictors of soil-transmitted helminthiasis found to be significant after adjustment included poor household hygiene score and large household size. The probability of being infected was 0.58 amongst children with both of these risk factors.

INTRODUCTION

Soil-transmitted helminthinthic infections are found worldwide, especially in communities with poor socio-environmental conditions. The existence of different risk factors results in a wide variation in the prevalence of soil-transmitted helminthiasis in different communities (Tshikuka and Scott, 1995; Sinniah *et al*, 1988; Norhayati *et al*, 1995). Many studies have shown the importance of socio-environmental factors that influence the transmission of soil-transmitted helminthiasis from one individual to another (Alakija, 1986; Haswell-Elkins, *et al*, 1989). Effective strategies in the prevention and control of soil-transmitted helminthiasis are dependent on identifying modifiable risk factors that increase the susceptibility of the community to soil-transmitted helminthiasis. Prioritization of prevention and control strategies based on these identified socio-environmental risk factors is important for the success of such programs. This study was undertaken to identify significant socio-environmental risk factors in the transmission of soil-transmitted helminthiasis in a rural community in Kelantan, Malaysia for the development and implementation of an effective prevention and control program.

MATERIALS AND METHODS

This prevalence study was part of a quasi-experimental study undertaken between October, 1992 to December 1993 to determine the socio-environmental predictors of soil-transmitted helminthiasis amongst children four years and below in Bachok, Kelantan, a rural state in the east coast of Malaysia. The district of Bachok covers an area of 264 km^2 with a total population of 104,320. Out of the 8 rural districts in Kelantan the district of Bachok was randomly selected, of which inturn the subdistricts of Tawang and Perupok in Bachok were selected. Using the formula for experimental studies (Jekel, 1996) and allowing for dropouts, a total of 388 children were randomly selected from a list of children attending government child health clinics in the subdistricts. Data was collected through interviews with heads of households or either parent of the selected children using a standard pretested questionnaire. Household hygiene score was based on environmental conditions such as clean water supply, sanitary latrines, rubbish disposal, fly problem while hygiene practices such as hand washing before meals and wearing of footwear (outside home) of both adults and children as well as indiscriminate defecation of children. The total score was 20. The cut-off point to determine poor and good household hygiene was based on the average score of household hygiene of both subdistricts. Stool specimens were collected from the selected children in 10% formalin-containing bottles and sent immediately to the laboratory for analysis by the formol-ether method. The national poverty line of 81 ringgit/month and below (Economic Planning Unit, 1996) was employed to de-

marcate poverty and non-poverty households. Households with more than 5 individuals were considered as large. The relationship between infection and the various socio-environmental exposure variables were assessed by univariate analysis. Significant predictors of soil-transmitted helminthiasis were classified into binary variables with '0' being low risk and '1' being risk. These significant variables were further analysed using forward stepwise logistic regression with the best fit or parsimonoius model to explain soil-transmitted helminthic infection was deduced. Statistical package for the Social Sciences (SPSS) and Epi-Info6 were utilized in analysis.

RESULTS

Out of 363 children who participated in the study, 178 (49.0%) were females and 185 (51.0%) were males. The majority of the children (82.1%) were 2 years and above and only 17.9% were below one year of age. A high proportion of the children (78.2%) were from low per capita income households with the majority (76.6%) coming from large households. Basic amenities such as sanitary water supply was available in 53.2% of the households while 96.1% of the households had sanitary latrines.

Of the 363 children sampled, 141 (38.8%) were infected with soil-transmitted helminthis, of whom 45.4% were females and the rest were males. Fig 1 shows the distribution of type of worm infection by sex. Mixed infection with *Ascaris lumbricoides*, *Trichuris trichura* and hookworm were the commonest type of infections inflicting 58.7% of the infected female children and 50% of the infected males. The highest single type of infection amongst both males (32.9%) and females (25.4%) was with *Ascaris lumbricoides*. Hookworm infection was the least commonest infection.

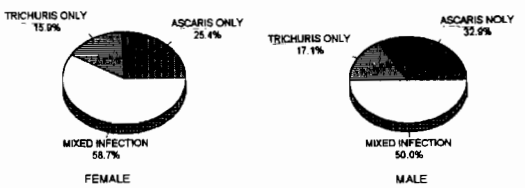

Fig 1–Distribution of types of infection by sex.

Table 1 shows the exposure variables by status of infection. The risk of being infected amongst children 2 years and above was five times higher than those below this age group. Children from poverty households and large household size had a higher risk of being infected with soil-transmitted helminths compared to those from high per capita income groups and small household size groups. It was also found in this study that children who came from households where children defecated indiscrimately had a higher risk of being infected with soil-transmitted helminths compared to those children who came from households whose children defecated in latrines. Low household hygiene score and children not wearing shoes outside homes were two other important risk predictors in the transmission of soil-transmitted helminthiasis.

Table 2 shows the adjusted risk predictors of soil-transmitted helminthiasis. It could be concluded that significant risk predictors in the transmission of soil-transmitted helminthiasis amongst children in Bachok were large household size and poor household hygiene score. The probability of infection for children from large households was 0.35, that with poor household hygiene score was 0.32. The probability of being infected with soil-transmitted helminthiasis for children with both risk predictors was 0.58 compared to only 0.16 for those without such risks.

DISCUSSION

The overall prevalence of 38.8% in Bachok was similar to that found by Kan (1982) amongst children age 0 to 9 years in Malaysia. Many studies have shown large variations in the prevalence of soil-transmitted helminthiasis between different age groups (Hlaing, 1993; Bundy *et al*, 1992). In this study toddlers 2 years and above were at higher risk than those below this age group, since in this age group, children tend to be more inquisitive and adventurous and may play in dirty environments with resultant contamination of their hands and feet with soil. The enthusiasism to play with peer groups outside homes is common amongst both male and female children.

It can be concluded that different socio-environmental risk factors exist in different communities and some are more important than others. In this

Table 1

Exposure variables by status of infection.

Exposure variables	Not infected	Infected	Odds ratio	Confidence interval	p-value
Sex					
Female	114	64	1.27	0.81-1.99	0.3174
Male	108	77			
Age group					
Below 2 yrs	123	28	5.0	2.99-8.45	0.0000*
2 yrs and above	99	113			
Percapita income					
High	59	20	2.19	1.21-4.01	0.0078*
Low	163	121			
Household size					
Normal	66	19	2.72	1.50-4.96	0.0005*
Large	156	122			
Mother's education					
Educated	205	128	1.22	0.54-2.78	0.7404
Uneducated	17	13			
Water Supply					
Sanitary	125	68	1.38	0.88-2.17	0.1628
Unsanitary	97	73			
Latrine					
Sanitary	5	9	0.34	0.10-1.14	0.0868
Unsanitary	217	132			
Rubbish disposal					
Sanitary	5	1	3.23	0.95-1.98	0.4112
Unsanitary	217	140			
Fly problem					
No	16	9	1.13	0.45-2.88	0.9428
Yes	206	132			
Indiscriminate defecation					
No	107	52	1.59	1.01-2.51	0.0444*
Yes	115	89			
Shoes					
Yes	144	66	2.15	1.37-3.40	0.0006*
No	76	75			
Wash hands					
Yes	185	115	1.20	0.66-2.16	0.6297
No	35	26			
Hygiene score					
High	102	37	2.39	1.47-3.90	0.0002*
low	120	104			

* $p < 0.05$

Table 2

Adjusted risk predictors of soil-transmitted helminthiasis.

Risk factors	OR	CI	p-value
Age of child	0.92	0.26-1.34	0.1801
Percapita income	1.51	0.67-3.39	0.1787
Household size	2.88	2.88-5.13	0.0003*
Indiscriminate defecation of child	1.31	0.54-1.73	0.1893
Hygiene score	2.50	1.60-3.92	0.0001*

* $p < 0.05$

study large household size coupled with poor household hygiene score carried a higher risk of infection with soil-transmitted helminthiasis than otherwise. In a study by George and Yang (1982), it was found that poor hygiene and overcrowding were important factors in the transmission of soil-transmitted helminthiasis. Various factors including poor household hygiene have been cited as playing an important role in the transmission of soil-transmitted helminthiasis (WHO, 1981). In this study a multitude of hygiene practices influenced the score of household hygiene, with indiscrimi-nate defecation by children as being the most important one. Indiscriminate defecation by children is common in many rural areas in Malaysia (Kiyu and Hardin, 1993) and results in the constant contamination of the soil with eggs of soil-transmitted helminthiasis (Institute of Medical Research, 1994). In areas where soil condition is favorable, the eggs of soil-transmitted helminths may remain viable for a long time and may be transmitted to a suitable host. Therefore, prevention and control strategies in the transmission of soil-transmitted helminthiasis in this community should take into consideration the two significant risk predictors with special emphasis on prevention of indiscriminate defection and wearing of footwear by small children. The long term approach towards the prevention and control of soil-transmitted helmin-thiasis in this community should be directed towards a comprehensive community oriented health education program.

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