

ENTEROBIUS VERMICULARIS INFECTION AMONG CHILDREN AGED 1-8 YEARS IN A RURAL AREA IN MALAYSIA

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Abstract. The infection rate and relationship of enterobiasis with socio-economic status were determined in children aged 1-8 years, living in a rural area in Malaysia. Of the 178 subjects 40.4% were infected with *Enterobius vermicularis*. The distribution of enterobiasis among these children were analysed in relation to age groups and sex. The rate of infection was significantly higher in older children (5-7 years). The association of enterobiasis with other factors studied such as number of persons per house, household income per month and mother's employment status were not significant. The sensitivity of three successive days anal swabs compared to a single swab was found to be statistically significant.

INTRODUCTION

Enterobiasis is one of the most common helminthic infections in humans. It is common in both developed and developing countries (Chan, 1985; Haswell-Elkins *et al*, 1987; Robert *et al*, 1991; Wagner and Eby, 1983; Libbus, 1984) and is prevalent in all groups in the community, especially children. Its ecological success is probably due to its close association with humans and their environment, and also due to its diverse modes of transmission.

Several studies have been done on the prevalence and epidemiology of this infection in children in Malaysia (Kan *et al*, 1971; Kan-Chua and Sinniah, 1979; Oothuman *et al*, 1989; Noor Hayati and Rajeswari, 1991; Rahman 1991) showing that the overall prevalence rate of this infection in children in Malaysia varied from 21.0% to 57.8%, depending on the type of community studied and also the number of anal swab tests carried out.

However there is no study done on children between 1-8 years old living in the rural area. The objectives of this study were to detect the frequency of egg detection when three consecutive anal swab tests were carried out to determine the rate of infection and to relate it to the epidemiology and socio-economic status of a rural community.

MATERIALS AND METHODS

One hundred and seventy-eight young children who attended a Health and Worm Infestation Exhibi-

tion participated in this study. Most of the children were Malays. Children were selected based on the following criteria: aged 1-8 years; no history of taking anthelmintics two months prior to the anal swab sampling; and able to submit three consecutive anal swabs.

This study was carried out in several rural villages in Labu and Dengkil, located about 70 km from Kuala Lumpur. Most of the residents were laborers, drivers and farmers, whilst a few worked in private and government agencies as office workers and some as teachers. The type of house ranged from wooden to permanent structures consisting of bricks and cement. Most of the villages were supplied with piped water, proper sewage systems and electricity. The interior and the immediate vicinity of the houses were adequately clean. Rubbish was either burnt or buried.

Informed consent to join the study was obtained from the parents or guardians. Each parent was shown how to perform the anal swab on their children using the modified adhesive cellulose tape/slide technique using Brooke's method (1949). They were requested to do three successive early morning anal swabs on their children before bathing or defecating. All three slides were examined under ordinary light microscope. The subjects were recorded as infected if either eggs or adult *Enterobius vermicularis* were detected in any of the slides.

RESULTS

Of 178 children who participated in this study 161 (90.4%) supplied three successive anal swabs; and 17

Table 1

Detection of *E. vermicularis* eggs according to one day, two and three consecutive days anal swab examination.

No. of children examined	First day No. positive	Second day No. positive	Third day No. positive
178	57 (32.0%)	65 (36.0%)	72 (40.4%)

(9.6%) children returned either one or two swabs. They were included in calculating the infecting rate if at least one of their swabs was positive. The overall infection rate of *E. vermicularis* was 40.4%. When only one swab from a subject was examined (first day) only 57 (infection rate 32.0%) children were found to be infected with *E. vermicularis*. However when two consecutive day swabs were examined 8 more cases were detected (infection rate 36.0%) and 7 more new cases were detected on the third day of swabbing (infection rate 40.4%), increasing the sensitivity of the test. The association between the number of swabs examined and the ability of this method in detecting positive cases was highly significant ($\chi^2 = 10.46$; $df = 1$; $p < 0.01$).

The distribution of *E. vermicularis* according to age and sex is shown in Table 2. The rate of infection increased with age. It was higher among the older

children aged between 60-96 months and less prevalent in the younger children aged 12-59 months. The difference was statistically significant ($\chi^2 = 6.81$; $df = 1$; $p < 0.05$). The rate of infection was slightly higher in girls (40.5%) compared to boys (36.4%). However the difference was not statistically significant ($\chi^2 = 0.31$; $df = 1$; $p > 0.05$).

Distribution of *E. vermicularis* infection in relation to the number of persons per house, household income per month and mother's employment status is shown in Tables 3 and 4. The rate of infection increased with increasing numbers of persons living in the house, but this was not statistically significant ($\chi^2 = 3.85$; $df = 2$; $p > 0.05$). The rate of infection was higher in higher income groups but not significant ($\chi^2 = 1.30$; $df = 2$; $p > 0.05$). The rate of infection in children of non-working and working mothers was similar and was not significant ($\chi^2 = 0.01$; $df = 1$; $p > 0.05$).

Table 2

Infection rate of *E. vermicularis* in children according to age and sex in the villages of Labu and Dengkil, Selangor, Malaysia - 1992.

	No. examined	No. infected (%)
Age (months)		
12-23	19	4 (21.1)
24-35	28	9 (32.1)
36-47	23	8 (34.7)
48-59	22	6 (27.3)
60-71	43	19 (44.2)
72-83	24	12 (50.0)
83-96	13	8 (61.5)
Boys	88	32 (36.4)
Girls	84	34 (40.5)
Total	172	66

Table 3

Infection rate of *E. vermicularis* according of persons per house in the villages of Labu and Dengkil, Selangor, Malaysia - 1992.

	No. examined	No. infected (%)
Number of persons per house		
1-5	57	16 (28.1)
6-9	81	35 (43.2)
> 10	34	15 (44.1)
Total	172	66

Table 4

Infection rate of *E. vermicularis* according to household income per month (Malaysian Ringgit) and employment status of the mother in the villages of Labu and Dengkil, Selangor, Malaysia - 1992.

	No. examined	No. infected (%)
Household income		
Low	132	48 (36.8)
Intermediate	24	10 (41.7)
High	16	8 (50.0)
Total	172	66
Mother's occupation		
Housewife	133	54 (40.6)
Working	45	18 (40.0)
Total	178	72

DISCUSSION

In this study infection rate of *E. vermicularis* among 1-8 years old children staying in the rural area was 40.4%. A study carried out among children aged 1-12 years living in a multi-storey flats in a urban area showed an infection rate of 41.7% (Noor Hayati and Rajeswari, 1991). A recent study done among middle class children aged 1-10 years staying in a residential housing estate showed an infection rate of 57.8 (Rahman, 1991). Our study showed that the infection rate was not very different from the other two studies although they were carried out in three communities of different social backgrounds, using the same method. Studies among children of similar age groups in other parts of the world have also revealed a very high infection rate (Chiu *et al*, 1975; Lian and Zi, 1981; Robert *et al*, 1991). The age distribution of *E. vermicularis* infection in children was similar in many communities studied (Welch, 1978; Lian and Zi, 1981; Chan 1985). The infection rate was lower in young children but increased with age. In this study, it was found that the infection rate was highest at the age of 5-7 years and the difference was statistically significant; this finding agreed with other studies (Chan, 1985; Nadham and Amir, 1990; Noor Hayati and Rajeswari, 1991; Robert *et al*,

1991). The infection rate remained high till the age of 13 years (Chan, 1985; Oothuman *et al*, 1989) but was low among young adult (Oothuman *et al*, 1992). Exposure to infection outside the house is probably the main reason why infection rates remain high in older children. Children of this age more often play outside the house and attend playschool or school. It is probable that once the older children were infected the younger children also became infected. There was no significant difference of enterobiasis rates between the sexes, in agreement with other studies (Kan *et al*, 1971; Kan-Chua and Sinniah, 1979; Chan, 1985; Oothuman *et al*, 1989; Noor Hayati and Rajeswari, 1991). However *E. vermicularis* has been reported to cause significant pathology in females. It has been found in association with urinary tract infection in young girls (Simon, 1974) and also has been reported to cause pathology in ectopic locations such as granulomas of the uterus and ovary (McMahon *et al*, 1984) and tubo-ovarian abscess (Khan *et al*, 1981).

Enterobiasis is easily transmitted among family members through inhalation, contaminated hands and fomites. Previous studies have shown that it is more prevalent in over-crowded areas or families with many members (Haswell-Elkins *et al*, 1987; Noor Hayati and Rajeswari, 1991) although it was not statistically significant as also in this study. Two other social factors that are often believed to be related to the transmission of *E. vermicularis* are socio-economic status and education. Earlier studies by Chan (1985) and Noor Hayati and Rajeswari (1991) showed that there was a significant reduction in infection the higher the household income. However other authors (Hitchcock, 1949; Warren and Mahmoud, 1975) did not find any significant difference in the rate of infection in children from different income groups. Our study showed that the infection rate was not associated with the household income. One possible reason why this finding was not in agreement with those of Chan (1985) and Noor Hayati and Rajeswari (1991) is that the study population of high income households did not reflect the educational status of the parents. The families had good income because both parents were employed; consequently the children were often left to the care of grandparents or baby-sitters. Because of this, we looked for an association between employment status of the mothers and infection rate of *E. vermicularis* in the children, but there was no relationship with the infection rate. A similar finding was reported by Chan (1985). One other possible reason why we did not

find any association was because the numbers of high income group families and working mothers were few compared to those of other groups. However, from our findings and those of previous authors (Hitchcock, 1949; Warren and Mahmoud, 1975; Haswell-Elkins *et al.*, 1987; Chan, 1985; Noor Hayati and Rajeswari, 1991) it can be surmised that the transmission of pinworm is determined by the cleanliness of the house and personal hygiene and not by the size of the family and socio-economic background.

Previous studies have shown a higher positivity rate using more than one swab to detect *E. vermicularis* infection (Hitchcock 1949, Noor Hayati and Norhayati, 1991; Oothuman *et al.*, 1992). This is because the frequency of migration of the adult worm to the perianal region is not consistent. In this study there was a significant increase in detection of infection when three successive anal swabs were performed.

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