Intestinal parasites, eosinophilia, haemoglobin and gamma globulin of Malay, Chinese and Indian schoolchildren

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PARASITES (protozoa and helminths) are commonly seen in people in the tropics. Very little is known regarding the incidence and nature of these parasites in Malaysian school children of different ethnic groups (Malay, Chinese, Indian and Orang Asli – "Original people of Malaya") living in the country. The cultural practices and the different conditions (social, economic) under which the various communities live is thought to influence the incidence of parasitism. The present report gives the incidence of the various parasites in these different groups of children.

Material and Methods

Four parameters were used in the study, namely stool examination, eosinophilia (significant if above 8%), haemoglobin (anaemia if below 70% (10.6G%)) and increase of gamma globulin after determination of serum proteins. A sample of children from five schools, namely rural Chinese (Bukit Tinggi School), rural Indian (Seafield Estate School) and rural Malay (Sekolah Kebangsaan Kg. Kuantan School, Kuala Selangor), a semi-rural Malay (Ulu Klang School) on the outskirts of Kuala Lumpur and an urban (Sultan Alam Shah School), Petaling Jaya were studied. In the latter two schools, the gamma globulin was not determined. The urban school had children of all three racial groups (Malay, Chinese and Indian) and they were studied separately.

The ages of the children in all the schools studied ranged from 7 to 12 years, except in the urban school in Petaling Jaya where it was 10 to 12 years. Stool examination was carried out by the formol-ether concentration technique and a gram of wet faeces (equivalent to a large pea) was used for determination of parasitic constituents. In the Orang Asli children at Gombak Hospital, three direct smears were examined before the specimen was pronounced negative for parasites. The proteins were electrophoresed on cellulose-acetate and the fractions were quantitated in the usual manner. Thick and thin blood smears were stained with Giemsa stain for blood parasites. All the children were weighed and their weights recorded in pounds.

Results (See Tables 1 and 2)

In the rural group, 60 per cent of the Chinese children carried no helminths compared with 12.7 per

TABLE 1

INVESTIGATION INTO STOOL PARASITES EOSINOPHILIA AND HAEMOGLOBIN

CHINESE–BUKIT TINGGI SCHOOL, PAHANG

TOTAL (AGE)	ASCARIS	TRICHURIS	HOOKWORM	ENTEROBIUS/ STRONGYLOIDES/ OPISTHORCHIS/ CLONORCHIS	ONE HELMINTH INFECTION	TWO HELMINTH INFECTION	THREE HELMINTH INFECTION	NO HELMINTH INFECTION	E.HISTOLYTICA	G.LAMBLIA	E.COLI	E.NANA/ I.BUTSCHLII	NUMBER WITHOUT ANY PARASITIC INFECTION	M.P/ M.F.	EOS ABOVE 8%	Hb BELOW 10·6G (70%) (INVARIABLY HELMINTHS-HOOKWORM)	GAMMA-GLOBULIN 1·42±0·19g/100ml.
96 (7–11 YRS.)	14 MAX 200 EGGS/G (14·5%)	21 MAX. 300 EGGS/G ((22%)	21 MAX. 50 EGGS/G (22%)	12 ENTEROBIUS 1 STRONGYLOIDES	20 (21%)	18 (19%)	0	58 (60%)	0	10 (10·5%)	1 (1%)	5 (E. NANA) (5·2%)	46 (47·9%)	0	45 (HIGHEST 27%) (46·8%)	16 LOWEST 7·6G (50%) (17%)	0·83 (AVERAGE 14)

INDIAN–SEAFIELD ESTATE (RUBBER-OIL PALM) TAMIL SCHOOL, SELANGOR

110 (7–11 YRS.)	38 MAX 2500 EGGS/G (34·5%)	65 MAX. 2000 EGGS/G (59%)	59 MAX. 2000 EGGS/G (53·5%)	2 ENTEROBIUS 5 STRONGYLOIDES	42 (38%)	39 (35·4%)	15 (13·6%)	14 (12·7%)	4 (3·5%)	10 (9%)	28 (25·5%)	4 E. NANA 1 I.BUTSCHLII (4·5%)	12 (11%)	0	80 (HIGHEST 36%) (73%)	24 LOWEST 5·4G (35%) (22%)	1·17 (AVERAGE 6)

MALAY–SEKOLAH KEBANGSAAN KG. KUANTAN, KUALA SELANGOR

138 (7–11 YRS.)	118 MAX 1000 EGGS/G (85·5%)	121 MAX. 2000 EGGS/G (87·5%)	20 MAX 200 EGGS/G (14·5%)	0	23 (16·5%)	88 (64%)	20 (14·5%)	7 (5%)	1 (0·7%)	7 (5%)	20 (14·5%)	1 E.NANA (0·7%)	4 (3%)	0	87 (HIGHEST 29%) (63%)	0 LOWEST 11·2G (75%)	

MALAY–ULU KLANG SCHOOL, KUALA LUMPUR

183 (7–12 YRS.)	91 MAX 1000 EGGS/G (50%)	150 MAX. 1000 EGGS/G (82%)	62 MAX. 200 EGGS/G (34%)	1 OPISTHORCHIS/ CLONORCHIS	65 (36%)	63 (34%)	37 (20%)	18 (10%)	5 (3%)	8 (4·5%)	35 (19%)	24 E. NANA 1 I.BUTSCHLII (13·5%)	11 (5·45%)	3 1 PF. 2 PM. (1·05%)	97 (HIGHEST 32%) (53%)	6 LOWEST 9G (60%) -3 CHILDREN 1) P.FALCIPARUM, ASCARIS & TRICHURIS 2) P.MALARIAE, ASCARIS, TRICHURIS HOOKWORM (3%)	1·73 (AVERAGE 10)

SULTAN ALAM SHAH SCHOOL, PETALING JAYA

151 (10–12 YRS.)	MAX. 200 EGGS/G	MAX. 200 EGGS/G	MAX. 50 EGGS/G														
MALAY 46	8 (17·4%)	20 (44%)	1 (2%)	0	20 (44%)	2 CHILDREN	1 CHILD	23 (50%)	0	2 (4·3%)	–	1 E. NANA (2%)	20 (44%)	0	12 (26%) HIGHEST (22%)	NOT DONE	NOT DONE
CHINESE 76	9 (11·8%)	11 (14·5%)	–	0	16 (21%)	1 CHILD	–	59 (78%)	0	–	–	1 E. NANA (1·3%)	56 (73%)	0	12 (16%) HIGHEST (20%)	NOT DONE	
INDIAN 29	6 (20%)	5 (18%)	1 (3·4%)	0	9 (31%)	4 CHILDREN	1 CHILD	15 (52%)	0	1 (3·4%)	3 (10%)	3 E. NANA (10%)	8 (28%)	0	14 (48%) HIGHEST (30%)	NOT DONE	

TABLE 2

GOMBAK HOSPITAL (ORANG ASLI)

AGE	TOTAL EXAMINED	ASCARIS	TRICHURIS	HOOK WORM	E. COLI	E. NANA	GIARDIA	E. HISTOLYTICA	OTHERS (TRICHOMONAS)	ONE HELMINTH INFECTION	TWO HELMINTH INFECTION	THREE HELMINTH INFECTION
1-12 YEARS	100	69 69·0%	80 80·0%	51 51·0%	4 4·0%	-	25 25·0%	1 1·0%	7 7·0%	18 18·0%	44 44·0%	31 31·0%

cent Indian children and 5 per cent Malay children. Ten per cent of the semi-rural Malay children were helminth-free. In the urban school, the figures for "no helminth infection" among the children in the different ethnic groups was Chinese 78 per cent, Indian 52 per cent and Malay 50 per cent.

Considering the rural school children "without any intestinal parasitic infection" (helminth and protozoa) the figures for the Chinese were 47.9 per cent, Indian 11 per cent and Malay 4 per cent. In the semi-rural Malay school, only 5.45 per cent did not show any such infection (helminth and intestinal protozoa). In the urban school, the figures for "no intestinal parasitic infection" among the children in the different ethnic groups was Chinese 73 per cent, Indian 28 per cent and Malay 44 per cent.

Higher levels of **Ascaris lumbricoides** (85.5%) and **Trichuris trichiura** (87.5%) was found in rural Malay school children.

Higher levels of hookworm were found in rural Indian children (53.5%) and also a higher incidence of **Strongyloides** i.e. those larval helminths which, by penetrating the skin, cause infection.

A higher incidence of **Enterobius** (12 cases) was seen in the Chinese school children.

No **Enterobius** or **Strongyloides** were detected in rural Malay children but the semi-rural Malay children showed a significant hookworm load (34%) and **Ascaris** (50% or 1 in 2 children). **Trichuris** infection was relatively the same in the two Malay schools.

No rural Chinese child had all three helminth infections whereas it was found in both the rural Indian and Malay children.

No **Entamoeba histolytica** cysts were seen in the Chinese children whether from rural or urban areas, but it was present in a small percentage of rural Indian and Malay children.

Giardia lamblia was present in all the children in the different ethnic groups and slightly more cases were seen in the rural Chinese children (10.5%), Indian (9%) and Malay (5%). Urban Malay (4.3%) and Indian (3.4%) children carried the infection.

Three cases of malaria (one **P. falciparum** and two **P. malariae**) were seen in semi-rural Malay children. No microfilariae was detected in the day blood of any child in the survey.

All the three groups of children showed blood eosinophilia associated with their parasitic infections. Eosinophilia was highest in rural Indian children (73%), followed by rural Malay children (63%) and rural Chinese children (46.8%).

The lowest haemoglobin level recorded in rural Indian children was 35% (5.4G) and these children as a group showed the highest number of anaemia cases; 24 children (22%) had haemoglobin levels below 70%. The lowest haemoglobin recorded in the rural Chinese children was 50% (7.6G). Sixteen (17%) had Hb levels below 70%. Six semi-rural Malay children were anaemic. The lowest Hb recorded was 60% (9G) and three of these children had a malaria infection together with intestinal helminths. Among the rural Malay children, the lowest haemoglobin level found was 75% (11.2G).

The gamma globulin levels of all groups were within normal limits; however, the highest levels were found in Malay semi-rural children.

Sultan Alam Shah School, Petaling Jaya (Urban school)

The children in this school come from urban families. They showed presence of intestinal helminths but with a reduced incidence and intensity of infection. The Chinese children had a lower percentage of helminths and no hookworm was found in them compared to the other racial groups in whom also the infection was here very low.

No **Enterobius** infection was found, although the stools tested were in a slightly higher age group, 11 to 12 years and of course the Scotch-tape method was not used.

A number of the children had one helminth infection, the highest being in Malay children (44%), Indian (31%) and then Chinese (21%). Only one Indian and one Malay child had all three helminths, **Ascaris, Trichuris,** hookworm.

Seventy-eight per cent of the Chinese children were without any helminth infection and 73% without any intestinal parasitic infection. The figures for Malay children was 50% and 44% and for Indian children 52% and 28% respectively.

No malaria parasites or microfilariae in day blood were found in this group.

In view of this group harbouring parasitic infections, a significant proportion of these children had eosinophilia in the blood (See Table 1).

Gombak Hospital (Orang Asli)

Ninety-three per cent of these children had helminth infections, with a high percentage of the children suffering from **Ascaris** (69%), **Trichuris** (80%) and hookworm (51%).

One in four children suffered from **G. lamblia** infection; **Trichomonas hominis** was also found in seven per cent of all the stools examined. A single case of **E. histolytica** was detected.

Other Helminths

Other helminth infections were rare in the children. No cestodes such as **Hymenolepis nana** was detected. Sandosham (1954) and Lie Kian Joe (1964) also reported on the rarity of cestode infections generally; Sandosham (1954) found **Dipylidium caninum** ova in an aboriginal girl. A single case of **Opisthorchis Clonorchis** infection was found in a child in the semi-rural Malay school at Ulu Klang, near Kuala Lumpur, and investigations revealed that she came from Kuantan, Pahang, nearly 200 miles away.

Weights

The average weights of both boys and girls in the 10-year age group were rural Chinese school 55.3 lbs. (lowest 45 and highest 75 lbs.), rural Indian school 48.9 lbs. (lowest 42 and highest 60 lbs.), rural Malay school 49.3 lbs. (lowest 40 and highest 63 lbs.), semi-rural Malay school 53.5 lbs. (lowest 42 lbs. and highest 76 lbs.), and urban school 62.2 lbs. (lowest 50 and highest 92 lbs.).

Discussion

Parasitic infection is prevalent in children of all racial groups. Lie Kian Joe (1964), who found few reports on the prevalence of intestinal parasites in Malaysians, found **Ascaris, Trichuris** and hookworm to be common in Malaya. Bergner and Tantalo (1963) found intestinal parasites in 92.5% of the people surveyed throughout the Federation of Malaya in 1962. The incidence in the military groups were considerably lower than in the civilian population. **Trichuris trichiura,** the most common helminth, ranged from 81 to 100%, followed by **A. lumbricoides** 15 to 97% and hookworm 34 to 91%. **E. vermicularis** averaged 5.2% and **E. histolytica** 0 to 13%.

Both pathogenic helminths and protozoa were found to be highest in the Orang Asli children (the level of malaria parasitaemia was not determined in this group) when compared to the other racial communities. This is to be expected considering their way of life in the jungle or on the edge of primary forest in close communities. A higher prevalence rate of parasitic infection was found in rural Malay and Indian children compared to rural Chinese children. In the study, the rural Indian, Malay and Orang Asli harboured **E. histolytica** cysts in a low percentage.

Contrary to popular belief, urban children suffer from parasitic infections, but it is in the rural children that the greater worm burden is seen reflecting their closer contact with soil. Greater prevalence of helminths in Malay and Indian children is suggested to be related to, (1) eating habits i.e. "chop-sticks" in the case of Chinese and "fingers" with Malay and Indian communities, and (2) the overall health status and resources (economic) of the Chinese population in being able to provide a better nutritional diet may probably play some part in their overall lower incidence of intestinal helminth infection.

Single stool examination, as opposed to three to six stool examinations spaced at intervals, will not reflect the true incidence of **Strongyloides stercoralis** infection but generally it has been found much less common than hookworm infection in the present study. Schacher and Danaraj (1960), who studied the relationship between tropical eosinophilia and intestinal helminth infection among patients of the General Hospital in Singapore, found a prevalence rate of 4 per cent. Sandosham (1955) recovered the worm in 6 per cent of 1,300 stool cultures of hospital patients in Singapore in 1948.

As stool examination is not an efficient method to detect **E.vermicularis** infection, the number of children in each ethnic group found to harbour the infection does not reflect the actual prevalence rate of the infection in Malaya. Sandosham (1955) found

a 40 per cent positive rate of infection in Singapore.

It is significant that while Kuala Lumpur may claim to be free of malaria, some transmission of the disease does take place on the outskirts of the city.

In view of the high incidence of parasitism, this, by itself, is not the only factor in the causation of anaemia except in the three Malay children with chronic malaria. Dietary intake is very important, especially in the rural Indian children. Hookworm infection is important, especially with heavy loads on a background of poor diet. Rural children, with haemoglobin below 70 per cent (10.6G), generally had a higher worm burden and invariably also carried hookworm infection. Peripheral blood films appeared to show only microcytic hypochromic anaemia in most of those examined. Lie-Injo Luan Eng and Virik (1966) investigated anaemias in children of the different ethnic groups in Malaya and found the causes multiple and complex; iron deficiency anaemia with low serum iron levels was by far the commonest and of the 108 children, 71 were Indians, 19 Chinese and 18 Malays. This would confirm our findings that Indian children formed by far the most anaemic group.

Weights generally correlate well with other parameters in the different racial groups. Considering the 10-year olds, it was found that the children in the rural Indian school were at the bottom of the weight scale and the urban school at the top. Both the rural Indian, rural and semi-rural Malay children were well below the average weights of the rural Chinese children whose intestinal worm loads were also the least. The rural Indian children, who formed the largest anaemic group with high intestinal worm loads, showed a poorer nutritional state compared with the other children except the rural Malay children who also had high intestinal worm loads.

Conclusion

It is concluded that intestinal helminths (**Ascaris, Trichuris,** hookworm) are common in Malaysian children, particularly in rural areas and this, inspite of improvements in general sanitary conditions and increase in the number of health clinics in rural areas in recent years.

As children form the most vulnerable group, the problem of soil-transmitted parasitic infections needs further investigation along the following suggested lines:

(1)The nature of disease, if any, caused by ascariasis, trichuriasis and hookworm infection in children. (Poor diet coupled with a worm burden often carried by particularly rural children in the tropics is in some part responsible possibly for a poorer school achievement when compared to the urban child).

(2)attitudes of the different racial groups to worm infections generally.

(3)control of environment factors leading to infection.

(4)treatment (mass chemotherapy) of ascariasis in kampongs and rubber estates and its relation to reinfection, including the pattern of worm replacements. Attempts should also be made to treat **Trichuris** and hookworm.

Summary

The results of a survey of stool parasites, eosinophilia and haemoglobin of primary rural school children according to ethnic group (Malay, Chinese, Indian) is presented and compared with semi-rural Malay children and urban Malay, Chinese and Indian school children.

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