

SOME PARASITOLOGICAL ASPECTS OF HUMAN MALARIA IN SRI LANKA

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Introduction

Malaria is caused by a germ called the malaria parasite (protozoa). A parasite is a creature that lives at the expense of another living creature, its host. Human parasites include viruses, bacteria, fungi, protozoa and worms (Wingate, 1985 p 330). The malaria causing parasites are protozoans and four of these malaria parasites of man have been generally recognized.

Plasmodium malariae (Laveran, 1881)

Plasmodium vivax (Grassi and Feletti, 1890)

Plasmodium falciparum (Welch, 1897)

Plasmodium ovale (Stephens, 1922)

The life of the malaria parasite can be divided into two phases; asexual and sexual. The life cycle is shown diagrammatically in figure 1. The asexual phase starts with the injection of the sporozoites into a host by a mosquito. As soon as the sporozoites are transmitted, they make their way in the blood to the liver where they remain for six to twelve days developing schizonts. At the end of this period, these schizonts divide into a large number of merozoites. The nucleus of merozoites invade the red cells and grow first to trophozoites and then into erythrocytic schizonts. After a certain time, some of the parasites in the blood develop into sexual forms called gametocytes (Bruce Chwatt, 1980; Bailey, 1982). The male gametocytes fertilize with the female gametocytes in the mosquito's stomach which result in a zygote (Dutta and Dutt, 1978). The zygote becomes encysted into a small cyst called an oocyst. The oocyst divides a number of times to produce sporozoites. The sporozoites then invade the salivary glands (Imms, 1964).

The malaria parasites need some ecological base in order to continue the life cycle. They are unable to survive inside the mosquito in extreme temperatures, for example below 10°C and above 32°C.

The types of malaria parasites in Sri Lanka

Plasmodium vivax and *Plasmodium falciparum* have been identified as malaria parasites which cause malaria in Sri Lanka (Tams, 1980; Kodisinghe, 1987). Table 1 shows the differentiation of *P.vivax* and *P.falciparum* in Sri Lanka. This table shows a sharp increase in the prevalence of both vivax and falciparum malaria since 1982 except a slight fall in falciparum malaria in 1984 and vivax malaria in 1985. The annual administrative report of the Anti-Malaria Campaign in Sri Lanka in 1985 referred to the fact that the environmental changes such as those known to occur in major irrigation and development projects may possibly favour the transmission potential and vectorial capacity of the mosquitoes. It was also revealed in the annual reports in 1984 and 1985 that the majority of the cases were found in gemming areas and the shifting cultivation areas. An increase in blood filming activities during this period also resulted in reporting more cases throughout the island. Two fold increase in falciparum malaria in 1986 was due to a sudden outbreak which occurred in several areas in Sri Lanka (Administrative Report, 1986).

Although *Plasmodium malariae* was reported in the 1960's, it disappeared with the resurgence of *P.vivax* in 1967. Since 1970 no *Plasmodium malariae* cases have been reported in Sri Lanka. The historical and contemporary data indicate that *Plasmodium vivax* was the predominant malaria parasite in Sri Lanka. This species of malaria parasite of man occurs in large areas of the tropics and is less common in tropical Africa (Bruce Chwatt, 1980). The time taken for this species to develop in a mosquito is 10 days at 25°C and 18 days at 20°C. The incubation period which is the time from infected bite to appearance of symptoms of disease in man is usually between 12 and 17 days, but sometimes it may be

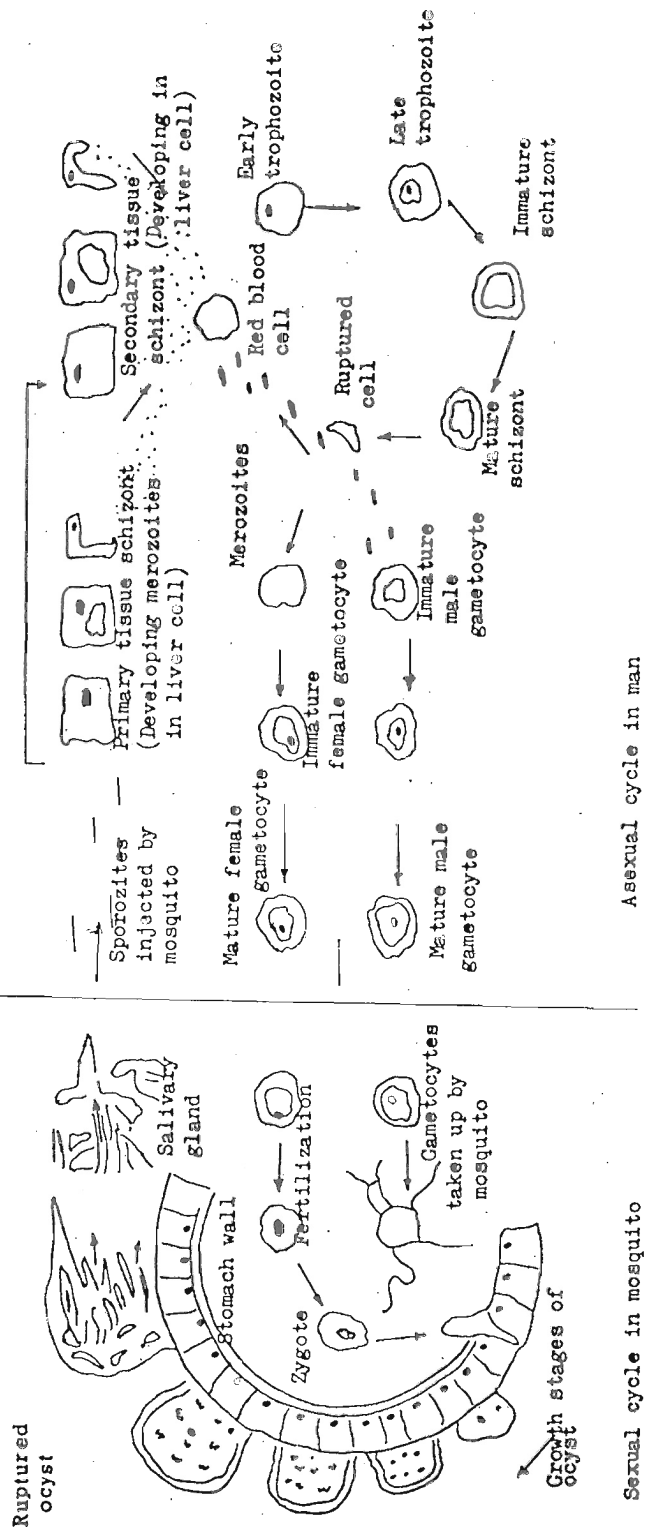


Fig. 1 The Life Cycle of the Malaria Parasite in the Mosquito and in the Human Host. (Balley, 1982)

Table 1
Differentiation of human malaria in Sri Lanka (1980-1986)

Year	Total	P.V.	P.F.	Mixed	% P.V.	% P.F.	% Mixed
1980	47954	46477	1425	52	96.9	2.9	.1
1981	47383	46143	12112	29	97.3	2.5	.06
1982	38566	36967	1541	58	95.9	3	.1
1983	127264	122764	4341	159	96.5	3.4	.1
1984	149470	145711	3593	165	97.5	2.4	.1
1985	117816	104759	12535	522	88.9	10.6	.5
1986	412521	328443	82689	1389	79.6	20.1	.3

Source: Administrative Reports, AMC

prolonged to 8-9 months (Bruce Chwatt, 1980). The time taken for the parasite to develop in human blood cells is about 48 hours. The malaria attack begins with headache, pain in the back and nausea. The primary fever is more severe in non immune than in partially immune persons (W.H.O., 1986). The fever is irregular for 2-4 days and the swings of fever occur between the mornings and the evenings. The cold, hot and sweaty stages become apparent in the afternoon or evening and the temperature may rise up to 40°C or higher. Dizziness and drowsiness may occur and the spleen is palpable during the second week of the attack. The headache, nausea and vomiting are usually less severe in vivax than in falciparum malaria. Relapses may occur in about 60% of untreated cases after a period of recovery (Bruce Chwatt, 1980). The duration of the untreated infection with *P.vivax* is about 2-3 years (Colbourne, 1966; Bruce Chwatt, 1980).

Plasmodium falciparum causes malignant fever, the most dangerous kind of malaria. *Plasmodium falciparum* is the major infection in areas of endemic malaria in Africa, in north west India and Sri Lanka (Bruce Chwatt, 1980). Falciparum parasite takes about 13 days at 25°C and 30 days at 20°C to develop in mosquito and the time from infected bite to the appearance of symptoms of disease in man is usually about 14 days, but it may be as short as 7 or as long as 27 days (Colbourne, 1966). The falciparum malaria attack starts with headaches, pains in the back, chill, nausea and perhaps vomiting. The attacks are frequent and irregular at intervals from a few hours to two days (Win-

gate, 1985). As the disease develops, symptoms increase and the hyperpyrexia with temperature well above 40°C is common together with convulsions. Sweating may occur even when the fever is low and the nausea, vomiting and diarrhoea may increase in severity. The spleen and the liver may become enlarged and slight jaundice may also be present (Bruce-chwatt, 1980). In falciparum infection, the fever may continue to be irregular throughout its course and the hot and cold stages.

The W.H.O (1986) divides the falciparum attack into three distinct stages; the cold stage, the hot stage and the sweating stage. In the cold stage, the temperature rises rapidly to 39°-41°C (102°-106°F) and the headache is often severe. The patient may feel hot and the headache is intense at the hot stage which lasts about 6 hours. The sweating follows the hot stage and continues for an hour or so. After the primary attack of falciparum malaria, there follows an afebrile interval of 48-72 hours. In falciparum infection, the headache, nausea and vomiting are more severe than in *P.vivax* and there is a greater tendency towards the development of delirium, haemolytic jaundice and anaemia (W.H.O., 1986). The falciparum malaria can cause a kind of dysentery and cerebral malaria (Wingate, 1985). The cerebral malaria particularly occurs when non immune persons have remained untreated for 7 to 10 days after development of the primary fever. At this time, the patient's condition deteriorates rapidly with increasing headache and drowsiness with light coma. The mortality of falciparum malaria is much greater than in other forms of malaria and those who survive with continuing falciparum infec-

tion with inadequate treatment or no treatment may suffer a few months with febrile episodes, malarial anaemia and body weakness (W.H.O., 1986). The falciparum infection may persist in man for about 2 years if not treated (Colbourne, 1966).

There are many drugs for treating vivax and falciparum malaria, all highly effective. The oldest, quinine is seldom used because of its toxic effects (Wingate, 1985). The newer synthetic drugs like chloroquine, amodiaquine and primaquine are recommended for vivax and falciparum malaria in different doses at different stages. There are two stages of treatment for both strains of malaria. The presumptive treatment is usually made when the diagnosis is not confirmed and the radical treatment is made after the diagnosis is confirmed in a blood test (W.H.O., 1986).

Summary

Malaria is caused by a parasite. The malaria causing parasites are protozoa and four of these malaria parasites of man have been recognized; *Plasmodium malariae*, *Plasmodium falciparum*, *Plasmodium vivax* and *Plasmodium ovale*. *Plasmodium vivax* and *Plasmodium falciparum* have been identified as malaria parasites which cause malaria in Sri Lanka of which *P.vivax* is the predominant parasite. However, *Plasmodium falciparum* is the most dangerous kind of malaria which is often fatal if the treatments are not taken.

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