

# MALARIA IN A RURAL AREA OF EASTERN THAILAND : BASELINE EPIDEMIOLOGICAL STUDIES AT BO THONG

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**Abstract.** Malaria is still a serious health problem in Thailand. Present attempts at controlling the disease by drug treatment and other means remain unsatisfactory. Thus, development of vaccination against malaria is a major research goal of malaria immunology. The objective of this study was to acquire epidemiological base line data for subsequent vaccine trials.

A cross-sectional descriptive survey was conducted among 253 local inhabitants during the beginning of the transmission season in July 1989 at Bo Thong District, Chonburi Province, Eastern Thailand where malaria transmission was likely to be moderately high. Following the cross-sectional survey weekly morbidity surveillance was started to detect new cases of malaria by using active and passive case detection at the district hospital, local health centers and at neighboring malaria clinics.

Fifty-four percent of the population were male and forty-six percent female : nearly a half (48.3%) were under the age of 15 and 17% under the age of 5 years. Eighty percent of the adults were married. Seventy percent of the subjects interviewed gave a history of malarial illness in the past. Malaria, malnutrition, anemia abnormal hemoglobin diseases and parasitic infestations were the main health problems in the study area.

The annual parasite incidence of malaria was 169.4/1,000 population and 77% of parasitemic individuals were asymptomatic, indicating the existence of a semi-immune condition among these subjects. Antibody level to crude parasite antigen increased with age. It is hoped that the information obtained from these field studies may be useful in malaria vaccine trials in the near future.

## INTRODUCTION

Malaria has been a major health problem of Thailand for more than the past century (Malaria Division, 1990). Extensive anti-malaria activities with WHO and UNICEF assistance were started in 1950 and the initial results were quite impressive. There appears to be a real possibility of eradication. Three major problems that have led to resurgence of the disease include the rapid dissemination of *Plasmodium falciparum* (*Pf*) strains highly resistant to both 4-aminoquinolines and sulfadoxine-pyrimethamine drugs, the exophilic behavior of malaria vectors, and occupational migration of the people (Pinichpongse, 1986). Present attempts

at controlling the disease by drug treatment and other means remain unsatisfactory. Malaria vaccines may offer an alternative weapon for control of the disease (Anonymous, 1981). The objective of this study was to acquire epidemiological baseline data important for the selection of vaccine candidate antigens and the performance of vaccine trials.

## MATERIALS AND METHODS

### Study area

Bo Thong District, located in Chonburi Province 87 km southeast of Bangkok, has been selected since malaria transmission is known to be low to moderate and there is a large number of migrant workers who temporarily migrate from the north-east region to work in sugar cane and cassava plantations. Many of these workers fall ill with malaria due to lack of acquired immunity. The

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climatological conditions are characterized as rainy (May-October), cool dry (November-February) and hot-dry (March-April) (Malaria Sector, 1989). The malaria transmission is classified as stable, although seasonal fluctuations may exist.

### Study population

253 local inhabitants living in a village of Bo Thong District were followed. Most of them have a long history of continuous or frequent intermittent exposure to the parasites.

### Study design

The cross-sectional descriptive survey was conducted during the beginning of the transmission season in July 1989 to gather base line information including important epidemiological factors (hosts, parasites, vectors and their environment) related to malaria transmission, population at risk and background immune status. A health interview survey was made among 131 studied subjects aged more than 15 years.

Following the cross-sectional survey, malaria surveillance by active case detection, *ie* weekly morbidity surveillance was carried out by field staff, and passive case detection by health service personnel at provincial and district hospitals and at local health centers.

### Baseline assessment

Epidemiological base line data were recorded. Subjects were examined for splenomegaly, other abnormalities (*eg* nutritional status) and blood samples were obtained for microscopy, immunological and biochemical investigation.

### Malaria surveillance

**1. Parasitological examinations:** A thick blood smear was performed for all subjects every month. Two hundred fields using 100 × objectives were carefully examined by well-trained microscopists and if no evidence of malarial parasites was found the smear was declared negative. All the slides were reviewed independently by one of the investigators who was blind to individual subjects. All malaria cases detected by this survey were contacted and given radical treatment in accordance with Malaria Division policies (mefloquine and primaquine for Pf; chloroquine and primaquine for Pv) (Malaria Division, 1990).

**2. Serological examination:** Serological cross-sectional survey was done in July 1989. Every month plasma was obtained from finger-prick blood samples collected in preheparinized 75 µl capillary tubes. Blood was centrifuged, separated and plasma stored at -20°C until analysis. Antibodies against crude *P. falciparum* antigens were determined by indirect immunofluorescence on air dried monolayers of *P. falciparum* infected red blood cells from continuous cultures (Trager and Jensen, 1976) of Pf clone T9/94 with most parasites in the schizont stage. Sera were tested at dilutions 1:1,000, 1:5,000 and 1:25,000.

## RESULTS

### Base-line observations

The age and sex distribution of the 253 subjects studied are shown in Fig 1. Fifty-four percent of the population were male and 46% females; 48.3% were under the age of 15 years and 17% under the age of 5 years. Eighty percent of adults were married. Most subjects (70.6%) had finished grade four level and 19% had no formal education, 53.0 percent were farmers and 23% gave a history of working at some time outside the area.

Approximately 70% of the subjects interviewed gave a history of a malaria illness in the past and many had a history of more than one episode (Fig 2). Ninety-five percent gave a history of sleeping under a mosquito net every night while only 2% never slept under a net. The major reason given

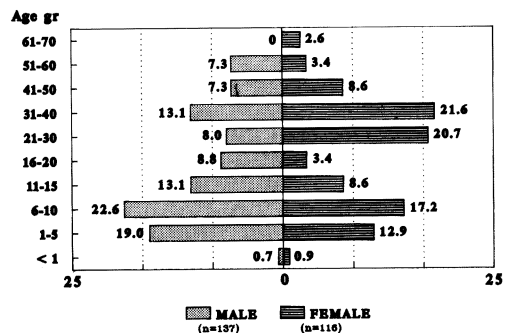


Fig 1—Age and sex distribution of the 253 studied subjects.

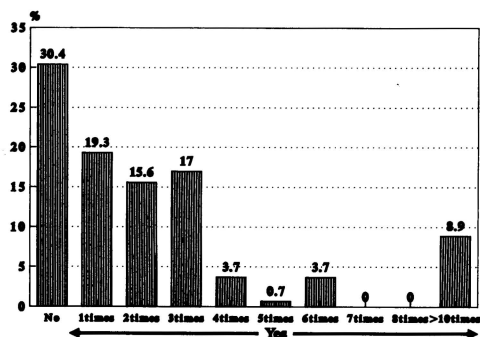


Fig 2—Past history of malaria among interviewed subjects.

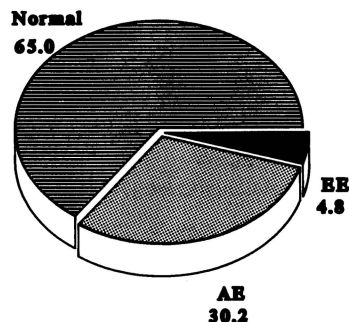


Fig 4—Hemoglobin genotype determination.

for not sleeping under a net was that this made it hot and uncomfortable. Only 20% of the population used any other form of personal protection.

On examination only 2% of subjects were found to have splenomegaly. Fifty percent and 53% of preschool and school children, respectively, were undernourished using weight for their age as the direct nutritional assessment.

Laboratory examination showed that 60% of subjects were anemic (Hb < 12 gm%). The distribution of hemoglobin by age is shown in Fig 3. Approximately 35% of subjects had an abnormal hemoglobin (Fig 4). The prevalence of hookworm, strongyloides and giardia was 43%, 9.5% and 9.1%, respectively.

**Incidence of malaria during one-year period of observation**

Among 242 inhabitants, 41 had malaria infection. Thus, the annual parasite incidence (API) equaled

169.4/1,000 population (Table 1). If we counted all malarial episodes, 57 episodes were found. Crude parasite rates by month of observation are shown in Fig 5. We can see some trends of fluctuation.

In term of species specific parasitemia, 33 episodes (57.9%) of falciparum parasitemia and 24 episodes (42.1%) of vivax parasitemia were seen. Seventy-seven percent of malarial infections were asymptomatic (Table 1).

Table 2 shows the incidence of active and passive cases increased with age except at ages above 40 years.

**Antibodies to crude parasite antigen**

Antibody level to the crude parasite antigen increased with age (Fig 6). Males trended to have antibodies more frequently than females in all age groups.

**DISCUSSION**

Most of the subjects studied were children and young adults of low socio-economic status. Malaria is a most important health problem for such a population. Only a few of them had a history of self protection from malaria. Malnutrition, anemia, abnormal hemoglobin diseases and parasitic infestations were also health problems in this area.

During one year of observation, we found that the incidence of malaria was quite high when compared with other areas (Malaria Division, 1990) in the same period of time but the morbidity

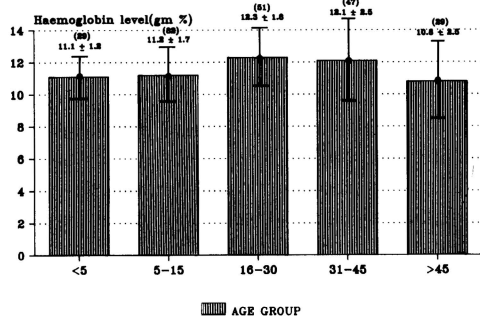


Fig 3—The distribution of hemoglobin by age.

Table 1  
Incidence of malaria during 1-year of observation.

No. subjects starting study	253
Subjects completing study (during 1-year of observation)	242
Subjects with malaria	41
Annual Parasite Incidence (API)	169.4
Total person-week (242 × 52)	12,584
Total malaria episodes	57
Episodes per 1,000/week	4.53
Species : Pf	33 (57.9%)
Pv	24 (42.1%)
Symptomatic cases	13 (22.8%)
Asymptomatic cases	44 (77.2%)

Table 2  
The incidence of cases - active and passive detection by age.

Age group (years)	Active case detection		Passive case detection		Total	
	No	Incidence (%)	No	Incidence (%)	No	Incidence
< 5	4	9.7	1	2.4	5	12.2
5-15	5	6.6	5	6.6	10	13.2
16-40	15	16.5	4	4.4	19	20.9
> 40	7	20.6	0	0.0	7	20.6
Total	31	12.8	10	4.1	41	16.9

rate in this area and throughout the country have been greatly reduced in comparison with previous years. The steady decrease in morbidity and mortality rate may be due to the increase in number of malaria clinics and expansion of primary health care by means of malaria volunteers, resulting in early diagnosis and prompt treatment in areas of high transmission (Ketrangsee and Thimasarn, 1989).

The malaria transmission is quite stable, although seasonal fluctuations can be observed in this area.

The parasite species found were not different from those found in the whole country.

Three-fourths of the malarial infections were asymptomatic indicating that most of the studied subjects were semi-immunes. These people have a long history of continuous or frequent intermittent exposure to the relevant parasite. The influence of acquired immunity on the course of malaria infection is indicated by the rising clinical threshold, producing little clinical disturbance (Playfair, 1982; WHO Scientific Group, 1968). The fact that

## RURAL MALARIA IN THAILAND

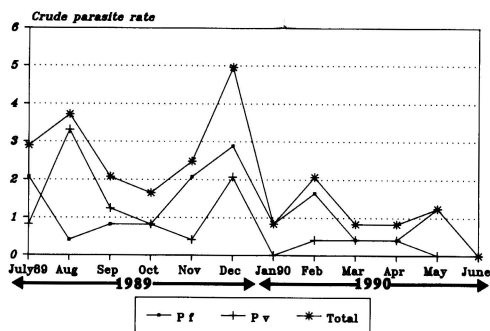


Fig 5—Crude parasite rate by month.

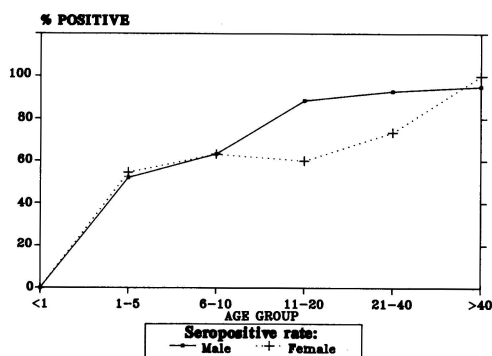


Fig 6—Antibodies against crude Pf-antigen.

antibodies to crude *P. falciparum* antigens increased with age illustrated the continuous exposure during adult life in our study population. However, antibodies against crude *P. falciparum* antigens are regarded as an indicator of exposure and not of protective immunity (Molineaux and Gramiccia, 1980), since we can see that the incidence of malaria increased with age in this study.

The information obtained from these field studies should be useful in helping to optimize the development of vaccines to the asexual blood stages of *P. falciparum* and will provide epidemiological base line data for subsequent vaccine trials.

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