

FINAL REPORT

SEATO Medic Study No. 104 Epidemiology of Malaria

Project No. 3A 025601 A 811 Military Medical Research Program
S. E. Asia

Task 01: Military Medical Research Program
S. E. Asia

Subtask 01: Military Medical Research Program
SEASIA (Thailand)

Reporting Installation: US Army-SEATO Medical Research Laboratory
APO San Francisco 96346

Division of Special Projects

Department of Malaria Project

Period Covered by Report: 1 April 1964 to 31 March 1965

Principal Investigator: Udaya Sandhinand, MD

Reports Control Symbol: MEDDH-288

Security Classification: UNCLASSIFIED

Objective: To elucidate the epidemiology of malaria in selected high endemic areas in Thailand. To determine the parasite species present. To follow the course of malaria infections through several seasons in a population at high risk, and to detect drug resistant malaria in the population.

Description: The human population in a highly malarious area in Southeastern Thailand was examined at frequent intervals through the year, by means of peripheral blood smears, and palpation of the spleen. All of the houses in the study area were visited and an attempt was made to interview and bleed all of the inhabitants. The parasitaemia rates, fever rates, spleen rates and other malarimetric data were tabulated. Other study area were visited when ever time permitted to observe the pattern of malaria transmission.

Progress: This report deals with the study area in the Southeastern Thailand. The field study was initiated in villages of Khao Mai Kaeo area of Bang Lamung District, Cholburi Province from May 1963 to March 1965.

Malarimetric Study: a. Spleen index: Three series of spleen examinations

Table I

SPLEEN EXAMINATION OF CHILDREN 2-9 YEARS. KHAO MAI KAEO,
BANG LAMUNG DISTRICT, CHOLBURI PROVINCE, THAILAND, DURING
MAY 1963 TO MARCH 1965

Period	Number examined	Total positive spleen	Spleen rate	Spleen size					
				0	1	2	3	4	5
May 1963	104	93	89.4	11	18	34	37	4	0
March 1964	127	109	85.9	18	27	48	31	3	0
December 1964	197	111	87.2	83	52	45	12	2	0

were made, during May 1963, March 1964 and December 1964. Children attending the primary school were examined there, the pre-school children were included during house-visits. The results of the spleen examination among the age group 2-9 years are shown in the Table 1. The spleen rate is observed to decline in general, but it should be pointed out that the individual spleen enlargement reduced very slowly, especially among the children with spleen size of 3 by Hackett's method.

b. Parasite index: Blood films for malaria parasite examination were obtained from the school children at the time of spleen examination. Smears from other age groups were collected from members present in the households during the time of visits. Thick and thin films on the same slide were made. Giemsa stain was first used in a dilution of 1:20 with a buffer solution of pH 7.2 stained for 60 minutes. This Giemsa staining was replaced during the 1964 operation by Aqueous Romanowsky Stain which was very easy to prepare and took only one minute in staining.

In order to study the prevalence and trends of malaria at different times of the year, blood collections were carried out at four different intervals. Table II shows the results of the examination.

The result of the blood examination (Table II) showed that the malaria rate was declining in 1964. Plasmodium falciparum out-numbered Plasmodium vivax, but the percentage of the P. falciparum was lesser in 1964 than in 1963. P. malariae

Table II

BLOOD FILM EXAMINATIONS, KHAO MAI KAEO, CHOLBURI PROVINCE
THAILAND, DURING MAY 1963 TO MARCH 1965

Months	No. Exam.	No. positive	Parasite rate	P. falcip.		P. vivax	
				Asex.	Sex.	Asex.	Sex.
May to June							
1963	757	191	30.0%	184	37	7	4
1964	586	101	17.2%	86	20	15	7
July to Sept							
1963	656	135	20.5%	131	23	4	1
1964	699	201	28.8%	192	27	9	3
Oct to Dec							
1963	810	284	35.0%	245	30	35	5
1964	1179	112	9.5%	92	3	9	1
Jan to Mar							
1964	1239	398	32.1%	340	26	48	12
1965	1521	295	19.3%	236	19	59	17

was not observed during the period of 1964.

3. Age-Group Distribution of Positive Blood Films: The examinees were classified into 3 different age groups, infants under 12 months old, children between 2 to 9 years of age, and those from 10 years up. Although the malaria rate was observed to decline, malaria parasites were found in the infants, even during the dry months between January to March. This result indicates that transmission still existed, and was very likely intra-domicillary. Table III, IV, and V showed the distribution of the parasite rate in the three age groups.

4. Infection Within Households: New houses were occupied during the study period. There were 383 houses during the period January to March 1965, compared with 345 houses during the same period in 1964. The population was also very migratory, especially among the labor group. Most of them came from the Northeastern region of Thailand, some moved into the area direct, many had worked somewhere else before seeking employment in Khao Mai Kaeo. Among those who lived in the area through the period of 1963 and 1964 there were 226 households with 752 persons. The record showed that 137 households, or 60.6% had at least a malaria patient with positive smear at least once during the examination period.

Although the rate of infection within households was high, not every individual was infected, although all were exposed roughly to the same risk of infection

Table III

DISTRIBUTION OF PARASITE RATE IN INFANT AGE GROUP - MAY
1963 TO MARCH 1965

Period	No. Exam.	No. positive	Parasite rate	P. falcip.		P. vivax	
				Asex.	Sex.	Asex.	Sex.
May - June							
1963	48	11	23.0%	10	3	1	1
1964	48	5	10.4%	3	3	2	1
July - Sept							
1963	29	2	6.8%	2	0	0	0
1964	35	11	31.4%	9	1	2	0
Oct - Dec							
1963	52	5	9.6%	4	0	1	0
1964	84	7	8.3%	7	0	0	0
Jan - March							
1964	116	23	19.8%	17	2	6	2
1965	121	8	6.6%	6	1	2	1

Table IV

DISTRIBUTION OF PARASITE RATE IN CHILDREN BETWEEN 2-9 YEARS
OF AGE - MAY 1963 TO MARCH 1965

Period	No. exam.	No. positive	Parasite rate	P. falcip.		P. vivax	
				Asex.	Sex.	Asex.	Sex.
May - June							
1963	195	47	24.0%	44	9	3	1
1964	178	30	16.8%	26	6	4	2
July - Sept							
1963	144	33	23.0%	30	8	3	0
1964	165	48	29.1%	47	5	1	1
Oct - Dec							
1963	212	75	35.0%	61	6	14	1
1964	275	25	9.0%	16	1	9	4
Jan - March							
1964	339	97	28.9%	75	9	19	5
1965	358	56	15.5%	43	6	13	6

Table V
DISTRIBUTION OF PARASITE RATE IN ADULT AGE GROUP -
MAY 1963 TO MARCH 1965

Period	No. Exam.	Number positive	Parasite rate	P. falcip.		P. vivax	
				Asex.	Sex.	Asex.	Sex.
May - June							
1963	514	133	25.8%	44	9	3	1
1964	360	66	18.3%	57	11	9	4
July - Sept							
1963	483	100	20.0%	99	15	1	1
1964	499	142	28.5%	136	21	6	2
Oct - Dec							
1963	546	200	37.0%	180	24	20	4
1964	820	80	9.7%	69	8	11	6
Jan - March							
1963	784	278	35.4%	248	15	23	5
1965	1042	231	22.1%	109	7	22	12

in the same household. The majority of these who escaped infection belonged to the older age-group. Among these 137 households with record of malaria infection there were 320 persons examined, and 256 were found never infected during 2 years of observation.

The survey during the period of January to March 1965, almost 6 months after the last residual insecticide spraying operation, showed that some newcomers to Khao Mai Kaeo harbored malaria parasites within the first month. There were 62 persons who gave reliable history of coming directly from the Northeastern Region, and denied any febrile attack during the last 3 months in their home village. The number of persons whose bloods were positive with malaria parasites was 8, giving a rate of 9.9% infection. All cases were infected with Plasmodium falciparum.

5. Glucose 6 Phosphate Dehydrogenase Deficiency and Malaria: A preliminary survey on the incidence of G6PD deficiency and its relationship to malaria was made. Only those who were born in or had lived in Khao Mai Kaeo for more than 20 years were included. The test was made with Cal-Biochem paper. 244 males and 233 females were studied. The results of the tests did not support the hypothesis that the percentage of G6PD deficiency should be high in a population within a highly endemic area. It was observed that only 3.9 per cent of persons in Khao Mai Kaeo examined for G6PD showed deficiency of this enzyme. Among those with normal G6PD, 80 per cent were free from malaria during two

years period of observation.

6. Asymptomatic Parasitaemia: To assess the extent of asymptomatic malaria parasitaemia in the Khao Mai Kaeo area, clinical thermometers were used to note the body temperature of all individuals visited during August and September 1964. The examinees were asked about their history of illness at the time blood films were made, then their body temperatures were recorded by the use of clinical thermometer. A rise of body temperature as measured by oral temperature above 100°F was considered fever. Correlation between verbal complaints and temperature reading was attempted. Out of 700 persons examined, it was noted that 201 were positive with malaria parasites, an infection rate of 28.7%. These 201 persons with parasites can be classified into different categories as follows:

- Asymptomatic:
- a. Malaria positive but no complaint and no rise of body temperature 152 = 75.6%
 - b. Malaria positive with a rise of body temperature but no complaint 10 = 4.9%
- Symptomatic:
- a. Malaria positive, complaining of fever and rise of body temperature 25 = 12.4%
 - b. Malaria positive, complaining of fever but no rise of body temperature 14 = 6.9%

7. Chloroquine Resistance Strains of P. falciparum: At least 2 strains of P. falciparum exhibiting the property of resisting chloroquine therapy were recognized in Khao Mai Kaeo. One of them, though resisting chloroquine, responded well to pyrimethamine. The other one not only proved resistant to chloroquine but parasitaemia persisted after a full course of pyrimethamine.

Summary: A two year malaria study was completed in Villages of Khao Mai Kaeo, Bang Lamung District of Cholburi Province, in Southeastern Thailand. The area was hyperendemic for malaria. Plasmodium falciparum was the predominant infection. At least 2 strains of P. falciparum from this area proved resistant to chloroquine therapy. The residual DDT house spraying slowly reduced the parasite rate to some extent. Infants born after the 1964 spraying operation found with malaria parasitaemia indicated that intra-domicillary infection was still probable. The percentage of Glucose 6 phosphate dehydrogenase deficiency among the old settlers in this hyperendemic malaria was found to be as low as 3.9 percent. Eighty percent of the persons without malaria infection during the period of 1963 and 1964 were found to show normal G6PD.

Conclusion: Malaria in Khao Mai Kaeo is hyperendemic. Chloroquine resistant strains of P. falciparum were discovered. G6PD deficiency has no relationship to malaria immunity in the study area.