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Asymptomatic malaria infections among foreign migrant workers in Thailand

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ABSTRACT

Objective: To determine the prevalence of malaria infections among foreign migrant workers in Thailand. **Methods:** Giemsa-stained thin and thick blood films were prepared from blood samples of 294 foreign migrant workers recruited in the study. Microscopic examination of these blood films was performed for malaria detection. **Results:** Blood film examination revealed 1.36% malaria infections in these 294 subjects. All positive cases were male Myanmar workers in which their blood films only ring stage of *Plasmodium* spp. was found at low parasite density (mean= 144 parasites/ μL of blood). The prevalence of malaria infections was not significantly different among foreign migrant workers classified by age, gender, and resident province (P>0.05). Thin blood films of these workers also showed 78.91% hypochromic erythrocytes and 61.9% relative Eosinophilia. **Conclusions:** These findings indicate a high risk of malaria transmission. Therefore active malaria surveillance by using molecular methods with more sensitive and specific than microscopy should be considered for malaria control in foreign migrant workers.

1. Introduction

Malaria still remains a major public health problem worldwide, particularly in tropics such as developing countries in Southeast Asia[1]. With frequent outbreak, 687 million people in this region are at high risk for malaria. The disease affects all age groups and causes over 120 000 deaths each year[1]. In addition, resistance to common antimalarials is emerging faster in Southeast Asia than in any other part of the world, resulting in the declining efficacy of chemotherapy[2-4]. Due to a severe and disastrous economic impact of malaria, besides its health impact, the WHO Regional Office for Southeast Asia call for an urgent attention from the policy-maker at the national level for malaria control[5].

Currently, mass migrations of foreign workers to Thailand from high endemic areas, mainly Myanmar, may enhance risk of malaria transmission[6-8]. Although registered foreign workers have to receive a health-screening program for communicable diseases (i.e., tuberculosis, leprosy, elephantiasis, and syphilis, malaria infections do not include in this health assessment[7]. In order to set up better and more effective interventions for malaria control, a significant epidemiological data are needed. Therefore, this study aimed to determine the prevalence of malaria infections among foreign workers by using microscopic examination on thin and thick blood films. Additionally a preliminary observation focusing on RBC morphology and differentiation of white blood cells were undertaken for screening of health status among foreign workers.

2. Materials and methods

2.1. Study areas and blood sample collection

A cross-sectional survey was conducted in Bangkok and Samut Sakhon province, central Thailand (Figure 1). A total of 294 foreign migrant workers were enrolled in the study. Each participant was questioned about signs and symptoms of malaria, travel history, and medications taken during the prior two weeks. Between April and May 2008, thick and thin blood films were prepared from fingerpick blood samples of these workers. The study was approved by the Ethics Committee of the Faculty of Medicine Technology at

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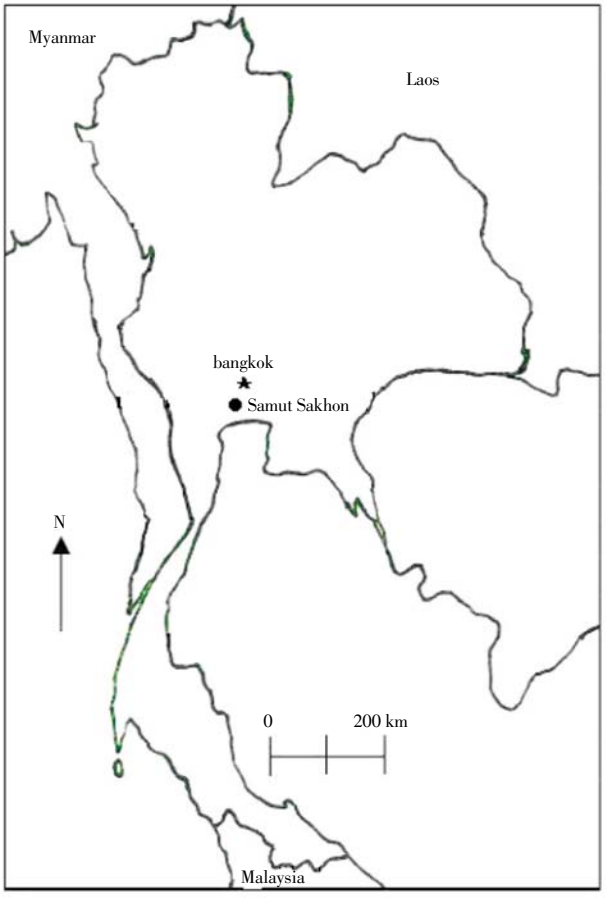

Figure 1. Map of blood collection sites.
Localization of two provinces in Thailand from which *Plasmodium falciparum* infected blood samples were obtained. Bangkok is the capital of Thailand. Samut Sakhon province is about 30 km southwest of Bangkok.

2.2. Microscopy

A thin and two thick blood smears were stained with 3% Giemsa solution (Merck) for 30 min and microscopically examined at ×1 000 for *Plasmodium* spp. detection and parasite density determination by three well trained microscopists[9]. Discrepancies of the results were resolved by an expert microscopist. The parasite density (parasites/ μ L) was done by counting 500 white blood cells from each positive thick blood film and the number of leukocyte density (WBCs/×L) was estimated as 8 000[10,11]. Red blood cell (RBC) morphology and White blood cell (WBC) differentiation were determined in thin blood films. Each blood film required approximately 20 minutes to read before negative results were reported.

Calculation of parasitemia = (the number of parasites × 8000) / the number of leucocytes

2.3. Data analysis

Prevalence of malaria infections was analyzed by using SPSS software package (SPSS 11.5 for Windows). *Chi*-square or Fisher Exact test was used to analyze differences of the data and association between techniques. The P values < 0.05 were considered statistically significant.

3. Results

Demographical data and the *Plasmodium* infection status of 294 foreign workers (92 females and 202 males) were described in Table 1. The age range of the participants was 9–46 years (median = 26 years). These subjects were mainly Myanmar (265), followed by Cambodian (10) and Laos

Table 1
Prevalence of *Plasmodium* infections among foreign migrant workers.

Paramater		No. of examined	No. of positive (%Prevalence)
Age	0 –20	94	2 (2.13)
	21–30	125	1 (0.80)
	30–40	59	1 (1.69)
	>40	16	0 (0.00)
Nationality	Myanmar	265	4 (1.50)
	Loa	10	0 (0.00)
	Cambodia	19	0 (0.00)
Gender	Male	202	4 (1.98)
	Female	92	0 (0.00)
Resident province	Bangkok	174	2 (1.10)
	Samut Sakhon	120	2 (1.70)
Type of blood smears	Thin Blood Smear	294	1 (0.34)
	Thick Blood smear (single)	294	3 (1.02)
	Thick Blood smear (double)	294	4 (1.36)
	Thin & Thick blood smears	294	4 (1.36)
Total		294	4 (1.36)

(19). The results showed the overall prevalence of malaria infections in foreign migrant workers was 1.36% (4/294). Of 265 Myanmar migrant workers, 1.5% was infected with malaria parasites. Only ring stages was found in the positive blood films with low parasitemia (range = 64 – 224; mean = 144 parasites/μL). A single of either thin or thick blood films were positive for malaria in 0.34% (1/294), and 1.02% (3/294), respectively. Both a thin blood film together with a thick blood films and double thick blood films detected 4 positive samples (1.36%).

Interestingly, anemia (78.91 % Hypochromic RBCs; 232/294) and relative eosinophilia (61.90%; 182/294) have been found in thin blood films of these foreign workers. Specifically, 116 (116/292, 39.45%) workers showed hypochromic normocytic RBC, of which 42 were from Samut Sakhon (42/120, 35.00%) and 74 (74/174, 42.53%) were from Bangkok. 113 (113/174, 64.94%) and workers from Bangkok 69(69/120, 57.50%) from Samut Sakhon showed relative eosinophilia.

4. Discussion

The results showed that 1.5% of Myanmar migrant workers were infected with malaria parasites. The Plasmodium spp. infections in this study were diagnosed by the detection of erythrocytic stages in blood films. The foreign workers randomly selected for a survey have resided in Thailand for more than six months so that these cases could not be defined as imported malaria infections. Likewise, the infecting species could not be actually identified because of the low parasitemia (mean = 144 parasites/μL) and the finding of only few ring stages. However multidrug resistant falciparum malaria is common in Myanmar and Thailand; this indicated that malaria carriers should be concerned among foreign migrants in Thailand, particularly in Myanmar groups[1, 5, 8]. Similar to previous studies, the Plasmodium spp. infections predominated in males who are more attractive to mosquitoes than females[12] and their hormone (testosterone) can act as anti-plasmodial immune repression[13]. In spite of only 4 positive cases, the prevalence of malaria infections was not statistically significant different according to demographic characteristics including gender (P = 0.134), age (P = 0.793), and resident province (P = 0.661).

The prevalence of *Plasmodium* spp. infection among foreign migrant workers was higher than the annual parasite incidence (API) in Thailand (0.41 per 1000 inhabitants, 0.041%)[14,15]. The reasons for the higher prevalence in Myanmar migrant workers than Thai population may relate to inadequate laboratory services and treatment facilities in Myanmar and the intensive malaria control programme in Thailand during the past five decades[8]. Our data also agree with several studies which reported that malaria infections are common among migrants in many countries (8.2%–60%)[16–20]. Regardless the clinical follow-up, in this study these positive cases without any symptoms were defined as the asymptomatic *Plasmodium* spp. infections based on physical examination including clinical interviews. The presence of these asymptomatic infections in Myanmar workers from Bangkok and Samut Sakorn province may lead to epidemic situation and these two provinces appear to represent the added risk of spreading malaria infections to Thai people. Therefore, laboratory diagnosis, treatment, and controlled population movement need to be promoted further.

Our results also showed that 1.36% (4/294) of the malaria-infected patients were diagnosed by the examination of double blood films, but not by either a single thin blood film (0.34%; 1/294) or thin blood film (1.02%; 3/294). Although the difference in the prevalence was not statistically significant (P>0.05), microscopic examination of double blood films; especially thin and thick blood films, is more helpful in surveillance for asymptomatic malaria infections due to the insufficient sensitivity of a single blood film for malaria detection[9]. In accordance with reliable diagnosis such as PCR technique, the collection of blood samples on filter paper is therefore recommended for differential diagnosis and epidemiological studies of malaria infections[21–25].

Interestingly, anemia (78.91 % Hypochromic RBCs; 232/294) and relative eosinophilia (61.90%; 182/294) have been found in thin blood films of these foreign workers. The etiology of chronic anemia is multifactorial, but asymptomatic *Plasmodium* parasitemia may be defined as the major cause[26]. In case of relative eosinophilia, it may be due to parasite infections which are mainly associated with the poor socioeconomic conditions, overcrowding, poor sanitation, and difficulty to access medical services among foreign workers in Thailand[27–37]. These preliminary observations highlight the importance of an active surveillance for infectious and noninfectious diseases in foreign workers.

In conclusion, the prevalence of *Plasmodium* spp. infections among Myanmar migrant workers represents a public health risk for Thailand. We suggest that the screening program for foreign workers should include a blood examination for malaria. Clinical follow-up of all asymptomatic cases might be useful for control of malaria transmission. In addition with improvements in personal hygiene and basic health education as a part of work-permit processing, antimalarial drug policy for migrants should be considered for the maintenance of drug efficacy.

Conflict of interest statement

We declare that we have no conflict of interest.

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