

THE FEASIBILITY OF A BED NET IMPREGNATION PROGRAM TO ENHANCE CONTROL OF MALAYAN FILARIASIS ALONG A SWAMP FOREST IN SOUTHERN THAILAND

Shiga Fumiya¹, Virasakdi Chongsvivatwong², Uchiyama Saburo¹ and Suwich Thammapalo³

¹Faculty of Health Science, Aomori University of Health and Welfare, Japan;
²Epidemiology Unit, Faculty of Medicine, Prince of Songkla University, Thailand;
³Vector-borne Disease Control Office 4, Songkhla Province, Thailand

Abstract. The purpose of this study is to document the potential feasibility of using a bed net impregnation program to enhance the control of Malayan filariasis in southern Thailand. A survey was conducted in one Muslim and one Buddhist village along the swamp forest in Narathiwat Province. Face-to-face interview was employed to collect data on practice of bed net use, knowledge and attitudes on filarial control and acceptance if a bed net impregnation program were to be introduced. Bed nets were used by 98.5% of the study households. Both Muslims and Buddhists were all in bed by 23.00 hrs. By 03.00 hrs, more than 20% of Buddhists were out of bed for rubber tapping, whereas more than 90% of the Muslim were still in bed until 04.30 hrs. Combining our data with biting rate from a previous study, approximately one-third of *Mansonia* bites were protected by the current bed net practice. The impregnation program was potentially welcome by both groups of villagers. From this study, we conclude that a bed net impregnation program in this area is feasible.

INTRODUCTION

Malayan elephantiasis, a disease characterized by swelling of the legs below the knees and transmitted by *Mansonia* spp, is common in the Asia and Pacific region. In southern Thailand, Malayan filariasis is endemic predominantly along the swamp forest where the density of vector mosquito is very high (Harinasuta *et al*, 1970).

Bed nets impregnated with pyrethroid, such as permethrin, have been extensively studied and widely used. They have been shown to be effective for malaria control program (Prasittisuk *et al*, 1996; Pierre *et al*, 1998). However, this use in prevention of

filariasis is not popular partly because of the high effectiveness of mass chemotherapy (Ottesen, 2000).

However, in southern Thailand, due to high density of mosquitos near the swamp area, it is likely that the population will use bed net to avoid annoyance. This habit, if further enhanced by impregnation of insecticide on the net, may play a significant role in preventing filarial transmission in the future. Since there has not been enough knowledge of such practice in the local communities, there is a need to study its potential. We therefore conducted a study aiming to document the current usage of mosquito nets in this endemic area, and to estimate the potential acceptance for impregnation service of mosquito repellent among this target population and the percentage of *Mansonia* mosquito bites protected by the currently used bed nets. If the practice and attitudes are favorable, further control by impregnation of insecticide may be considered.

Correspondence: Mr Shiga Fumiya, Faculty of Health Science, Aomori University of Health and Welfare, 58-1 Mase, Hamadate, Aomori, 030-8505, Japan.
Fax: +(81 17) 765 2030
E-mail: f_shiga@auhw.ac.jp

MATERIALS AND METHODS

Study site

The study was conducted in two villages of Narathiwat Province, southern Thailand; a southernmost province where the prevalence of Malayan filariasis is the highest in the country (Filariasis Division, Thailand, 1998).

Narathiwat Province has 459 km² of waterlogged peat soils, where the vector density is high. Among several villages located along this peat forest, the study communities were intentionally selected on the basis of having the highest prevalence of microfilaremia. One village was Muslim and the other was Buddhist. This allowed researchers to take a look at the effects of the different lifestyles of the two groups on risk for transmission of Malayan lymphatic filariasis.

According to the results of the latest blood test one year prior to the study, microfilaria prevalence was 2.1% and 2.3% in the Muslim and the Buddhist villages, respectively. Mass treatment with diethylcarbamazine (DEC) was given after the blood test.

The study design was a cross-sectional survey using all villagers in the study villages as the subjects. Face-to-face interview was employed after good rapport had been established with the villagers. Through home visit, we collected data on demographic characteristics, history of blood test for microfilaria, knowledge on cause of filariasis and the behavior of mosquito net use if the program was to be introduced.

Data were analyzed using descriptive statistics and chi-squared test for the difference between the Buddhist and Muslim villages. From the individual data on use of bed net, time-to-bed at night and time-out-of-bed in the morning, the percentage of subjects sleeping under the mosquito net at each hour interval was computed. Finally, the percentage in each hour was weighted by the total number of bites per human bait for each corresponding hour reported in a previous study in the same area (Guptavanij *et al*,

1973). The weighted average of these percentages was used as the percent of *Mansonia* bites prevented by the existing practice of mosquito net use.

RESULTS

Basic demographic characteristics of the study villages are shown in Table 1. The Muslim village was larger than the Buddhist. The sex ratio, age distribution were similar. The percentage of population engaged in rubber tapping (necessary to work outdoor at night, thus having a greater chance of exposure to the vector) and working in the peat forest during daytime were slightly higher among the Buddhists.

History of blood test

The Buddhist subjects were more receptive to the blood tests than the Muslim sub-

Table 1
Site population characteristics.

	Buddhist village no. (%)	Muslim village no. (%)
Population	131	552
Household	28	109
Sex		
Male	70 (53.4)	294 (53.3)
Female	61 (46.6)	258 (46.7)
Age group (year)		
<1	3 (2.3)	13 (2.4)
1-4	7 (5.3)	70 (12.7)
5-14	25 (19.1)	126 (22.8)
15-24	28 (21.4)	97 (17.6)
25-44	40 (30.5)	155 (28.1)
45-64	21 (16.0)	72 (13.0)
>65	7 (5.3)	19 (3.4)
Occupation		
Rubber tapping	22 (78.6)	78 (71.6)
Employee	6 (21.4)	18 (16.5)
Store (owner)		12 (11.0)
None		1 (0.9)
Work in the swamp	(7.6)	(4.6)

Table 2
Distribution of blood test taker and non-taker by village and age group.

Age group (year)	Buddhist			Muslim		
	Test	Non-test	Total	Test	Non-test	Total
<1	2	1	3	1	12	13
1-4	7	0	7	52	18	70
5-14	24	1	25	124	2	126
15-24	28	0	28	94	3	97
25-44	40	0	40	150	5	155
45-64	21	0	21	72	0	72
>65	7	0	7	19	0	19
Total	129	2	131	512	40	552

jects. 98.5% of Buddhist subjects were tested, compared to 92.8% of the Muslims (chi-squared=5.05, $p < 0.05$). Muslim children under five years of age accounted for 71.0% (30/42) of all subjects who had not taken the blood tests (Table 2).

Information on mosquito net: Almost all households (98.5%) had at least one mosquito net and the average number was 2.28. In this respect, both villages were quite similar.

There was no evidence of an association between age or sex and the use of mosquito nets, although 5-14 year-old Muslim children had the highest percentage (11.5%) of sleeping outside the net. When the head of the family was asked "What transmits elephantiasis?", 82% of the Buddhist and 61% of the Muslim answered correctly as "mosquito". The difference of these percentages was not statistically significant.

By the end of the interview, for the question "Would you agree if a health worker comes to impregnate your bed net with a safe insecticide?", 73% of the Buddhists agreed whereas only 61% of the Muslims did so. The difference between these percentages was not statistically significant.

Timing of sleep under net: As seen in Fig 1, there was a slight difference of timing of sleeping under net. The Buddhists went to bed slightly earlier than the Muslims. By

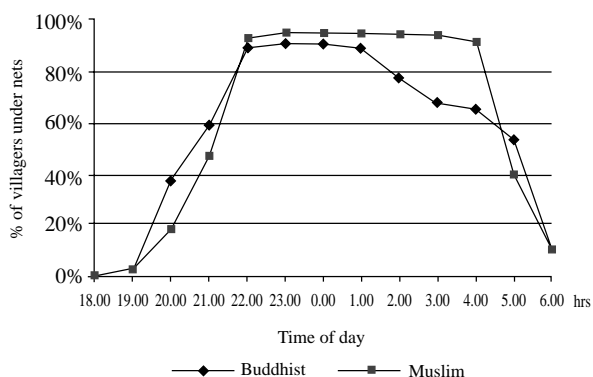


Fig 1—Proportion of villagers sleeping in bed net by time.

23.00 hrs, all were in bed. On the other hand, a larger proportion of the Buddhists got out of bed quite early. By 03.00 hrs, more than 20% of them are out of bed for rubber tapping, whereas more than 90% of the Muslims are still in bed until 04.30 hrs. By 05.00 hrs, the majority of Muslims get up to pray. By 06.00 hrs, almost everybody in both groups was out of bed. The lines in the figure do not reach 100% as a few subjects did not sleep under the mosquito net.

The upper line of Fig 2 shows the total number of bites per hour per human bait from four *Mansonia* spp reported by Guptavanij (1973). The number was highest between 19.00-20.00 hrs and declined but persisted throughout the night. The lower two lines are the

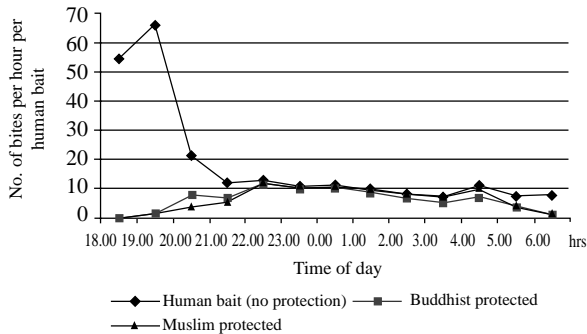


Fig 2—Bites per hour per human bait and those prevented among the Buddhist and the Muslim villagers (see text for more explanation).

results of calculation of number of bites prevented by sleeping under the net among the Buddhist and the Muslim villagers in our study. For example, between 18.00-19.00 hrs, almost nobody was in bed. The number of bites per hour per human bait was 54 and the number of bites prevented by the net was close to zero. In contrast, between 22.00-01.00 hrs, almost everybody was in bed and the number of bites prevented was thus close to all potential bites. Overall, the proportion of bites prevented was 33.1% among the Buddhists and 33.4% among the Muslims.

DISCUSSION

We found that mosquito nets were quite commonly used in the study villages. However, there were differences in the details of use. For example, the Buddhist villagers go to bed slightly earlier than the Muslims. On the other hand, they get out of bed earlier. Almost all Buddhist villagers complied to blood test whereas the test could not be done among the young Muslim children. The Buddhists also had better knowledge related to transmission of disease and higher tendency to accept impregnation of bed nets. Combining our data of time-to-bed and time-to-get-up with the previous *Mansonia* biting study, approximately one-third of both populations are protected from indoor *Mansonia*

biting.

The high percentage of use of mosquito bed nets in the study area is quite different from the findings of other studies reported concerning the recent status of filariasis in Thailand (Rozendaal and Curtis, 1989; Aramrattana *et al*, 1994). This is probably due to the fact that the population density of the mosquitos in general was very high in our study area, forcing the residents to use bed nets at night.

The poorer knowledge and attitudes related to filariasis control and compliance to blood test among Muslims may reflect a barrier between the health care providers, the majority of whom are Buddhists, and the Muslim population, whose language and beliefs are different (Golomb, 1985).

Both the Buddhists and the Muslims, however, shared a similar overall chance of getting *Mansonia* bites. As the peak biting frequency for *Mansonia* in southern Thailand is around 19.00 hrs, the period when most residents are still having their usual activities, the protective effect of bed nets from total number of bites was only approximately one-third. For the parasite to enter the human host from the mosquito, this level of protection may be quite low. However, since most of the microfilaria appear in the peripheral blood mainly from 22.00 hrs to 02.00 hrs (Rajan, 2000), the time when most villagers are sleeping, the bed nets may have some effect in reducing transmission.

As the general lifestyle of most villagers is changing toward urbanization, *eg* wide spread television, to encourage the resident to stay under the bed net during early period of night is likely to be not feasible. For the Buddhists who get up early to work in the rubber plantation, their long exposure to mosquitos after midnight cannot be ignored either. The use of personal repellent should be promoted to increase prevention of man-mosquito contact outdoor as well as during the period when the people are not sleeping.

Our study shows that impregnation of

existing bed net is potentially welcome by the residents and the rate of use of bed nets has been shown to be enhanced by some control programs (Picard *et al*, 1993; Prasittisuk *et al*, 1996; Gyapong *et al*, 1996). If a bed net impregnation program is introduced, this may provide important enhancement to the effectiveness of the existing mass chemotherapy program.

To our knowledge, this study is the first to integrate the finding of bed net use with the existing data on biting of vectors of Malayan filariasis. The findings are, however, limited to only two communities. Further studies on the same issue in other endemic areas of Malayan filariasis are needed.

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