PREVALENCE OF CLINICAL MALARIA AMONG AN ORANG ASLI COMMUNITY IN MALAYSIA

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Abstract. An epidemiological cross-sectional study was undertaken to determine the prevalence of clinical malaria among the Orang Asli population of Raub, Pahang, Malaysia. The study was conducted on a representative sample of 520 Orang Asli. Malariometric and clinical measurements were taken. The overall parasitemic rate was 24.2% (95% CI 20.7-28.1). Twenty-three point four percent (95% CI 19.5-26.9) of respondents age two years and above were clinically febrile. The prevalence of fever, chills, perspiration and body aches during a one month period prior to the survey among the same group ranged between 4.2% (95% CI 2.7-6.4) and 13.5% (95% CI 10.6-16.7). Children 2-12 years old were more likely to present with fever, and symptoms of malaria than older children. Gender was not significantly associated with fever or any of the other malaria symptoms. Presence of clinical fever and history of malaria symptoms were all strongly associated with current infection. The association was significant even after controlling for age (adjusted OR 2.8-5.1, 95% CI 1.1-8.3). Orang Asli children significantly experienced greater morbidity due to malaria compared to adults. Control and treatment of malaria should focus on children, while further research should explore the effects of malaria morbidity on the quality of life of these children.

INTRODUCTION

Despite advances in the control of communicable diseases, malaria is a disease that still poses challenges to mankind today. An estimated 350-500 million clinical cases and over one million deaths occur annually globally (Korenromp *et al*, 2005). Asian countries comprise 38% of cases and 10% of deaths (National Institutes of Health, 2007). It is estimated that almost 50% of the population in this region are at risk for malaria (Korenromp *et al*, 2005).

While quantifying the number of malaria cases with complications or deaths is a useful indicator of the severity of malaria, mild to moderate cases presenting with clinical symptoms such as fever, are important indicators of the level of malaria morbidity and endemicity in a population. Clinical malaria results in short and long term morbidity, such as fever and anemia, which affect the functional ability and quality of life of the affected individual. It has been estimated that about 60 school days are missed by children annually as a result of malaria, and 40% of all clinical episodes of fever in children are attributable to malaria in some populations. (Greenwood *et al*, 1987; NETwork Against Malaria, 2008).

In Malaysia, 1,755,641 people live in malarious areas (Department of Statistics Malaysia, 1997). The majority of cases of malaria reported in Peninsular Malaysia are

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focal in nature and largely concentrated among the hinterland Orang Asli, an indigenous minority population of Peninsular Malaysia. Although they have mostly been resettled in forest fringes, they still rely heavily on the forest for subsistence and are constantly exposed to malaria transmission from childhood. While there are many studies on malaria prevalence among the Orang Asli, a gap in understanding the magnitude of clinical morbidity of malaria among this community and the factors associated with it still exists.

This study was carried out to determine the magnitude of malaria morbidity among the Orang Asli in Raub, Pahang, Malaysia. The specific objectives of the study were to determine the prevalence of clinical manifestations of malaria in the study population, the association between selected factors and these clinical manifestations and the association between clinical manifestations and current malaria infection among the Orang Asli.

MATERIALS AND METHODS

This study was a cross-sectional study, part of a larger study to determine the prevalence of malaria among the Orang Asli of Raub, Pahang. Epi Info was used to calculate the sample size of 210. In order to account for possible non-response as a result of absence of study subjects during the survey, all Orang Asli present in 10 of 19 randomly selected Orang Asli villages were included in the study. Consenting Orang Asli were examined for the presence of malarial parasites with thick and thin blood smears obtained from capillary blood. They were also examined for the presence of clinical fever defined as an eardrum temperature of ≥38.0ºC. The eardrum temperature was measured in all respondents using the Braun Thermoscan eardrum thermometer by a single trained observer. The average of two readings was taken. All respondents were interviewed for perceived presence of fever in the past one month prior to the survey, along with perceived presence of chills, extreme perspiration and body aches including headaches during the same period. Only children two years old and above were included. For children <10 years old, the mother was interviewed. Standard structured and pre-tested questionnaires were used to collect the data by trained community nurses via face-to-face interviews.

Current malaria infection was defined as positive parasitemia. The data were analyzed using SPSS version 13.0 and Epi Info version 6.0 statistical programs. A significance level of 0.05 (2-tailed) at a 95% confidence interval (CI) level was chosen.

RESULTS

Five hundred and twenty Orang Asli from 10 randomly selected villages, *ie* 20.9% of the total Orang Asli population in Raub, were successfully interviewed and examined. The majority of both the study sample (58.3%) and study population (54.2%) were below age 15 years old. Just over half (50.7%) the study population were males, the reverse was true with the study sample where females predominated. The study sample did not differ significantly from the study population with respect to age and gender (Table 1).

The majority of the study sample (51.2%) was comprised of those with at least primary school education, who earned an average monthly household income of between RM 100-250 (61.7%), used a gravity feed system for water supply (55.8%) and gathered jungle produce for a living (54.5%) (Table 2).

The overall slide positivity rate (SPR) for malaria parasites was 24.2% (95% CI 20.7-28.1). The highest prevalence of parasitemia was among children 2-5 years old (47.4%),

Table 1
Comparison of age and gender between study subjects and controls.

Variable	Study sample (%)	Study population (%)	*p*-value	cOR (95% CI)
Age group (years)			0.0968	
≥15[a]	217 (41.7)	1,138 (45.8)		
<15	303 (58.3)	1,345 (54.2)		1.2 (1.0-1.4)
Gender			0.6988	
Male[a]	258 (49.6)	1,258 (50.7)		1.0 (0.8-1.2)
Female	262 (50.4)	1,225 (49.3)		

[a]reference group

declining with age to 12.0% of children ≥15 years old (Table 3). The temperature ranged from 35.5ºC to 40.2ºC, with a mean (± SD) of 37.6ºC (± 0.5). Of 520 subjects, 23.1% (95% CI 19.5-26.9) had a temperature ≥38.0ºC, classified as clinical fever in the study. The majority of respondents (>86.0%) had none of the four malaria related symptoms during the month prior to the survey. The most common of the four symptoms was fever in 13.5% (95% CI 10.6-16.7) followed by body aches in 10.7% (95% CI 8.1-13.8). The prevalence of self-reported chills and perspiration during the same period were 6.9% (95% CI 4.8-9.5) and 4.2% (95% CI 2.7-6.4), respectively. The frequency distribution of these findings is presented in Table 4. More than half (56.6%) the subjects age two and above who gave a history of fever were found to be clinically febrile at the time of the survey.

The prevalence of clinical fever (≥ 38.0ºC) was highest (54.4%) in the 2-5 year old age group; a declining pattern was seen with increasing age (Table 4). Only 15.2% of sujects ≥15 years old were found to have clinical fever. In terms of self-reported symptoms experienced during the month prior to the survey, the prevalence of fever, chills, perspiration and body aches was higher among children 2-10 years old than among older children and adults. The rates for history of fever, chills and perspiration were highest each among children 2-5 years old (24.6, 10.5 and 7.0%, respectively), and body aches, were the most common among children 5-10 years old (15.3%). Females had a slightly higher prevalence of being febrile and were more likely to report having all four symptoms of malaria in the past month compared to males.

The differences observed among the different age groups in the prevalence of clinical fever and past symptoms were significant (Table 5). Children age 2-12 years old were at least 8 times (cOR 8.5, 95% CI 4.6-16.1) more likely to be febrile than those older than age 12. They were also 2 to 4 times more likely to report one of the four symptoms in the study compared to children >12 years old. The strongest association was between perspiration and age (cOR 3.5, 95% CI 1.1-12.5) and the weakest was between body aches and age (cOR 1.8, 95% CI 1.0-3.2). There was no significant association between clinical fever and gender or past malaria symptoms and gender.

More than half the subjects studied who were febrile or had a history of malaria related symptoms in the past one month also had current malaria infection (Table 6). Among those clinically febrile, 55.2% were found to have parasitemia; 15.3% of those afebrile had parasitemia. Among respondents with a history of any of the other four

Table 2
Demographics of study subjects.

Socio-demographic characteristics	Frequency	Percentage (%)
Age group (years) (*n*=520)		
<2	25	4.8
2-<5	57	11.0
5-<10	158	30.4
10-<15	63	12.1
≥15	217	41.7
Gender (*n*=520)		
Male	258	49.6
Female	262	50.4
Marital status (*n*=226)		
Never married	61	27.0
Married	162	71.7
Divorced	3	1.3
Educational level (*n*=342)		
None	120	35.1
Kindergarten	35	10.2
Primary	175	51.2
Secondary	12	3.5
Monthly household income (RM) (*n*=520)		
≥500	31	6.0
250-<500	127	24.4
100-<250	321	61.7
<100	41	7.9
Source of water supply (*n*=520)		
Gravity feed	290	55.8
Treated tap water	145	27.9
River	62	11.9
Gravity feed and treated tap water	12	2.3
Well	11	2.1
Occupation (*n*=213)		
Jungle produce gatherers	116	54.5
Agricultural sector	77	36.1
Hunting	7	3.3
Trading	3	1.4
Others	4	1.9
Housewife	6	2.8

symptoms, the prevalence of current malaria infection was 56.6% in those with body aches and 52.2% in those with fever.

Presence of a temperature ≥38.0ºC (clinical fever) and reporting symptoms of malaria were associated with current malaria infection among studied subjects. Subjects with clinical fever were 6.8 times (95% CI 4.3-10.8) more likely to have current malaria infection than those without clinical fever (Table 7). Respondents who reported experiencing fever, chills, perspiration or body

Table 3
Parasitemia by age group.

Age group	Number examined	Number positive (%)
2	25	4 (16.0)
2-<5	57	27 (47.4)
5-<10	158	55 (34.8)
10-<15	63	14 (22.2)
≥15	217	26 (12.0)
Total	520	126

aches in the last one month were 3.6-5 times more likely to be parasitemic than those without these symptoms.

The associations remained significant after controlling for age, though the magnitude dropped slightly. After controlling for age, respondents were 5.1 times (95% CI 3.1-8.3) more likely to be parasitemic if they had clinical fever. They were 2.8-4.6 times more likely to have malaria if they reported having one of the symptoms in the past month.

DISCUSSION

The prevalence of malaria in a defined population is indicated by its frequency of occurrence in relation to time and place. Conventionally, malaria is identified by a positive blood smear for *Plasmodia.* Since malaria infection may give rise to a wide spectrum of manifestations, ranging from asymptomatic to death, the various outcomes or events may be quantified. Malaria symptoms include fever, chills, perspiration, headaches, vomiting and malaise. The presence of such symptoms is affected by factors such as host immunity and socio-cultural conditioning. Describing the prevalence of malaria symptoms provides better understanding of the local epidemiology of malaria in the population.

In this paper, the prevalence of malaria

Table 4
Frequency of sign and symptoms by age and sex.

Variable	Frequency	Percentage (%)
Clinical fever		
Overall (*n*=520)	120	23.1
Gender		
Male	53	20.5
Female	67	25.6
Age group		
<2	5	3.0
2-<5	31	18.9
5-<10	68	41.5
10-<15	27	16.5
≥15	33	20.1
Fever		
Overall (*n*=520)	70	13.5
Gender		
Male	31	12.0
Female	39	14.9
Age group		
<2	3	12.0
2-<5	14	24.6
5-<10	31	19.7
10-<15	7	11.1
≥15	15	6.9
Chills		
Overall (*n*=495)	34	6.9
Gender		
Male	18	7.3
Female	16	6.4
Age group		
2-<5	6	10.5
5-<10	14	8.9
10-<15	6	9.5
≥15	8	3.7
Perspiration		
Overall (*n*=495)	21	4.2
Gender		
Male	10	4.1
Female	11	4.4
Age group		
2-<5	4	7.0
5-<10	8	5.1
10-<15	5	7.8
≥15	4	1.8
Body aches		
Overall (*n*=495)	53	10.7
Gender		
Male	24	9.8
Female	29	11.6
Age group		
2-<5	7	12.3
5-<10	24	15.3
10-<15	6	9.5
≥15	16	7.3

Table 5
Association between age group and sign and symptoms.

Variable	*p*-value	cOR	95% CI
Clinical fever	0.0000		
2-≤12 years			
>12 years[a]		8.5	4.6-16.1
Fever	0.0001		
2-≤12 years			
>12 years[a]		3.1	1.7-6.0
Chills	0.0125		
2-≤12 years			
>12 years[a]		2.7	1.1-6.7
Perspiration	0.0184		
2-≤12 years			
>12 years[a]		3.5	1.1-12.5
Body aches	0.0316		
2-≤12 years			
>12 years[a]		1.8	1.0-3.2

[a]reference group; cOR, crude odds ratio; 95% CI, 95% confidence interval

Table 6
Clinical characteristics and parasitemia status.

Clinical variable (≥2 years old) *n*=495	Parasitemia +ve (%)	Parasitemia -ve (%)	Total
Clinical fever			
Yes	64 (55.2)	52 (44.8)	116
No	58 (15.3)	321 (84.7)	379
Fever			
Yes	35 (52.2)	32 (47.8)	67
No	87 (20.3)	341 (79.7)	428
Chills			
Yes	19 (55.9)	15 (44.1)	34
No	103 (22.3)	358 (77.7)	461
Perspiration			
Yes	11 (52.4)	10 (47.6)	21
No	111 (23.4)	363 (76.6)	474
Body aches			
Yes	30 (56.6)	23 (43.4)	53
No	92 (20.8)	350 (79.2)	442

among the Orang Asli is described using measures such as parasitological findings, clinical signs and self-reports of malaria related symptoms. Current fever or a history of fever was elicited from all respondents. The study was confined to children 2 years old and above since these symptoms cannot be articulated reliably by younger children

Table 7
Association between sign and symptoms and current malaria infection.

Variable	cOR	95% CI	aOR	95% CI
Clinical fever				
Yes	6.8	4.3-10.8	5.1	3.1-8.3
No[a]				
Fever				
Yes	4.3	2.5-7.3	3.5	2.0-6.1
No[a]				
Chills				
Yes	4.4	2.2-9.0	3.7	1.8-7.8
No[a]				
Perspiration				
Yes	3.6	1.5-8.7	2.8	1.1-7.0
No[a]				
Body aches				
Yes	5.0	2.8-9.0	4.6	2.5-8.6
No[a]				

[a]reference group; cOR, crude odds ratio; aOR, adjusted odds ratio after controlling for age; 95% CI, 95% confidence interval

or cannot be elicited from the mothers of these young children. Fever is easily perceived by mothers. Respondent bias in reporting these perceived symptoms is assumed to be minimal since the Orang Asli are familiar with malaria related symptoms. Conversely, clinical fever measured objectively may not be perceived as fever by the respondent, as it is a subjective perception. High grade fevers (≥39.5ºC or ≥103ºF) (Adult Health Advisor, 2005) are more likely to be perceived than low grade fevers (≤38.9ºC or ≤102ºF).

In this study, the overall prevalence of parasitemia was similar to the prevalence of clinical fever. However, the one-month prevalence of other malaria symptoms was at least 1.7 times lower, ranging from 4.2% to 13.5%. These findings support the fact that most malaria infections in an endemic area are asymptomatic. Fever is the commonest symptom of malaria. The study found that more than half of respondents with clinical symptoms were currently infected with malaria.

The prevalence of fever and other symptoms was more common among females than males but the difference was not significant. The prevalence of current or a history of fever was highest among children 2-5 years old, and declined with increasing age. The prevalence of all symptoms was higher among children <15 years old than in older subjects. The significant difference in morbidity among age groups supports the fact that children are more vulnerable to malaria morbidity due to their relatively weaker immune system compared to adults.

In a previous study conducted in the same area, the prevalence of parasitemia was lower than in this study (10.2%) while the prevalence of self-reported fever in the previous 60 days was much higher (30.2%) (Premaraj *et al*, 1993). The apparent differ-

ence could be explained by the different operational definitions for fever used in terms of time. It must be noted that a longer recall period is more prone to bias. The age-specific prevalence of fever in the study by Premaraj *et al* (1993) was similar to this study, being higher among children <15 years than in older children and adults. In Sudan it was found the frequency of malaria among children under five based on clinical history was 27% (El Samani *et al*, 1987). The under five prevalence of self-reported fever in this study was 20.7%, while the prevalence was almost twice as high in a study by Premaraj *et al* (1993).

Although a positive history of malaria related symptoms does not equate to current infection, the prevalence of these symptoms and clinical fever may be taken as a crude indicator of the level of malaria among the Orang Asli population, since there was a significant association between these parameters and parasitemia in this study. However, it must be pointed out that one potential bias in this study is the possibility that the current and history of fever may have been due to other common infections such as upper respiratory tract infections or ear infections, especially in children. This possibility, irrespective of the status of parasitemia, was not further examined in the study. It must also be noted that a negative current infection status does not discount the fact that the respondent could have been infected with malaria in the past month. Due to spontaneous recovery or treatment, parasitemia may not have been detected at the time of the survey. The strongest associations with parasitemia were found with current fever, history of fever, and body aches. Even after controlling for age, all parameters remained significantly associated with parasitemia. The finding is supported by Luxemberger *et al's* (1998) study which showed that temperature of ≥38ºC, headaches and muscle/joint pains, were associated with malaria. Cox *et al* (1994) also found fever, history of fever, and parasitemia to be reliable indicators for malaria morbidity in Papua New Guinea. However, in a previous study by Premaraj *et al* (1993) in the same area did not show any association between fever and malaria. Studies in other Orang Asli communities also did not find any relationship between fever and malaria (Norhayati *et al*, 2001; Mohammed *et al*, 2004). Similarly, in other populations, Sowunmi (1995) did not find a relationship between body temperature and parasitemia among Nigerian children in a hyperendemic area. The different findings may be due to differences in several factors, such as intensity of malaria transmission, level of parasitemia, host immunity and treatment practices in the populations examined.

In conclusion, the prevalence of malaria related morbidity ranged from 4.2% to 23.1%, with clinical fever being the most common manifestation, followed by a past history of fever and body aches in the preceding month. These symptoms also had the strongest association with malaria. All symptoms were more likely to be manifested among children 2 to 12 years old than in older children and adults. Since children are more vulnerable to morbidity with malaria, an assessment of the impact of clinical malaria on the growth and development of Orang Asli children as well as the quality of life among the general Orang Asli population is recommended.

ACKNOWLEDGEMENTS

This research was supported by a grant from the University of Malaya (Vot F:F0060/2000B). The author would also like to thank the Director-General of Health, Ministry of Health, Malaysia for his permission to publish this paper.

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