

Heterogeneity in the prevalence of subclinical malaria and anemia among pregnant women in rural areas of Myanmar: A community-based longitudinal study

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Abstract

Introduction: The prevalence of clinical malaria is 1-2 % among pregnant women in Myanmar. This study assessed the prevalence of subclinical malaria and helminth co-infections among pregnant women, and the adverse outcomes of pregnancy in the presence of infection.

Methods: A prospective longitudinal study was conducted in 12 villages in two townships in Myanmar between 2013 to 2015. A total of 752 pregnant women, with mean age of 27 years, were enrolled and followed up once a month, until six weeks after the delivery.

Results: About 84% of women were asymptomatic and 40% were primigravida at the time of enrolment. The prevalence of subclinical malaria as measured by nested PCR was 5.7% for either *P. falciparum* or *P. vivax* (2.7% *P. falciparum* only and 2.8% *P. vivax* only). Helminth infections were prevalent in 17% of women. The burden of anemia was high, with an overall prevalence of 37% with or without helminth infection. Eleven abnormal pregnancy outcomes (7 stillbirth, 2 premature, 2 twins) were identified. Poisson regression showed that women in their first trimester had a 2.9 times higher rate of subclinical malaria compared to women in the third trimester ($p=0.019$), women enrolled during the wet season were 2.5 times more likely to be malaria positive than women enrolled in the dry season ($p=0.008$), and the malaria positivity rate decreased by 5% when increased in one year of woman's age ($p=0.02$).

Conclusions: The low prevalence of heterogeneous subclinical malaria among pregnant women should not be neglected when targeting malaria elimination.

Background

- Burden of clinically suspected malaria in pregnant women in Myanmar was 1-2% in 2016, whereas the prevalence of confirmed positive rapid diagnosis test (RDT) malaria in general populations was 0.23%.
- However, the total burden of subclinical malaria among pregnant women is unknown.
- In India, the prevalence of malaria was 29.3%, with 20.8% being asymptomatic, associated with 92.4% of anemia among pregnant women.
- Intestinal parasitic infections also increase anemia in pregnant women. Prevalence of soil-transmitted intestinal helminth (STH) with malaria co-infection was 7% in Ethiopia (21) and 16.6% in Ghana.
- In low and middle-income countries, the superimpose of other co-infections such as HIV and helminths on malaria in pregnancy causes an increased risk of adverse maternal and perinatal outcomes.
- Many studies have looked at the burden of malaria during pregnancy and its effect on maternal health and childbirth, but data did not cover for the integration of malaria with other co-infections such as HIV and intestinal parasites in different transmission endemicity sites in Myanmar.
- More evidence is required to help reducing morbidity and mortality of maternal and improving child health outcomes in Myanmar.

Objectives

This longitudinal study aimed to identify (1) the prevalence of subclinical malaria among pregnant women; (2) the prevalence of co-infections with HIV and intestinal parasites during pregnancy; (3) the burden of anemia during pregnancy; and (4) the outcome of pregnancy in the presence of infections.

Methods



Figure 1. Map of Myanmar with study sites; Shwe Kyin in Bago Region and Madaya in Mandalay Region, indicated by stars.

Laboratory methods

Malaria smear microscopy: Giemsa-stained thick & thin smears read under light microscopy

Conventional nested real-time PCR (nested -PCR): DNA extraction using Qiagen DNA Mini Kit following the manufacturer's instructions; Initial screening by real-time PCR assay using specific ribosomal RNA 18S primer to identify *P. falciparum* and *P. vivax* infections (Seder *et al*,2013); Amplification of extracted DNA from falciparum positive samples by nested PCR

HIV RDT: Determine* rapid test kits along with pre- and post-test counseling

Stool examination: By Kato-Katz method & microscopic examination

Data Analysis: *P. falciparum* and *P. vivax* infection treated as a dichotomous variable. The socio-demographic and risk factors were compared between the two study sites. The prevalence of malaria by the two detection methods were compared. Poisson regression with robust variance was used to analyze the prevalence rate of asymptomatic malaria and identify the association of covariates. Risk factors with $P \leq 0.2$ were considered for multivariable model and goodness-of-fit was tested for the best-fit model. The level of significance was set at $P \leq 0.05$.

Conclusion

- A low prevalence of heterogeneous subclinical malaria and co-infections among pregnant women from rural areas of high and low malaria endemicity sites in Myanmar.
- Integrated intervention for malaria, anemia, and helminths that targets pregnant women should be promoted through antenatal care services by basic health staff in rural areas of Myanmar.

Results

Table 1. Baseline characteristics of pregnant women

Demographic characteristics	Study sites		Total n (%)
	Shwe Kyin n (%)	Madaya n (%)	
Mean age (SD) (years)	27.2 (6.24)	27.4 (6.23)	27.3 (6.23)
Gestation (week)			
Median (IQR) 1 st trimester*	12 (5-13)	8 (3-13)	10 (3-13)*
Median (IQR) 2 nd trimester*	22 (14-26)	20 (14-26)	20 (14-26)*
Gravidity			
Primigravida	138 (35.9)	160 (43.5)	298 (39.6)
Secundigravida	89 (23.2)	104 (28.3)	193 (25.7)
With fever *	20 (5.2)	3 (0.8)	23 (3.1)*
Mean (SD) hemoglobin (g/dl)	10.2 (1.28)	10.4 (1.31)	10.3 (1.30)*

* gestational age 1-13 week by fundal height; * gestational age 14-26 week; * Fever defined as axillary temperature $\geq 37.5^\circ\text{C}$ or reported fever in 24 hours prior; * $p < 0.05$ by t-test; * $p < 0.05$ by Pearson chi2; IQR: Interquartile range

Figure 2. Percent of observed intestinal parasites

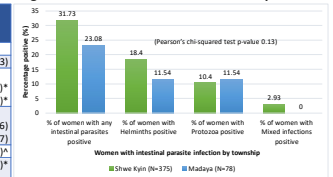


Table 2. Prevalence of subclinical malaria

Pathogen positive	Diagnostic method	Positive rate by study sites		Total* n (%)
		Shwe Kyin n (%)	Madaya n (%)	
		(N=384)	(N=368)	(N=752)
Any malaria positive	by rt-PCR	26 (6.77)	17 (4.62)	43 (5.72)
	by microscopy	5 (1.30)	2 (0.54)	7 (0.93)
<i>P. falciparum</i> positive	by rt-PCR	13 (3.39)	7 (1.90)	20 (2.66)
	by microscopy	3 (0.78)	1 (0.27)	4 (0.53)
<i>P. vivax</i> positive	by rt-PCR	13 (3.39)	8 (2.17)	21 (2.79)
	by microscopy	2 (0.52)	1 (0.27)	3 (0.40)

Table 3. Prevalence of anemia and co-infections

Prevalence of co-infection among pregnant women	Study sites		Total* n (%)
	Shwe Kyin n (%)	Madaya n (%)	
			(N=384) (N=368) (N=752)
Prevalence of anemia*	152 (39.6)	124 (33.7)	276 (36.7)
Prevalence of HIV infection	1 (0.26)	0 (0.00)	1 (0.13)
Prevalence of helminth infection	69 (18.40)	9 (11.54)	78 (17.22)

* hemoglobin ≥ 10 g/dl with moderate-severe anemia; * Pearson chi2 and Fisher's exact test are statistically not significant

Table 4. Factors influencing prevalence rate of subclinical malaria in pregnant women by rt-PCR

Potential risk factors	Total (N=752)	rt-PCR (+) n (%) (N=43)	Unadjusted PR (95% CI)	P-value*	Adjusted PR (95% CI)	P-value*
Season (≥ 3 month in study)						
Dry (Ref)	226	7 (3.1)		1		1
Wet	526	36 (8.4)	2.492 (1.274, 4.875)	0.008	1.863 (0.821, 4.228)	0.137
Mean Age	27.3	24.8	0.952 (0.912, 0.993)	0.022	0.917 (0.851, 0.987)	0.021
Gravidity						
Multigravida (Ref)	259	11 (4.3)		1		1
Secundigravida	193	13 (6.7)	2.326 (1.232, 4.392)	0.009	1.137 (0.480, 2.690)	0.771
Primigravida	298	19 (6.4)	1.564 (0.832, 2.941)	0.165	0.718 (0.279, 1.850)	0.493
Gestation from Fundal Height						
Third trimester (Ref)	129	5 (3.9)		1		1
Second trimester	460	29 (6.3)	1.870 (0.793, 4.410)	0.153	2.080 (0.737, 5.866)	0.166
First trimester	153	8 (5.2)	2.951 (1.191, 7.311)	0.019	1.862 (0.567, 6.118)	0.306

* Poisson Regression model with robust variance using the count episode of malaria positivity; * Fever with $\geq 37.5^\circ\text{C}$ Degree Celsius; PR: Prevalence Rate

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