

## Research Article

# Prevalence of Malaria and Frequency of Severe Symptoms among Pregnant Women in Pawe Hospital, North Western Ethiopia

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## Abstract

Although the current trend of malaria infection showing a declining pattern, it is a major cause of death in some parts of the world. Majority of deaths due to malaria are frequently occurring in sub-Saharan Africa among biologically risked groups. Thus, this study was designed to assess prevalence of severe malaria symptoms among pregnant women in Pawe hospital, Northwestern Ethiopia. Febrile pregnant women, seeking medication for malaria infection in the hospital during the study period were recruited in the study. Socio-demographic characteristics, physical and clinical features of uncomplicated and complicated malaria symptoms were assessed following standard parasitological and clinical procedures. Data was analyzed using SPSS statistical software (version 20.0 Armok, NY: IBM Crop). During the study period, a total of 124 pregnant women were malaria positive, showing a prevalence of 16.31% (n=124/760). Of these, 73.55% (n=89) were infected with *Plasmodium falciparum*. The rest were positive for *P. vivax* and had mixed infections. Severe malaria symptoms such as respiratory distress, confusion, severe anemia, hyperparasitemia, prostration, and hemoglobinuria were observed among assessed malaria infected pregnant women. The study revealed the high prevalence of malaria infection in the study sites. In addition, significant number of the pregnant women assessed were developed severe life threatening malaria symptoms.

## INTRODUCTION

Malaria is still the major cause of morbidity and mortality in least developed regions. Until recently, only the four *Plasmodium* species (*Plasmodium falciparum*, *P. vivax*, *P. ovale* and *P. malariae*) were recognized as the only etiological agents of human malaria. But, recently *P. knowlesi*, a simian parasite, is also considered as human malaria parasite and included as the fifth human malaria parasite [1]. *P. falciparum* and *P. vivax* have worldwide distribution, with *P. falciparum* being the more pathogenic. Few years back, it was indicated that about 1-3 million mortality per year, mainly in children and pregnant women, are due to severe malaria infection caused by *P. falciparum* [2]. However, according to the latest estimates released by World Health Organization (WHO) [3], there were about 198 million cases of malaria in 2013 and an estimated 584,000 deaths. The same report showed reduction of malaria associated death rates among biologically risked groups in Africa by an estimation of 47% globally since 2000 and by 54% in the WHO African Region [3].

In agreement to the global and continental trend, in Ethiopia mortality and morbidity associated with malaria showing a declining pattern [4]. This is because of the scaled-up vector control strategies [indoor residual spraying (IRS) and utilization

of insecticide treated bed net (ITN)], early diagnosis and treatment of malaria patients using combination ACT, contributed for malaria reduction [4]. However, this remarkable achievement is not uniformly attained in all parts of the country [5]. Besides, as biologically risked groups (pregnant women and children) are the most vulnerable, ensuring the effectiveness of the existing prevention and control strategies among these groups are very critical. Thus, the current study was designed to assess the prevalence of malaria and severe symptoms among pregnant women despite intense interventional strategies undertaking in one of malaria endemic areas of the country.

## MATERIALS AND METHODS

## Description of the study area

The study was conducted in Pawe hospital, Benishangul Gumuz regional state, Northwestern Ethiopia. Detail geographical location of the study site (map), feature of malaria infection, metrological information, and population of the study area are described in the published work of the same authors [5].

## Study population

The study participants were all febrile pregnant women

seeking medication at antenatal care (ANC) unit in Pawe hospital (based on availability) during the study period, from October 2013 to May-2014. Pregnant women with chronic infections such as Tuberculosis and HIV infection were excluded from the study.

### Clinical data collection

Clinical and demographic characteristics of the study participants were recorded by health professionals working in the Pawe hospital. Accordingly, body temperature was measured by digital thermometer, uncomplicated and severe malaria symptoms such as prostration (inability to sit), hypoglycemia, jaundice, impaired consciousness, splenomegaly, hepatomegaly, fever, headache, hyperpyrexia, persistent vomiting, respiratory distress, and hemoglobinuria were documented by assessing the clinical symptoms of all participants.

### Parasitological tests

Briefly, a drop of blood sample was collected on clean glass slide for preparation of thin and thick blood smears in duplicate per patient for microscopic examination. This was done after patients were confirmed to have malaria infection using blood sample from pricked finger. Thick and thin blood smears were stained with 10% Giemsa (pH=7.2, for 10 minutes), while thin smears fixed in methanol prior to Giemsa staining. Malaria parasite identified under a microscope and parasite load was calculated after counting asexual parasites per 200 white blood cells (WBC), assuming mean WBC count is 8,000/ $\mu$ L.

To determine acute and repeated malaria infections among the pregnant women, malaria-induced anemia was classified following WHO diagnostic guidelines: mild anemia is defined as hemoglobin concentration < 11 g/dL or hematocrit (HCT) < 33%, severe anemia Hb < 5 g/dL (for pregnant women) or hematocrit < 15%. Hyperparasitemia (parasite load >100,000 parasite /  $\mu$ L), respiratory distress, confusion, coma, hemoglobinuria, prostration, hyperpyrexia (body temp >40°C), mild or severe anemia accompanied by *P. falciparum* infection is designated uncomplicated and severe malarial anemia, respectively [6,7].

### Data analysis

Data was analyzed using SPSS software (version 20.0 Armok, NY: IBM Crop). Descriptive statistical tests were used for analysis of clinical, demographic and parasitological data. Continuous data were presented as means. Median was considered over mean for non-normally described variables. In all analysis significance level (P<0.05) was considered at 95% confidence interval (CI).

### Ethical consideration

The study was ethically approved by ethical review committee of Jimma University, College of Natural sciences. From all study participants consent, oral and written agreement was obtained before data collection.

## RESULTS

### Socio-demographic characteristics of the study participants

During the study period, a total of 760 blood samples were collected from presumptive malaria infected pregnant women.

About 124 were malaria positive and willing to participate in the study. Among this, 12(9.67%), 23 (18.5%), and 86 (69.35%), were infected with *P.vivax*, had mixed infection, and *P. falciparum* infection, respectively (Figure 1). *P. falciparum* was the most predominant species (responsible for 69.35%) of all malaria infections among pregnant women assessed in the study.

### Prevalence of malaria in the study area

During the study period malaria was the top public health concern in the study site. Although the trend of malaria positive cases showing a declining tendency in the study area as well, the five years malaria prevalence data from the hospital (2009-2013) showed that the proportion of malaria positive pregnant women were still high (Figure 2).

The median age of malaria infected pregnant women enrolled in this study was 30  $\pm$  7.5years. Most of malaria infected pregnant women were found in age range from 20-30 years. But, the general patterns showed that majority of them were in age range from 20 to 40 years. Proportion of pregnant women found in age below 20 and above 40 years were almost the same (Figure 3). However, except three, all pregnant women were found in reproductive ages (15-44years).

Mean auxiliary body temperature of the study participants was 38.03oC. Proportion of pregnant women with vomiting and diarrhea symptoms were equal (67.74%, n= 84). In the current study the bed net coverage (availability and utilization) was very limited, only 16.13% (n= 20). Mean hemoglobin and HCT levels measured were 8.8g/dL and 26.4% respectively. Overall geometric mean parasite count was 8234 parasite/ $\mu$ L (Table 1).

### Clinical characteristics of pregnant women with malaria parasites

The mean body temperature for pregnant women was 38.11, 38.04 and 38.21oC for *P. falciparum*, mixed infection and *P. vivax* infections, respectively. High proportion of *P. falciparum* infected pregnant women had vomiting 50 (40.32%), diarrhea 53(42.74%), high parasite load 11, 984 parasite/ $\mu$ L, chill rigor 42(3 3.87%), nausea 40 (32.25%), abdominal pain 36 (29.03%) and self-medication 20 (16.13%) (Table 2).

The predictive value of some clinical symptoms was evaluated against *P. falciparum* infection. Accordingly, absence of vomiting, diarrhea and prostration were significantly lower (P<0.05) among pregnant women infected with *P. falciparum* infection. Implying that, presence of these clinical symptoms was strongly associated with *P. falciparum* infection. While, being febrile, having headache and history of fever were not strongly associated (P>0.05) with *P. falciparum* infection (Table 3).

### Frequency of severe malaria among pregnant women

Severe malaria symptoms were observed in a total of n= 41 (47.67%) *P. falciparum* infected pregnant women. The most common severe malaria symptoms observed in *P. falciparum* infected pregnant women were hyperparasitemia [n= 37 (43.02%)], respiratory distress [n= 5 (5.43%)], hemoglobinuria [n= 8 (8.6%)], prostration [25 (28.09%)], severe anemia [n=15 (16.85%)], confusion [n= 14 (15.73%)] and persistent vomiting [n= 20 (22.47%)]. Also some of these severe malaria

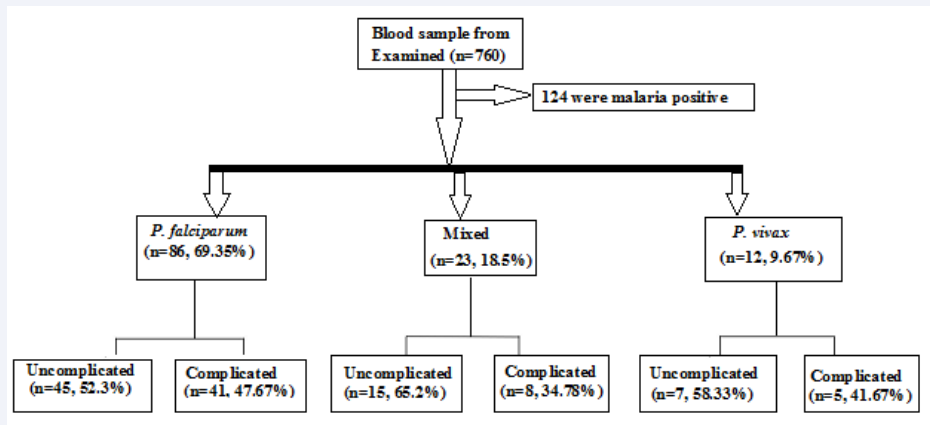


Figure 1 Flow chart of the study.

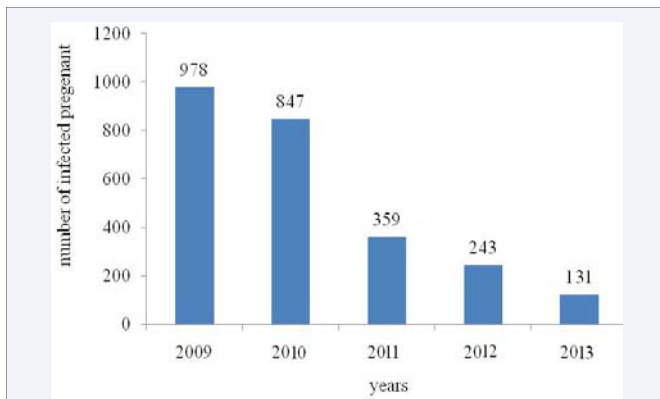


Figure 2 Malaria prevalence report among infected pregnant women from 2009-2013 in Pawe Hospital, Northwest Ethiopia.

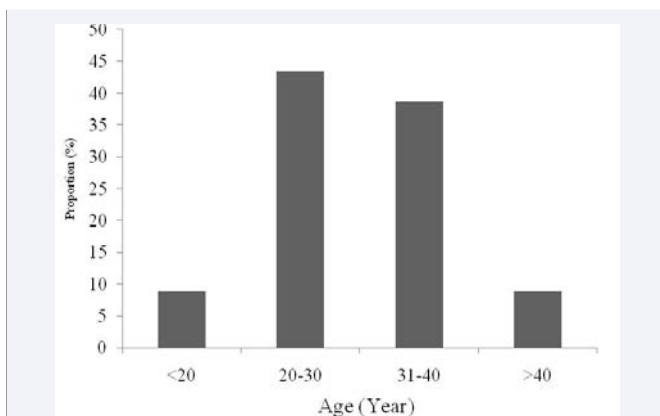


Figure 3 Proportion of malaria infected pregnant women with respect of their age, Pawe Hospital, Northwest Ethiopia.

complications were observed in *P. vivax* mono-infected pregnant women. These were, severe anemia (n=2), prostration (n=5), confusion (n=5), respiratory distress (n=1), and hemoglobinuria (n=1) (Table 4).

The analysis made on association between malaria symptoms and trimester showed that most of severe malaria symptoms observed was not affected by stage of the pregnancy. In pregnant

Table 1: Socio-demographic and clinical characteristics of malaria infected pregnant women (n=124) in Pawe Hospital, Northwest Ethiopia.

Characteristics	Pregnant women
Age (median) (range)	30 (19-46 year)
Mean body temperature (°C)	38.03
Bed net (%)	16.52
BMI (Body Mass Index)	22.07
Vomiting (%)	84 (67.74)
Diarrhea (%)	84 (67.74)
Mean hemoglobin (Hb) level (g/dL)	8.86
Mean hematocrit (HCT) (%)	26.37
Geometric mean parasite count/ $\mu$ L	8234 $\pm$ 2829
Headache (%)	98 (79)
Fever (temp. >37.5°C) (%)	90 (72.58)
History of fever (%)	84 (67.74)
Pre-medication (%)	27 (21.77)
Hyperpyrexia (%)	6 (4.8)

Clinical characteristics of pregnant women with malaria parasites

Table 2: Clinical manifestations and laboratory results of pregnant women (n=124) infected with different Plasmodium species in Pawe Hospital, Northwest Ethiopia.

Characteristics	<i>P. falciparum</i> (n=86) Proportion (%)	Mixed infection (n=26) Proportion (%)	<i>P. vivax</i> (n=12) Proportion (%)
Temperature (°C)	38.11	38.04	38.21
Vomiting	50 (40.32)	24(19.35)	10(8.06)
Diarrhea	53(42.74)	25(20.16)	6(4.8)
Hb (g/dL)	8.9	9.0	8.8
Geometric mean parasite/ $\mu$ L	11,984 $\pm$ 4481	7576 $\pm$ 5833	3789 $\pm$ 3649
BMI (kg/m <sup>2</sup> )	22.07	21.89	23.05
HCT (%)	26.37	26.70	26.41
Chill rigor	42 (33.87)	21(16.93)	10(8.06)
Nausea	40 (32.25)	24 (19.35)	10(8.06)
Abdominal pain	36 (29.03)	20(16.13)	10(8.06)
Self-medication	20 (16.13)	7(5.6)	0

**Table 3:** The predictive value of some clinical symptoms for *P. falciparum* malaria infection among pregnant women (n=124) in Pawe Hospital, Northwest Ethiopia.

Symptoms	Proportion (%)	OR (95% CI)	P. value
Vomiting			
• Yes	66 (53.22)		
• No	58 (46.8)	0.14 (0.045-0.45)	0.001
Diarrhea			
• Yes	46 (37.1)		0.035
• No	78 (62.9)	0.337 (0.12-0.925)	
Headache			
• Yes	122 (98.4)		0.193
• No	2 (1.6)	7.29 (0.37-149.46)	
History of fever			
• Yes	84 (67.74)	0.89 (0.29-2.7)	0.836
• No	40 (32.26)		
Fever			
• Yes	90 (72.58)	0.35 (0.08-1.58)	0.173
• No	54 (43.55)		
Prostration			
• Yes	49 (39.5)	0.285 (0.104-0.783)	0.015
• No	75 (60.48)		

**Table 4:** Frequency of severe malaria in the study area among *P. falciparum* infected pregnant women, Pawe Hospital, Northwest Ethiopia.

Characteristics	<i>P. falciparum</i>	Proportion (%) <i>P. vivax</i>
Severe anemia	15 (17.44)	2 (16.67)
Hyperparasitemia	41 (46.67)	0 (0)
Prostration	25 (29.09)	5 (41.67)
Confusion	14 (16.28)	5 (41.67)
Respiratory distress	5 (5.8)	1 (8.3)
Hemoglobinuria	8 (9.3)	1 (8.3)
Comma	4 (4.65)	0 (0)

women at different trimester significant differences in incidence of prostration, respiratory distress, hemoglobinuria, confusion, comma, and severe anemia were not observed ( $P>0.05$ ). While hyperparasitemia was significantly higher ( $P=0.016$ ) among pregnant women found in third trimester (data not given).

## DISCUSSION

Currently the malaria burden has declined worldwide in the past few years (WHO, 201). The main reason for the reduction could be the expanded key vector control interventional strategies; availability of diagnostic tests at most malaria endemic areas and effective treatment with combination therapy (ACT) [8,9]. However, the trend has not been equally attained in all parts of the world. Likewise, even if the reduction pattern is true in Ethiopia in some parts still malaria is a major public health problem, mainly among biologically risked groups. Accordingly, the five year prevalence report from the study site (Pawe

hospital), malaria positive cases showed a pattern of reduction. However, the current proportion of malaria infected pregnant women observed were much higher (16.3%) compared to the same country in Guba, southern part of Ethiopia (1.4%) [4].

Malaria is a deadly disease to all human races. But, those at highest risk biologically are infants and young children (from six months to five years) due to their underdeveloped immunity and pregnant women, as their immunity reduce during malaria infection. Thus, in these groups of population besides death, mainly in pregnant women it causes increased risk of abortion, stillbirth, premature delivery and low-birth weight infants [10,11]. Thus, in areas where infectious diseases like malaria is a major problem, good surveillance system is essential to identify most at-risk populations and geographical areas and to assess trends and impact of the interventions [7].

Some of severe malaria complications such as hemoglobinuria, hyperpyrexia, prostration and hyperparasitemia were high among malaria infected pregnant women [12]. In other report from Ethiopia, cerebral malaria, convulsions, altered mental state and prostration were among the common manifestations of severe malaria symptoms observed in pregnant women [13,14] was also reported that, severe anemia and jaundice had been observed as the presenting manifestations of severe *P. falciparum* malaria in pregnant women in central and eastern Sudan [13]. In line to the above reports, frequency of malaria associated to *P. falciparum* severe malaria complications documented in pregnant women were severe anemia, hyperparasitemia, prostration, and confusion.

Pregnant women assessed in this study had comparable prevalence of severe anaemia, hyperparasitemia, and respiratory distress to report of Ali et al. [15], where hyperparasitemia, and severe anemia were the most common symptoms associated to *P. falciparum* and *P. vivax* malaria observed among pregnant women. It is well known that *P. falciparum* is generally accepted as a leading cause of anemia in pregnant women [16]. It is estimated that anemia causes as many as 10 000 maternal deaths each year [17]. However, despite the dangerous impact of malaria on pregnant women and their infants, it is estimated that less than 5% of pregnant women have access to effective interventions.

The symptoms and complications of malaria in pregnancy vary depending of transmission intensity and the level of acquired immunity of the individual [7]. In high-transmission settings, where levels of protective immunity tend to be high, *P. falciparum* infection is usually asymptomatic in pregnancy [7]. Although, parasites may be present and contribute to maternal anemia even in the absence of peripheral parasitemia. In low-transmission settings, where women of reproductive age have relatively low protective immunity, malaria in pregnancy is associated with anemia, an increased risk of severe malaria, and it may lead to spontaneous abortion, stillbirth, and prematurity and low birth weight [7]. Different studies suggested that pregnant women are more likely to suffer (3 times) from severe disease caused by malaria and 50% of mortality compared with their non-pregnant counterparts [1,18,19]. Immuno-suppression state of pregnancy and sequestration of infected RBC to placental are considered as the major reasons for higher risk of pregnant women to the diseases [20]. The observed high rate of severe

malaria among the assessed pregnant women has implication for their high vulnerability.

Although bed net is unquestionable tool of malaria vector control and widely applicable in most malaria endemic areas of the country, in the current study site its distribution and utilization was very limited. This situation could be among the most important factor responsible for still higher prevalence of malaria in the study area, when the current trend of malaria infection dramatically dropped in most malaria endemic area of Ethiopia.

## CONCLUSION

Although malaria prevalence is decreasing due to intensive intervention approaches in the country, clinical data showed that, malaria is still a major health concern in the study area. Severe malaria complications associated with *P. falciparum* and *P. vivax* such as respiratory distress, hyperpyrexia, comma, hepatomegaly, splenomegaly, hemoglobinuria was observed in a number pregnant women studied. Thus, early detection of infected cases and implementation of effective treatment should be in practice to reduce the burden of malaria. Furthermore, increasing understanding of the community on prevention and control measure of the disease, on clinical symptoms of malaria and early seeking medication should be emphasized.

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