

Full Length Research Paper

Malaria in pregnancy in the Ndop health district (North West Region, Cameroon): results from retrospective and prospective surveys

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Malaria is a life-threatening parasitic disease that is entirely preventable and curable. Pregnant women are among the most vulnerable groups to this deadly disease. Increased efforts towards prevention and control of the disease have led in drastic reduction in mortality rates by 54% in the world health organisation (WHO) African Region. However, the widespread implementation of WHO policies remains highly challenging and the disease still persists despite the efforts of control programmes and stakeholders. The objective of the present study was to capture the situation of malaria during pregnancy in the Ndop health district (North West Region, Cameroon), and assess the knowledge, attitudes and practices of pregnant women regarding this killer disease. Retrospective data was then collected between April and November, 2013 in all public and private health facilities' registers of the Ndop health district, and pregnant women attending the Ndop district hospital interviewed about their knowledge, attitudes and practices regarding malaria. A total of 1,080 pregnant women, aged 14 to 46 years old attended the seven health facilities of the Ndop health district. The prevalence of *Plasmodium falciparum* infection in pregnant women was 19.3% (95% CI: 17.0 to 21.7%), with similar trends between age groups and periods (month) of health facility attendance, indicating a stable transmission throughout the period of performance of the survey. Also, different patterns in malaria transmission were observed between rural and urban areas, with huge infection rates in rural settings. Pregnant women were aware of the malaria prevention methods, the persistence of the infection suggesting that the WHO policy to defeat malaria is not fully applied.

Key words: Malaria, *Plasmodium falciparum*, pregnant women, KAP, Ndop, North West, Cameroon.

INTRODUCTION

Malaria is a life-threatening parasitic disease caused by five *Plasmodium* species: *Plasmodium falciparum*,

Plasmodium vivax, *Plasmodium malariae*, *Plasmodium ovale* and *Plasmodium knowlesi*, and transmitted to

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human by mosquito vectors. Although *P. falciparum* and *P. vivax* are the most widespread species, *P. falciparum* is the most deadly. Known as the malaria parasite in monkeys, *P. knowlesi* was recently identified as the one responsible of some human cases of malaria (WHO, 2015a). Pregnant women are among the most vulnerable groups to this parasitic disease. Malaria in pregnancy consists in having a positive diagnosis of malaria during pregnancy, and is associated with maternal anemia, prematurity, intra-uterine growth retardation, and low birth weight (Luxemburger et al., 2001; Kamuliwo et al., 2015). *P. falciparum* infection, which occurs predominantly in Africa, is associated with maternal illness and is one of the most important determinants of low birth weight (Menendez, 1995).

World health organisation (WHO) latest estimates reported about 198 million cases of malaria in 2013, with an estimated 584,000 deaths (WHO, 2015a). About twenty-five million pregnant women were at risk for malaria, the latter accounting for over 10,000 maternal and 200,000 neonatal deaths per year (Schantz-Dunn and Nour, 2009).

In Cameroon, malaria is endemic in the 10 regions, with an estimated prevalence of 29% (Mangham et al., 2012). According to the 2011 demographic and health survey, this infection is responsible of 40 to 45% of medical consultations, 30% of hospitalisations, and 24% (5% in pregnant women) of death in hospitals. Also, malaria is the cause of 26% of work absences, and 40% of household health expenses.

To reduce the burden of the disease, increased efforts towards prevention and control have been recommended. For malaria in pregnancy in particular, WHO recommends three evidence-based package of interventions for the prevention and treatment of the disease including long-lasting insecticidal nets (LLINs), intermittent preventive treatment in pregnancy (IPTp) with sulfadoxine-pyrimethamine (SP) in areas of stable malaria transmission of sub-Saharan Africa, and prompt diagnosis and effective treatment of malaria infections (WHO, 2015b). The implementation of these interventions has resulted in dramatic reduction in malaria mortality rates by 54% since the years 2000 in the WHO African Region (WHO, 2015a). Indeed, the assessment of the trends in malaria prevalence over seven years in a health centre of the North West Cameroon have shown a very fluctuating pattern, with higher decrease observed after implementation of insecticide treated net distribution (Ndong et al., 2014). However, the widespread implementation of effective programmes remains highly challenging. Indeed, many African women living in remote areas for example have limited access to medical care and effective malaria control tools such as LLINs (Marchesini and Crawley, 2004). Also, most high-burden countries are not capturing essential malaria data on a continuing basis, making it difficult to optimize interventions, assess disease trends

and respond to outbreaks. Consequently, the disease still persists despite efforts of control programmes and stakeholders. The World Health Assembly then recently adopted a new comprehensive strategy to help endemic countries reduce global malaria incidence and mortality rates by at least 90% by 2030 (WHO, 2015c).

The objective of this present study was to capture the situation of malaria in pregnancy in the Ndop health district (North West Region, Cameroon), and assess the knowledge, attitudes and practices of pregnant women regarding this deadly disease.

MATERIALS AND METHODS

Study area and population

The Cameroon health system has a pyramidal structure with central, intermediate (regional) and peripheral (district) levels. Health districts are implementation units for all health interventions. Each health district is divided into health areas which are further divided into communities or villages targeted for interventions. At the outset of this study, 181 health districts were operational in the entire country, among which 19 were enumerated in the North West Region.

The study was conducted in the Ndop health district (6°00'00" N and 10°25'00" E), especially in the health areas belonging to the Ndop central subdivision (Ngo-Ketunjia Division, North West Region, Cameroon). Then, amongst the 15 health areas constituting the Ndop health district, four (Bamali, Bambalang, Bamessing and Bamunka where the Ndop town - capital of the Ngo-Ketunjia Division - lies) were included in the study. According to the Ndop district hospital statistics department, the total population of the health district is estimated at 80,804 inhabitants, the head count being equal to 7,877 people in the Bamali health area, 16,670 individuals in the Bambalang health area; 18,753 individuals in the Bamessing health area and 37,504 inhabitants in the Bamunka health area. The demographic and health survey conducted in Cameroon in 2011 has revealed an average fertility rate (4.4) in the North West Region, with 6.9% of women aged 15 to 49 years of age pregnant during the 36 months of the performance of the survey. The main activity of the population is agriculture, especially rice, maize and oil palm farming. Habitats are made up of mud bricks, usually with food gardens around houses.

The climate prevailing in the Ndop health district is of equatorial type, and it is further divided into two seasons: a short dry season from November to March, during which the maximum average daily temperature is 30°C, and little or no precipitation is recorded; a long rainy season from March to November, with peaks in July and August. The maximum daily temperatures vary between 24°C and 25°C, the highest precipitation records ranging from 217 to 273 mm. The Ndop health district then belongs to an endemic and perennial transmission zone for malaria. The North West is among the most painstaking Regions of Cameroon regarding WHO policy to reduce the burden of malaria. Indeed, to shift away from presumptive treatment, the standard diagnostics (SD) *BioLine Malaria Antigen Pf/Pan* rapid diagnostic tests (RDT) is systematically used, and microscopy conducted to confirm the presence or absence of parasites. A recent survey indicated that 56.2% of pregnant women received IPTg (55.7% during antenatal clinic), and 30.0% had received at least two doses of sulfadoxine-pyrimethamine. Also, 40.0% of women slept under LLINs or in household submitted to indoor residual spraying (IRS) with insecticides (DHS-MICS, 2012).

Study design

All public and private health facilities of the Ndop health district (Bamali Integrated Health Centre, Bamessing Integrated Health Centre, Bamunka Integrated Health Centre, Bamunka Rural Health Centre, Bamalang Medicalized Health Centre, Saint John Catholic Health Centre and Ndop District Hospital) were included in the present survey. Retrospective data were collected from health facilities' registers between April and November 2013. In each register, the information regarding the number of pregnant women who attended the antenatal clinic in each of the seven health facilities, their age as well as the period (month) of their visit were recorded. The number of pregnant women who tested positive for *P. falciparum*, either by the standard diagnostics (SD) *Bioline Malaria Antigen Pf/Pan* RDT or microscopy, was also recorded for the prevalence study. These retrospective data were collected by one investigator (ENM), and cross checked, for the Ndop district hospital, by another investigator (LS). To complement these prevalence data and better capture the situation of malaria in the study area, a quick knowledge, attitudes and practices (KAP) survey was conducted. In brief, a questionnaire was administered to pregnant women attending the antenatal clinic in the Ndop district hospital during the period of retrospective data collection. Information regarding age, occupation, knowledge and usage of malaria prevention methods were collected on a survey form.

Data analysis

All relevant data regarding malaria and pregnancy collected from prescription registers as well as KAP survey forms were recorded into a purpose-built Microsoft Excel database and subsequently exported into *PASW Statistics* version 18 (SPSS Inc., Chicago, IL, USA) for statistical analysis. Malaria prevalence was expressed as the percentage of *P. falciparum* infected pregnant women among the total number of pregnant women who attended the health facility; the percentage proportions of different indicators of knowledge, attitudes and practices of pregnant women regarding malaria were also calculated. The 95% confidence intervals (CI) of these percentages were calculated using the Wilson method not corrected for continuity (Wilson, 1927; Newcombe, 1998). Pearson's Chi Square test was used to compare *P. falciparum* infection prevalence between age groups, health facilities and the months during which the health facilities were visited by the pregnant women, as well as the percentage proportions of different indicators of knowledge, attitudes and practices of pregnant women regarding malaria, according to their age and occupation. The threshold for significance was set at 5% for all tests.

Ethics statement

The present study was approved by the Faculty of Science of the University of Bamenda and the Ndop District Medical Officer. Each pregnant woman record was attributed an individual code to insure the privacy and confidentiality of personal information as well as anonymous data analysis.

RESULTS AND DISCUSSION

A total of 1,080 pregnant women, aged 14 to 46 years old, attended the seven health facilities included in the

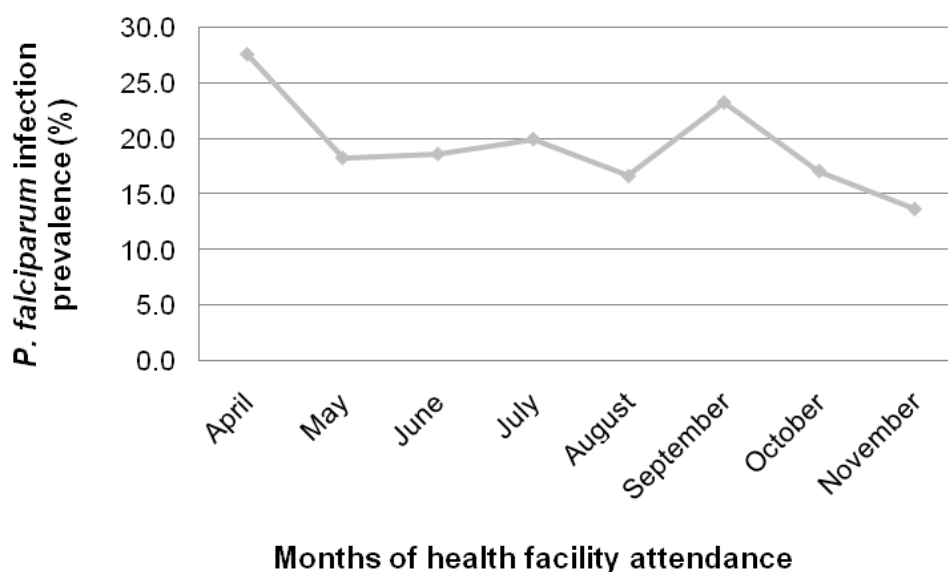
present survey between April and November, 2013 (Table 1). The proportion of pregnant women harbouring *P. falciparum* in Ndop health district was 19.3% (95% CI: 17.0 to 21.7%), significantly lower ($p < 0.0002$) than the malaria prevalence reported in the general population across Cameroon (29.0%; 95% CI: 22.0 to 36.0%) (Mangham et al., 2012), or in febrile patient attending the Mbakong health centre in the North West Region of Cameroon (29.3%; 95% CI: 27.9 to 30.7%) (Ndong et al., 2014). One would have expected higher *P. falciparum* prevalence in this high risk group; however, it should be mentioned that in our survey, the pregnant women were in general asymptomatic, visiting the health facilities during regular antenatal clinic. It was shown that in high-transmission settings where levels of acquired immunity tend to be high, *P. falciparum* infection is usually asymptomatic in pregnancy. Yet, parasites may be present in the placenta and contribute to maternal anaemia even in the absence of documented peripheral parasitaemia (WHO, 2015b). This relatively low prevalence can also be explained by the observance of WHO policies to defeat this killer disease. Indeed, recent demographic and health surveys conducted in Cameroon have shown that the North West Region was among the most committed Regions of Cameroon in the fight against malaria (DHS-MICS, 2012). Also, the result of the quick KAP survey conducted in the Ndop district hospital indicated that all the pregnant women attending the antenatal clinic were aware of at least one preventive intervention against malaria, most of them using LLINs (79.4%; 95% CI: 67.8 to 87.5).

Table 1 summarizes the proportion of pregnant women harbouring *P. falciparum* according to their age group or health facility visited. No significant difference was found between age groups (chi square: 4.34; p : 0.114), indicating that the exposition to the infection was even among age groups. However, the proportion of pregnant women harbouring *P. falciparum* was significantly higher ($p < 0.02$) in Bamunka Rural Health Centre, Bamali Integrated Health Centre and Bamalang Medicalized Health Centre as compared to the other health facilities of the Ndop health district. It is believed that malaria is much more acute in the rural areas, the absence of urbanization representing an important collateral risk factor (Alemu et al., 2011; Govoetchan et al., 2014). However, all kind of development might not necessarily lead in the reduction in malaria prevalence. Indeed, under the Upper Nun Valley Development Authority (UNVDA), one assisted in the introduction of heavy machinery in the development of rice fields and drainage channels in Bamali which would have favour the installation of breeding sites and the development of malaria vectors. According to the month during which pregnant women visited the health facilities, a wide fluctuation in *P. falciparum* prevalence was observed (Figure 1) but no significant difference found (chi square: 10.99; p : 0.139). This result indicated a stable transmission of malaria

Table 1. Percentage prevalence of *P. falciparum* infection in pregnant women according to their age group and the health facility visited.

Variable	No pregnant Women attending the health facility	Percentage prevalence (95%CI)	Chi square	p-value
By age group (years)				
14 - 25	616	19.8 (16.9 - 23.1)	-	-
25 - 36	362	16.6 (13.1 - 20.8)	-	-
36 - over	102	25.5 (18.0 - 34.7)	-	-
By health facility				
Bamali integrated health centre	51	54.9 (41.4 - 67.7)	-	-
Bamessing integrated health centre	29	13.8 (5.5 - 30.6)	-	-
Bamunka Integrated health centre	320	13.1 (9.9 - 17.3)	-	-
Bamunka rural health centre	42	61.9 (46.8 - 75.0)	-	-
Bambalang medicalized health centre	80	31.3 (22.2 - 42.1)	-	-
Saint John catholic health centre	382	13.4 (10.3 - 17.1)	-	-
Ndop district hospital	176	18.2 (13.2 - 24.5)	-	-
Overall	1,080	19.3 (17.0 - 21.7)	115.19	< 0.0001

No: Number of; 95% CI: 95% confidence interval.

**Figure 1.** Percentage prevalence of *P. falciparum* infection in pregnant women according to month of health facility attendance during the year 2013.

during the period of performance of the survey. Although the data were collected only for the period spanning from March to November, 2013 (rainy season) and might not be used to support perennial transmission of malaria, the Ndop health district belongs to the western plateau of Cameroon, with 7 to 12 months of rainfall, where endemic and perennial transmission of malaria prevails (Ndong et al., 2014). Although, rainfall is among the high risk factors for malaria transmission and it is associated with abundance of the vector (Galardo et al., 2009), as reported in another previous studies by Protopopoff et al. (2009) and Gardner et al. (2012), this study also

demonstrated the opposite in which malaria prevalence was lower among pregnant women for the month of August which is the peak of rainfall.

As regards to the KAP survey, a total of 63 pregnant women (37 housewives, 12 farmers, 7 civil servants, 6 traders and 1 student), aged 17 to 39 (median: 25) years old were interviewed during their clinic day in the Ndop district hospital. All of them (either residing in or visiting the Ndop town) were aware of adequate methods to prevent malaria, including LLINs (79.4%; 95% CI: 67.8 to 87.5), hygiene and sanitation (9.5%; 95% CI: 4.4 to 19.3), insecticides (6.3%; 95% CI: 2.5 to 15.2) and drugs (4.8%;

95% CI: 1.6 to 13.1) (Chi square: 65.13; $p < 0.0001$). Almost all interviewed pregnant women declared having been informed during antenatal clinics by physicians or nurses (87.3%; 95% CI: 76.9 to 93.4), the small remaining fraction being aware of these preventive interventions via medias (TV and radio) (Chi square: 24.92; $p < 0.0001$). The results of this KAP survey, together with the persistence of malaria during pregnancy, might indicate that the WHO recommendations were not fully applied as hypothesised in the World Health Assembly report (WHO, 2015c). Further studies are of high interest to identify the reasons of the persistence of malaria in pregnancy despite the control efforts deployed, and investigate the determinants of the observance of these recommendations in the Ndop health district.

LIMITATIONS OF THE STUDY

Although this study is of high interest, it has some limitations in capturing more accurately the situation of malaria in pregnancy in the Ndop health district (North West Region, Cameroon): data were collected only during the rainy season (March to November) and as such, cannot allow concluding about the perennial transmission of malaria; the clinical presentation of the disease was not assessed, rendering it impossible to distinguish between clinic malaria and asymptomatic carriers of *P. falciparum*; despite rigorous data cleaning and cross check, retrospective data are usually prone to flaws, notably potential misreporting by health centres which may underestimate true prevalence of malaria in pregnancy in the Ndop health district; more covariates (environmental and demographic data) would have been necessary to evaluate the risk factors associated with malaria in pregnancy; the sample size - especially for the KAP survey - was low, not allowing accurate estimations of the knowledge, attitudes and practices of pregnant women regarding malaria prevention.

Conclusion

This study reveals that *P. falciparum* infection rate is low amongst pregnant women attending the antenatal clinics in the Ndop health district. Similar infection rates were observed across the survey period, indicating a stable transmission. This study also confirms that malaria transmission showed different patterns between rural and urban areas, with higher infection rates in rural settings. A quick KAP survey organized in the Ndop district hospital has shown that pregnant women were aware of malaria prevention methods, the persistence of infection indicating that the WHO policy to defeat malaria is not fully applied.

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Conflict of interest

The authors have none to declare.

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