Prevalence of laboratory confirmed malaria and associated factors among pregnant women at the Ebolowa Regional Hospital Centre (ERHC), Cameroon

Prévalence du paludisme confirmé en laboratoire et facteurs associés chez les femmes enceintes au Centre hospitalier régional d'Ebolowa (ERHC), Cameroun

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Abstract

Introduction: Malaria infection in pregnancy remains a major public health problem in Sub-Saharan Africa. Several studies have been conducted on this subject in Cameroon, but none to date in the South region of Cameroon. The objective of our study was to determine the prevalence of malaria and associated factors among pregnant women at the Ebolowa Regional Hospital Centre.

Methodology This was a hospital based cross-sectional study with an analytical component conducted over a 6 months period from July 1st 2024 to January 1st, 2025, at the Ebolowa Regional hospital Centre(ERHC). We included all pregnant women who underwent a malaria diagnostic thick blood smear during the study period. Data was collected using a previously tested and validated questionnaire. Association between independent and dependent variables was determined using the Chi square test and those significantly associated with positive malaria thick smear were used for multivariate analysis.

Results We included 306 pregnant women. The prevalence of malaria was 65.5%.. The mean age of participants was 26.5± 3.2 years. In a multivariate analysis not using insecticides treated nets (AOR ;2.5 CI 1.5- 4.5; p < 0.001), non-intake of sulfadoxine pyrimethamine prophylaxy (AOR ;1.7 CI 1.0- 2.8; p = 0.04), and living in a rural area (AOR ;2.1 CI 1.3- 3.4; p < 0.005) were the independent factiors associated to malaria in pregnancy

Conclusion :The prevalence of malaria among pregnant women was quite high in our study compared to other studies, suggesting the need to intensify awareness and fight against malaria during pregnancy in this zone.

Key words; Prevalence, associated factors, Malaria, pregnancy, Ebolowa

Introduction

Malaria remains a major health problem for it is a life threatening parasitic infection caused by a protozoa plasmodium transmitted by the female anopheles mosquito endemic in Sub Saharan African, South-East Asia, and parts of latin America [1]. There are five different human malaria species *P.Falciparum, P. vivax, P. malariae, P. Knowlesi and P. Ovale.* [1]. Notwithstanding strategies developped by the World Health Organization (WHO) and endemic countries, the prevalence and morbi mortality linked to malaria has increased over the years when considering the WHO 2023 malaria report with an estimated 249 million malaria cases worlwideand compared to 216 million in 2016 and over 600,000 malaria-related deaths worldwide in 2022 compared to 445000 deaths in 2016. Of these cases and deaths, 95% and 96%, respectively, occurred in 29 African countries. [2].

In endemic areas malaria in pregnancy remains significant and its effect on maternal and fœtal well being none negligeable [3,4].The WHO in its 2023 report estimated that 35.4 million pregnancies occurred in 2022, 12.7 million of which (36%) were exposed to malaria infection during pregnancy with the highest rates of exposure observed in Central Africa (40.1 %) [2].

Due to the immunological changes they experience, pregnant women are particularly susceptible to malaria [5,6]. The prevalence and impact of malaria during pregnancy depend on the intensity of malaria transmission and the availability of preventive measures, as shown by several studies[7-9]. The impact of malaria on maternal and neonatal health is considerable, with maternal complications such as anaemia, cerebral malaria and pulmonary oedema resulting in increased mortality [10-15]. Foetal complications include poor fetal growth, low birth weight and premature delivery [14,15]. Consequently, preventive and therapeutic strategies should be adopted to prevent malaria during pregnancy, such as environmental clean-up,Sulfadoxine intermittent preventive tratment (IPT) and longlasting insecticide spread mosquito nets (LLINs) use. [16-23].

In Cameroon, the rate of malaria-related morbidity during pregnancy has increased, rising from 13% in 2013 to 39 .8% in 2021, despite efforts of the Cameroonian Ministry of Public Health's National Malaria Control Programme, which involved the widespread distribution of longlasting insecticide spread mosquito nets and sulfadoxine-pyrimethamine for intermittent preventive treatment of malaria during pregnancy [24,25]. Many recent Cameroonian studies have shown a high prevalence of malaria. A hospital-based study carried out by Dobgima et al. in 2024 among 380 pregnant women found that 18.4% had a positive malaria rapid diagnostic test (RDT) [8]. Another study by Kuete et al. in Douala in 2024 found that the prevalence of Plasmodium infection was 3.5% and 4.3% by RDT and microscopy, respectively, with the absence of ITN being the major associated factor [4].. Elime et al. (2019) found a malaria prevalence in pregnancy of 39.6% in the Mamfe district and concluded that the presence of bushes around homes and the absence of IPT and ITN were associated with malaria in pregnancy [5]. Unfortunately, to the best of our knowledge, few studies have been published to date on the prevalence and associated factors of malaria in pregnancy in the south of Cameroon, which justifies our study.

Methodology

We carried out a hospital-based cross-sectional study with an analytical component at the Ebolowa Regional Hospital Centre from 1 July 2024 to 1 January 2025. Ethical clearance was obtained from the South Regional Delegation for Public Health, and administrative authorisation was obtained from the Ebolowa Regional Hospital Centre.

Our sampling was consecutive and non-probabilistic and included all pregnant women who came for antenatal clinic during the study period who had given their written concern to be part of the study. All patients already receving a malaria treatment on arrival were excluded.

Data was collected on a daily basis by an investigator. The investigator administered a pre-tested questionnaire comprising sociodemographic data (age, marital status, educational level, profession, religion, area of residence), clinical data (parity, gestational age,past history) and malaria prevention practices such as intermittent preventive treatement and the use of long-lasting insecticides treated nets. After administering the questionnaire, capillary blood samples were collected from pregnant women by a finger prick under standard aseptic conditions. Preparation of Giemsa-stained thick blood films for malaria parasite investigation was done by laboratory technicians an microscopic examination done by two experienced laboratory technicians for quality control measures.All samples positive on microscopy were considered positive for malaria in this study .

Data were entered in microsoft excel and analysed using SPSS statistics version 25 we used Statistical significant association at the bivariate analysis were put in a multiple regression model to adjust for any possible confounders and results presented in the form of Tables, pie charts and graphs. Pearson's $\chi 2$ test was used to compare prevalence of malaria in different groups. Our confidence interval was set at 95% for a significance threshold of $p< 0.05$. Adjusted Odds Ratio (AOR) with 95% confidence interval (CI) was used as a measure of association.

Results

During the study period a total of 315 pregnant women were received. 7 were already receiving a malaria treatment and 2 refused to give a written concern to take part in the study.A total of 306 prenant women were included. The mean age of participants was 26.5± 3.2 years. Most of our participants lived in the urban area (n=201 ,65.7%), had a secondary level of education (n=129, 42.2%), were singled (n=216, 70.6%) and aged between 21-25 years (n=120, 39.5%) as shown on **Table 1**.

Table 1 ; Sociodemographic characteristics of pregnant women diagnosed for malaria at the Ebolowa Regional Health Center

Characteristics	Modality	Frequency (N= 306)	Proportion (%)
Area of residence	Urban area	201	65.7
	Rurale area	105	34.3
Level of education	Primary	101	33

	Secondary	129	42.2
	Higher education	61	19.8
	Non scolarised	15	5
Marital status	Maried	90	29.4
	Single	216	70.6
Age groups	15-20	45	14.7
	21-25	120	39.5
	26-30	72	23.1
	≥31	69	22.7
Occupation	Housewife	117	38.2
	Public sector	63	20,5
	Private sector	91	29,9
	Student	35	11 .4

Considering their clinical characteristics They were mostly enrolled in the first trimester(70%) of pregnancy and were primigravida (63.7%).More than half , 65.7% (201/306) of the pregnant women declared not having a longlasting insecticide treated mosquito net prior to pregnancy and 63.5% (194/306) had not yet taken IPT. Amongs those having LLINs, 60% declared haven received a LLINs from hospital during ANCs ,10% by a community health worker (CHW), and 30% bought theirs from a pharmacy or market place. (**Table 2)**

Table 2 : Clinical characteristics of pregnant women diagnosed for malaria at the Ebolowa Regional Health Center

Characteristics	Modality	Frequency (N= 306)	Proportion(%)
Gestation period	First trimester	214	70.0
	Second trimester	50	16.3
	Third trimester	42	13.7
Gravidity	Primigravida	195	63.7
	Multigravida	111	36.3
IPT	YES	112	36.5
	NO	194	63.5

LLIN possession	YES	105	34.3
	NO	201	65.7
LLIN Usage	Every day	40	13.0
	Once in a while	50	16.3
	Seldom	15	04.9
	Not use	201	65.7
Source or LLIN	Hospital		60.0
	Community		10.0
	Purchased		30.0
	Not use		
Presence of mosquito breeding sites	132		43.5
	174		56.5

IPT= Intermittent preventive treatment LLIN= Long lasting insecticide impregnated nets

In our study 200 pregnant women out of 306 had va positive thick smear malaria giving a prevalence among pregnant women at the Ebolowa regional health center of 65.5% (95% CI :60.50-86.52) .On bivariate analysis , being a Single pregnant women(OR ;1.8 CI 1.1- 3.1; p < 0.003) , living in a rural area(OR ;4.3 CI 2.3- 5.4; p < 0.05) , having a secondary level of education(OR ;1.7 CI 1.1- 2.8; p < 0.003) , not using long lasting insecticides treated nets(OR ;3.8 CI 3.1- 4.8; p = 0.03) and not haven taken sulfadoxine-pyrimethamine malaria intermittent preventive treatment (OR ;2.2 CI 1.0- 4.1; p < 0.003), were found as statistically significant factors linked to malaria in pregnancy. (**Table 3).**

Table 3 ; Bivariate analysis for associated factors to malaria in pregnancy among pregnant women followed at the ERHC

Independent variable	**Modality**	**Positive N=200 n(%)**	**Negative N=106 n(%)**	**OR (95% CI)**	**P-value**
Area of residence	Urban area	109(54.5)	92 (86.8)	1 (référence)	-
	Rural area*	91(45.5)	14(13.2)	4.3 (2.3-5.4)	< 0.05
Level of education	Primary	61(30.5)	40 (37.8)	0.9 (0.8-2.2)	0.25

	Secondary*	91(55.8)	38(36.0)	1.7 (1.1-2.8)	<0.003
	Higher education	40(16.9)	21(19.8)	0.7 (0.6-1.9)	0.21
	Not scolarised	8 (04.0)	07(02.6)	1 (référence)	
Marital status	Married	53(26.5)	37(34.9)	0.78 (0.7-2.1)	0.52
	Single*	147(73.5)	69 (65.1)	1.8 (1.1-3.1)	<0.003
Age group	15-20	25(12.5)	20 (18.9)	1 (référence)	-
	21-25	80(40.0)	40(39.0)	1 (référence)	
	26-30	42(21.0)	30(28.3)	0.8 (0.1-1.3)	0.71
	≥31	37(18.5)	32(30.1)	0.5 (0.3-2.0)	0.43
Occupation	Housewife	76(38.0)	41(38.6)	1 (référence)	-
	Public sector	38(19.0)	25(23.5)	0.6 (0.4-0.9)	0.66
	Private sector	60(30.0)	31(29.2)	1 (référence)	0.34
	Student	26(13.0)	9(08.5)	1.6(1.3-2.7)	0.09
Gravidity	Primigravida	120(60.0)	75(70.8)	0.7 (0.3-1.1)	0.07
	Multigravida	80(40.0)	31(29.2)	2.7 (2.1-3.6)	0.61
IPT	Yes	31(15.5)	81(76.4)	0.3 (0.1-0.9)	0.31
	No*	169(84.5)	25(23.6)	2.2 (1.0-4.1)	<0.003
Possession of LLINs	Yes	56(28.0)	49(46.2)	0.8 (0.1-1.6)	0.66
	No*	144(72.0)	57(53.8)	3.8 (3.1-4.8)	0.03
Presence of Mosquito breeding sites	Yes	76(38.0)	56(52.8)	0.6 (0.1-0.9)	0.71
	No	124(62.0)	50(47.2)	1.3 (1.1-3.1)	0.08

IPT= Intermittent preventive treatment LLIN= Long lasting insecticide impregnated nets

CI= Confidence interval * Significant P value

To reduce confounding factors and determine which factor best explained malaria in pregnancy associations found to be statistically significant ($p<0.05$) in bivariate analysis were included in a multivariate logistic regression.We found that not using long lasting insecticides treated nets (AOR ;2.5 CI 1.5- 4.5; $p < 0.001$), non-intake of sulfadoxine pyrimethamine malaria intermittent preventive

treatment ((AOR ;1.7 CI 1.0- 2.8; p = 0.04), and living in an rural area (AOR ;2.1 CI 1.3- 3.4; p < 0.005) were the independent factiors associated to malaria as shown on **Table 4.**

Table 4 : Covariates of developping malaria in pregnancy in a Multivariate analysis at the ERHC

Characteristics	AOR	95% CI	P-value
Area of tresidence Rural area*	2.1	1.3 -3.4	<0.005
Marital Status Single	1.8	1.1-3.1	0.13
LLINs Usage No*	2.5	1.5- 4.1	< 0.001
IPT No	1.7	1.0-2.8	0.04

IPT= Intermittent preventive treatment ;LLIN= Long lasting insecticide impregnated nets

AOR= Adjusted odd ratioCI= Confidence interval* Significant P value

Discussion

Malaria during pregnancy poses a health risk to pregnant women in endemic zones such as Cameroon, as it increases the risk of poor maternal and foetal outcomes[4,5] . Many studies have been carried out in Cameroon on the prevalence and associated risk factors of malaria during pregnancy [4,5,8], but few, to the best of our knowledge, have been conducted in the south of the country, which is characterised by a tropical rainforest climate and diverse geography, including a coastline, rivers and dense forests.The region's humid equatorial climate provides ideal conditions for mosquito breeding and malaria transmission, hence a high malaria prevalence zone [20]. Our aim was therefore to determine the prevalence of laboratory-confirmed malaria and its associated factors among pregnant women at the Ebolowa Regional Hospital Centre (ERHC), the main referral hospital in the south of Cameroon.

Prevalence of Laboratory confirmed malaria

We found a very high prevalence of malaria (65.5%) among pregnant women attending antenatal care (ANC) at the ERHC. Although this is surprising given the efforts made by Cameroon's National Malaria Control Programme, the results are in line with those obtained by Bamou et al. in a community-based study on knowledge, attitudes and practices regarding malaria in the South Region of Cameroon, in which 63.9% of the general population had malaria, with a prevalence of 48.7% among pregnant women [20]. This

similarity could be linked to the fact that the South Region experiences malaria transmission throughout the year, and according to the 2023 Cameroon Malaria Survey Indicator, the South Region has the third highest malaria incidence rate in Cameroon, at 111 cases per 1000 inhabitants, after the Centre and East Regions [24].. According to the same survey, access to mosquito nets is lowest in the South region of Cameroon, with only 52% of households sleeping under LLINs. This is consistent with our study, in which only 34.7% of women reported owning and regularly sleeping under LLINs . Ntonifor et al. also found a high malaria prevalence in Bambili (70.7%), as did two studies in Nigeria (59.9%; 58%)[26,27]. Conversely, many studies have found a lower malaria prevalence, for example in some parts of Cameroon (18.4%, 5.5% and 35.5%) [4,5,8], Ethiopia (10.2 %) [28] and Guinea (14%) [9]. Different study designs, settings, levels of urbanisation and time periods could possibly explain this discrepancy. Nevertheless, the clinical characteristics of our participants could explain the high prevalence, as most (70%) were attending their first antenatal care appointment and had not taken intermittent preventive treatment (IPT) (73.5%).

Associated factors- bivariate analysis

In a bivariate analysis, single pregnant women and those living in rural areas were respectively 2 and 4 times more likely to have malaria during pregnancy than others. These results are consistent with those obtained by Hadidja et al. in Guinea and Dohbgima et al [8,9]. These studies support the idea that single women lack community support, resulting in late initiation of antenatal care and inadequate prophylaxis, leading to a high prevalence of obstetrical complications. Rural areas have many mosquito breeding sites, resulting in higher exposure to malaria parasites.

Our study also found that a lack of use of vector-targeting strategies, such as long-lasting insecticide-treated nets (LLINs), leads to an increased risk of malaria during pregnancy. Similar observations have been reported by several authors, including Kuete et al. in Cameroon, Gemechu et al. in Ethiopia, and Kabalu et al. in the Democratic Republic of the Congo[4,10,17]. The south of Cameroon suffers from an inadequate distribution of LLINs in health centres, as evidenced by the low availability of LLINs (34. 3%) in our study, an issue previously identified by Bamou et al. in 2022 [20]. The 2023 Cameroon Malaria Indicator Survey also states that the south, alongside the centre and east, has the lowest access to mosquito nets and the Cameroon National Malaria Control Programme is working on various strategies to reduce the malaria burden, including the distribution of LLINs, indoor residual spraying, and seasonal malaria chemoprevention [24,25]. Nevertheless, most of our women were seen in the first trimester for their first antenatal care (ANC) appointment, which could explain the low use of intermittent preventive treatment (IPT) and the low availability of LLINs. Talipou et al. (2019) found high LLIN utilisation among pregnant women, and they explained that self-reporting could overestimate mosquito net use [21]. Several studies have reported high LLIN usage among pregnant women, probably because some were conducted a few months after the distribution of mosquito nets and the patient charecteristics were different from ours, a good exemple being the study conducted in Bamenda where LLINs usage was at 79.2% with most women (94.5%) included in their second and third trimester of pregnancy. [4,5,16,20].

Associated factors multivariate analysis

Multivariate analysis revealed that the absence of malaria chemoprophylaxis with sulfadoxine-pyrimethamine intermittent preventive therapy (IPT) was an independent risk factor for a positive malaria test during pregnancy, a finding consistent with several studies [18,22] On the contrary, Dobgima et al. found no statistically significant association between IPT use and positive Plasmodium falciparum tests[8]. It is well known and recommended that IPT be used following a well-established algorithm to reduce poor fetal and maternal outcomes during pregnancy. Despite efforts to distribute IPT on a large scale, shortages are frequent, contributing to a high malaria prevalence.

Limitations

This hospital based study cannot be generalised to the whole Cameroonian population for it was conducted in one health center without any community based research.The cross sectional study design that we used meant that it was not possible for us to establish a direct temporal relationship. We could ameliorate the sensitivity of our malaria test by combining PCR and microscopy and answers given could not be verified by investigators.

Conclusion

Malaria in pregnancy remains a major public health problem in the South region of Cameroon, as evidenced by its high prevalence (65.5%). Many factors associated with malaria were found as described in the literature, emphasising the need for community-based sensitisation on malaria risk factors, vector-targeting strategies, and the importance of IPT in pregnancy. Furthermore, clinicians receiving women at antenatal clinics should promote IPT and the distribution of long-lasting insecticide-treated nets.Further could focus on the reasons for low LLINs and IPT usage and the prevalencence of malaria per trimester of pregnancy in order to better evaluate the efficiency of established prophylaxies against malaria.

Conflict of interest: The authors declare no conflict of interest

Authors' contribution

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