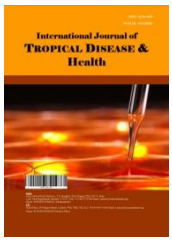

International Journal of TROPICAL DISEASE & Health

42(14): 1-7, 2021; Article no.IJTDH.73089
ISSN: 2278–1005, NLM ID: 101632866

Prevalence of Malaria from Blood Smears: A Four-Year Retrospective Study from the Jean Claude Handrault Hospital, Southern Gabon

Hilaire Moundounga Kenguele[1*], Barclaye Ngossanga[2], Thièry Ndong Mba[1,3], Angélique Kombila[4] and Cyrille Bisseye[1]

[1]Laboratory of Molecular and Cellular Biology, University of Sciences and Techniques of Masuku (USTM), Franceville, Gabon.
[2]Laboratory of Parasitology, Centre de Recherches Médicales de Lambaréné, Gabon.
[3]Laboratory of Research in Biochemistry, University of Sciences and Techniques of Masuku (USTM) Franceville, Gabon.
[4]Jean Claude ANDRAULT Hospital, Mounana, Gabon.

Authors' contributions

This work was carried out in collaboration among all authors. Author HMK designed the study and wrote the first draft of the manuscript. Authors BN and AK collected and analyzed the data. Author TNM conducted the literature searches. Author CB wrote the protocol. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJTDH/2021/v42i1430511
Editor(s):
(1) Dr. Zhiheng Zhou, Harvard medical school, USA and Guangzhou University, China.
Reviewers:
(1) Sankha Bhattacharya, Deemed-to-be University, India.
(2) Edmund Ilimoan Yamba, Kwame Nkrumah University of Science and Technology, Ghana.
Complete Peer review History: https://www.sdiarticle4.com/review-history/73089

Original Research Article

Received 01 July 2021
Accepted 07 September 2021
Published 01 October 2021

ABSTRACT

Background: Malaria remains a public health concern in developing nations despite the reduction of its burden worldwide. In Gabon, the prevalence of malaria has declined in major urban cities due to the implementation of the preventive strategies recommended by the World Health Organization. However, the few studies conducted in rural areas have revealed that malaria still poses threats. The scarcity of data on rural areas of Gabon in general, and the Haut-Ogooué province, in particular, has led us to conduct the present study. The main objective of this four-year retrospective study was to determine the slide positivity rate of malaria at JC ANDRAULT hospital of Mounana, Southern Gabon.

**Corresponding author: Email: hkenguele@gmail.com;*

Methods: Sociodemographic and clinical data from malaria suspected patients were collected from laboratory annual reports and analyzed.
Results: The results revealed a mean annual prevalence of 67.43%, no statistical difference was recorded among the years. The mean malaria cases of female (896) patients were nearly double of that of male patients (467), and patients aged 5-18, and older than 18 were the most affected; both results were found to be statistically significant. Although two peaks malaria cases were recorded during the great rainy season (482) and small dry season (476), the difference among seasons was not statistically significant.
Conclusion: The results of this study revealed that malaria transmission is high in the study area and thus preventive measures should be strengthen and extended to the older patients. This study is the first one to ever report the prevalence of malaria in a rural area of the Haut-Ogooué province.

Keywords: Malaria; slide positivity rate; rural area; southern Gabon; rainy season.

1. INTRODUCTION

Malaria burden has substantially been reduced worldwide since 2000 according the WHO 2016 report [1]. Indeed, the incidence and estimated mortality rates have declined respectively by 21, and 29 % between 2000 and 2015. Moreover, the number of malaria endemic countries has decreased from 108 in 2000 to 91 in 2015. Despite this progress, malaria remains a serious public health problem in sub-Saharan Africa. In 2015, WHO reported that 90% of the malaria new cases (191 millions) and 92% of estimated deaths (394, 000) occurred in Africa. Unfortunately, the majority of these deaths were children under five years old. In 2017, nearly all (99,7%) the malaria cases in the WHO African regions were due to the most prevalent malaria parasite, *Plasmodium falciparum* [2].

In Gabon where *Plasmodium falciparum* is the major Plasmodium species, the incidence rate of malaria has increased by 20 % whereas the estimated mortality rate has decreased by 20% between 2000 and 2015[1]. Studies conducted in Gabon on the prevalence of malaria have mainly been conducted in the major urban cities of Gabon. Maghendji-Nzondo et al**.** conducted two cross-sectional studies in Franceville, the capital city of the Haut Ogooue province [3,4] and reported prevalences of 21.2 % and 22, 23 % by RDT and 18,8 % by thick blood smear in children l< 15 years old.

Studies conducted in different health facilities of Gabon have reported a significant drop in the prevalence of malaria (from 45 to 15%) among children under 11 years old in major urban cities (Libreville, Port-gentil, Oyem) between 2000 and 2008 [5,6].In contrast, studies conducted in two health centers located in rural regions of Dienga and Makokou have reported an increase in the malaria infection between 2003 and 2014 [7,8]. The scarcity of data on the prevalence of malaria in rural regions of the Haut-Ogooué province (southern Gabon) has led us to conduct the present study. The main objective was to determine the prevalence of malaria in Mounana, a rural area of the Haut-Ogooué province between 2012 and 2015.

2. MATERIALS AND METHODS

2.1 Study Site

The study was conducted at the Jean Claude ANDRAULT Hospital of Mounana (Southern Gabon), the only one of the city. This hospital was formerly a property of COMUF, a French mining company that exploited uranium from 1958 to 1999.The city of Mounana covers an area of 36.547 Km^2 with a total population of about 17,443 inhabitants (2017) and is located in the Haut-Ogooué province (1°26' South, 13°06 East) at 53 Km of Franceville, the capital province. The annual average temperature is 24.1°C and precipitation,1102.7 mm. Climate in Gabon is characterized by alternating rainy and dry seasons throughout the year: two rainy seasons (February-May, the great rainy season and October-November, the small rainy season) and two dry seasons (June-August, the great dry season and December-January, the small dry season).

2.2 Study Design

This is a four-year retrospective study (2012-2015) to determine the malaria slide positivity rate by examining annual reports and laboratory registration books at the JC ANDRAULT HOSPITAL.

2.3 Data Collection

Sociodemographic and clinical data were collected from patients suspected of having

malaria. Patients were declared sick based on clinical symptoms and a positive thick blood smears. In total, we examined four (04) annual malaria reports and 4 patient registration books. In the JC ANDRAULT Hospital, the thick blood smear was realized according to the Lambaréné method [9].

2.4 Statistical Analysis

Data were collected from malaria annual reports and patient registration books, entered into Excel spreadsheet, and exported into R for analysis using R-software version 3.6**.** Pearson Chi-square test was used to compare the proportions of different variables and P≤ 0.05 was considered statistically significant. Bargraphs and tables were created in Excel and used to give the overall and the specific trends of malaria prevalence in the last four years

3. RESULTS

3.1 Malaria General Trend during the Study Period

A total of 8,099 thick blood smears from febrile patients who attended the JC ANDRAULT hospital were realized during the 4-year study period; of which, 5,453 tested positive for malaria giving an overall prevalence of 67.32% (Table 1). The proportions of positive slides gradually increase from 57.10 % (1226/2147) in 2012 to 77.73% (1669/2147) in 2015. A very significant difference (p< 0.01) was found among the four years with the highest malaria mean positive slide being recorded in 2015.

3.2 Malaria Prevalence by Sex, Age, and Season

3.2.1 Malaria prevalence by sex

More than forty four percent (3,585/8099) of the examined slides that tested positive were from male patients (Fig. 1). The difference between male and female was found to be statistically very significant (P<0.001).

3.2.2 Malaria prevalence by age

The patients were distributed into three different age groups, 0-5, 5-18, and >18 years (Table 2). Patients from all age groups tested positive to malaria. The highest cumulative annual prevalence (77.28%) was recorded for the oldest patients, followed patients aged 5-18 (67.21%), and aged 0-5 (55.39%) respectively. The oldest group ranked first every single year during the study period. The difference among age groups was found to be statistically significant (P<0.001).

Table 1. Malaria prevalence from 2012-2015 in the JC ANDRAULT Hospital, Southern Gabon

Year	Screened	Positive	Percentage	P-value
2012	2147	1226	57.10	
2013	1962	1175	59.88	
2014	1843	1383	75.04	
2015	2147	1669	77.74	0.01
Total	8099	5453	67.32	

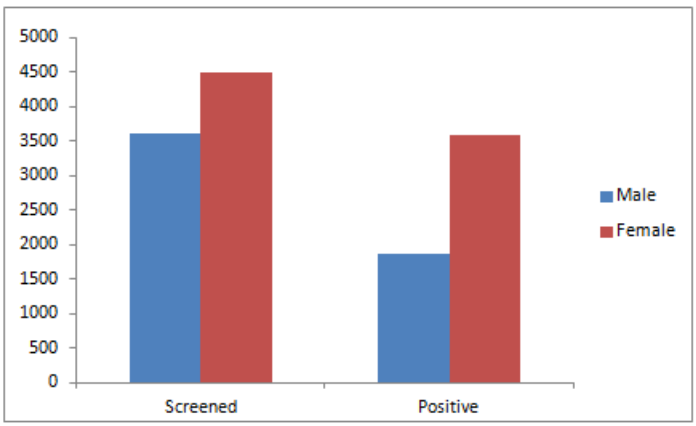

Fig. 1. Malaria prevalence by sex at the JC ANDRAULT Hospital, Southern Gabon, 2012-2015

Table 2. Malaria prevalence by age group at the JC ANDRAULT Hospital, Southern Gabon, 2012-2015

Age group (years)	Screened	Positive	Prevalence	P-value
0 -5	2547	1411	55.39	
5-18	2471	1661	67.22	
> 18	3081	2381	77.28	0.001
Total	8099	5453		

3.2.3 Malaria prevalence by season

Malaria infection was very high and occurred every single month throughout the year with the highest peak observed during the small rainy seasons (SRS), a period covering the months of February to May (Fig. 2). Malaria cumulative annual prevalences were 65.90, 65.83, 78.87, and 65.09%, respectively for the great rainy season (GRS), the great dry season (GDS), the small rainy season (SRS), and the small dry season (SDS). Although, the highest prevalence was recorded during the great rainy seasons, the difference among the seasons was not statistically significant (P=0.60).

3.2.4 Malaria prevalence by year

Malaria annual prevalences were 57.10, 59.88, 75.02, and 77.73% respectively for 2012 (Table 1), 2013, 2014, and 2015. The difference among the years was statistically significant (P<0.05). The mean annual prevalence was 67.43%.

4. DISCUSSION

Malaria remains a public health problem in terms of morbidity and mortality, and is the main cause of outpatient visits in most health centers of Gabon (WHO, 2012). The study revealed high mean annual malaria prevalence in the city of Mounana (67.43 %), the study area. This result is higher than the mean prevalences of 23.4 %, 44.2% and 37%, reported respectively in Dienga, Oyem, Tsamba-Magotsi, three rural areas of Gabon [8,6,10].

The results have also revealed that malaria transmission was constantly high during the study period with peaks recorded in 2014 and 2015. A number of factors could be responsible for the observed situation including the non-adherence to the preventive actions (distribution of insecticides treated nets, indoor residual spraying, mass education, etc.) recommended by the World Health Organization and lead by malaria national programs. In addition, the city of Mounana is characterized by a permanent artificial lake; and thus, constitute a breeding site for mosquitoes. The study showed that prevalence of females (79.92 %) infected with malaria was higher than that of males (51.70%). The difference between gender was very significant (p-value< 0. 001). This may be explained by the fact that the majority of females who attended the health center were pregnant and thus vulnerable to malaria infection [11,12]. Also, in rural areas women are more involved in fishing and farming activities than men which may expose them more to mosquitoes' bites. However, this finding is different from a previous study which has found a higher malaria prevalence in men compared to women [13].

Our results also showed that patients aged 5 to 18 and older than 18 were the most affected by malaria with prevalences of 67.21% and 77.28%, respectively. This increased of the age at risk population was also reported in studies conducted in Ethiopia and Gabon [14,15,6]. This is due to the fact in the study area, these age groups are involved in agricultural activities and often sleep in camps with their parents. And thus, expose themselves to anopheles bites. Regarding children under 5 years old, this age group is normally as vulnerable as pregnant women. However, in this study, they were the least affected with a prevalence of 55.39%.This result is similar to the 52.5% reported by a 8-year retrospective study conducted in Makokou, a rural area located in North-Eastern Gabon[7]. This shift is mostly likely due to the non-adherence to the preventives measures such as insecticide-treated nets (ITNs) and the availability of artemisinin-derived antimalarial drugs, taken towards that age group in 2003 by the Gabonese government [2]. Moreover, a recent survey conducted in Moanda, ,a semi-urban city of the Haut Ogooue province, located 21 Km from our study site, revealed that 58.6 % of households admitted to sleep under an insecticide treated net [16]. Last December, the Ministry of health through the National Malaria Control Program lunched the." zero malaria! I take action "campaign and freely distributed 60,000 long-lasting insecticide- treated nets (LLITNs) to pregnant women living in the nine (9) provinces

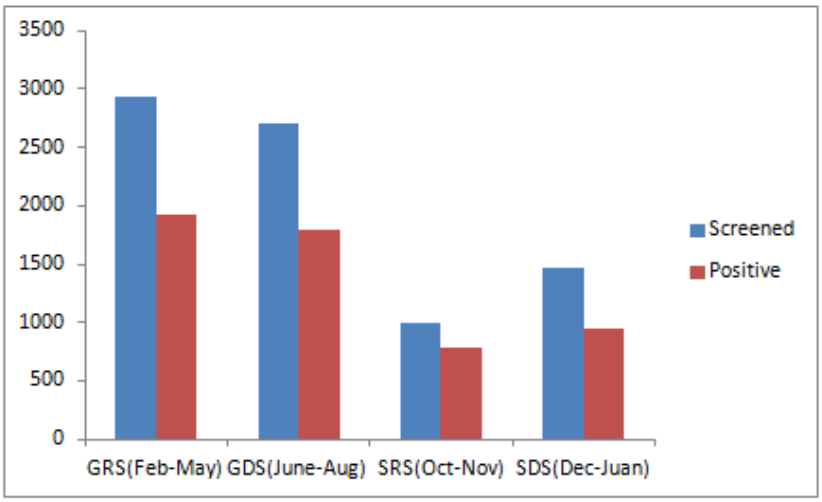

Fig. 2. Malaria prevalence by seasons at the JC ANDRAULT Hospital, Southern Gabon, 2012-2015

GRS: great rainy season; GDS: great dry season; SRS: small rainy season; SDS: small dry season

of Gabon. More recently, in April, on the occasion of the World Malaria Day, the Sylvia BONGO ONDIMBA foundation has distributed 30, 000 LLITNs to vulnerable population living in six (6) provinces including the Haut-Ogooue province. This type of initiatives should be repeated and extended to rural areas where malaria prevalence remains high [7,4].

Our results showed that the malaria transmission was high across the seasons irrespective of the years. Two peaks of malaria cases were recorded during the great rainy season and the small dry season. These findings are not only consistent with the perennial trend of malaria transmission in Gabon but also confirm previous studies that reported no decline of malaria in rural areas [4,7,10]. However, the difference among seasons was not statistically significant (p-value>0. 05).

This study found that there was an overall decrease in the malaria cases during the great dry season. The observed drop could be explained by the fact that malaria transmission is associated with the rain in Gabon. Indeed, the highest peaks of malaria cases are recorded during the great rainy season, and the small dry season (December and January), a season that is preceded by the small rainy season. While, the lowest malaria transmission period occurs during the great dry season (June to September) and the small rainy season (October and November). During the great dry season in the country, there is a decrease in the number of anopheles mosquitoes due to a hostile environment. Indeed, the lack of rain during four (4) months drastically reduces the mosquitoes breeding sites. Our findings are in accordance with a previous report on malaria vectors in Libreville, the capital city of Gabon, that showed the seasonal influence in mosquitoes' infection with a peak during the rainy season [17].

5. CONCLUSION

The study revealed that Malaria in the city of Mounana remains a serious health problem as attested by the high slide positivity rate recorded. The results also highlights a shift in the malaria vulnerable population, children aged 5 to 18 and adults were the most affected. Thus, the government should extend the preventive measures towards this age group and keep implanting and strengthening the preventive strategies across the country, especially in rural areas. To our knowledge this is first study to ever report le prevalence of malaria in a rural region of the Haut-Ogooué province.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

ACKNOWLEDGEMENTS

We thank Dr. Angélique KOMBILA, the chief medical officer of the JC ANDRAULT hospital of Mounana, for granting the permission to conduct this study and the staff for recording the data.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Report WM. World malaria report;2016.
2. WHO. World Malaria Report;2018. ISBN 978 92 4 156469 4. Who.
   Available:http://doi.org/ISBN 978 92 4 1564403
3. Maghendji-nzondo S, Nzoughe H, Lemamy GJ, Kouna LC, Pegha-moukandja I, Lekoulou F, Lekana-douki JB. Prevalence of malaria , prevention measures , and main clinical features in febrile children admitted to the Franceville Regional;2016.
   Available:http://doi.org/10.1051/parasite/20160032
4. Nzondo SM, Kouna LC, Mourembou G, Boundenga L, Karl R, Limoukou I, Douki L. Malaria in urban , semi - urban and rural areas of southern of Gabon : comparison of the Pfmdr 1 and Pfcrt genotypes from symptomatic children. Malaria Journal. 2016;1–9.
   Available:http://doi.org/10.1186/s12936-016-1469-1
5. Bouyou-akotet MK, Mawili-mboumba DP, Kendjo E, Mabika-mamfoumbi M, Ngoungou EB, Dzeing-ella A, Kombila M. Gabon from 2000 to 2008. 2009;*7*.
   Available:http://doi.org/10.1186/1475-2875-8-300
6. Mawili-mboumba DP, Akotet MKB, Kendjo E, Nzamba J, Medang MO. Increase in malaria prevalence and age of at risk population in different areas of Gabon. 2013a;1–7.
7. Assele V, Ndoh GE, Nkoghe D, Fandeur T. No evidence of decline in malaria burden from 2006 to 2013 in a rural Province of Gabon : Implications for public health policy. 2015;1–8.
   Available:http://doi.org/10.1186/s12889-015-1456-4
8. Pegha-moukandja. Marked Rise in the Prevalence of Asymptomatic Plasmodium falciparum Infection in Rural Gabon. 2016;1–14.
   Available:http://doi.org/10.1371/journal.pone.0153899
9. Planche T, Krishna S, Kombila M, Engel K, Faucher JF, Ngou-Milama E, Kremsner PG. Comparison of methods for the rapid laboratory assessment of children with malaria. American Journal of Tropical Medicine and Hygiene;2001.
   Available:http://doi.org/10.4269/ajtmh.2001.65.599
10. Manego RZ, Witte M, Held J, Gmeiner M, Gebru T, Tazemda B, Mordmüller B. Demography, maternal health and the epidemiology of malaria and other major infectious diseases in the rural department Tsamba-Magotsi , Ngounie Province , in central African Gabon. BMC Public Health. 2017;1–7.
    Available:http://doi.org/10.1186/s12889-017-4045-x
11. Desai M, ter Kuile FO, Nosten F, McGready R, Asamoa K, Brabin B, Newman RD. Epidemiology and burden of malaria in pregnancy. Lancet Infectious Dis. 2007;7(2):93–104.
12. Jäckle MJ, Blumentrath CG, Zoleko RM, Akerey-diop D, Mackanga J, Adegnika AA, Kremsner PG. Malaria in pregnancy in rural Gabon : A cross-sectional survey on the impact of seasonality in high-risk groups. 2013;1–6.
    Available:http://doi.org/10.1186/1475-2875-12-412
13. Feleke DG, Gebretsadik D, Gebreweld A. Analysis of the trend of malaria prevalence in Ataye , North Shoa, Ethiopia between 2013 and 2017. Malaria Journal, 2018;1–6.
    Available:http://doi.org/10.1186/s12936-018-2474-3
14. Ferede G, Worku A, Getaneh A, Ahmed A, Haile T, Abdu Y, Alemu A. Prevalence of Malaria from Blood Smears Examination : A Seven-Year Retrospective Study from Metema Hospital, Northwest Ethiopia. 2013;0–2.
15. Diba K, Gondar N, Alemu A, Muluye D, Mihret M, Adugna M, Gebeyaw M. Ten year trend analysis of malaria prevalence in. Parasites & Vectors. 2012;5(1):1.
    Available:http://doi.org/10.1186/1756-3305-5-173
16. Mabiala, Alix, Obame-Nkoghe, Judicael, Bisseye, Cyrille, Tanga, Tanguy, Mombo, L. Connaissances et méthodes de lutte contre le paludisme au sein des ménages

de la cité minière de Moanda en zone semi-rurale au Sud-Est Gabon. Journal of Applied Biosciences. 2020 ;159:16411–16419.
Available:http://doi.org/10.35759/JABS.159.5

17. Mourou J, Coffinet T, Jarjaval F, Cotteaux C, Pradines E, Godefroy L. Malaria transmission in Libreville : results of a one year survey;2012.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle4.com/review-history/73089