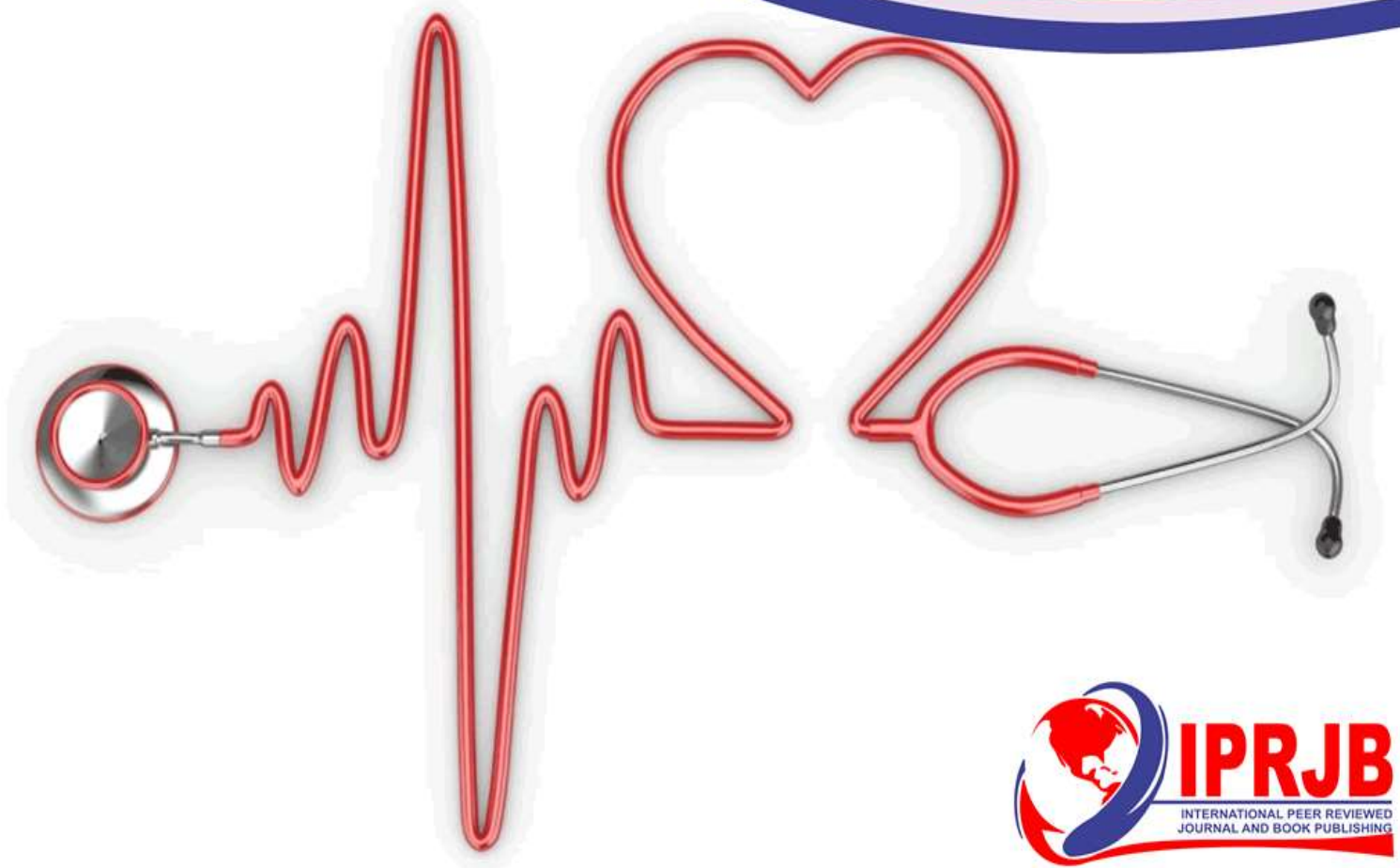









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Abstract

Purpose: Malaria is one of the febrile illnesses and the most common fatal disease in the world caused by one or more species of *Plasmodium*. Because malaria and typhoid fever usually display similar symptoms, malaria patients are likely to be suspected of typhoid fever, especially when they do not respond to the malaria first line medication. To determine the prevalence of malaria infection among patients suspected of typhoid fever in the Bamenda and Bafoussam regional hospitals.

Methodology: This study was a descriptive cross sectional study in which participants were recruited by convenience. The population for this study was volunteer patients suspected of typhoid fever by the respective hospital physicians. Blood samples were collected and Rapid Diagnostic Test was carried out, as well as thin and thick blood films. Data was analyzed using SPSS V20.0. Chi-square test was used to assess the association between results with a p-value of 0.05 considered significant at 95% confidence interval.

Results: A total of 356 patients suspected of typhoid fever were contacted for the study of which 337 signed the consent form and took part in the study from the two targeted Regional Hospitals giving a participation rate of 94.66%. Among the participants, 195[57.9%] were from the Bamenda regional hospital while 142[42.1%] were from the Bafoussam regional hospital. Majority 65.9% of the participants were females recorded in both hospitals. An overall prevalence of 37.4% was recorded in both the Bafoussam and Bamenda regional hospital there was thus no statistical significant difference between the result gotten from the two Regional Hospitals [p=0.3]. The age group with the highest prevalence was that of 10-29 years. More than 90% of infections were caused by *Plasmodium falciparum* while about 3% of the infections were due to *Plasmodium vivax*. The prevalence of malaria infections in patients suspected of typhoid fever in the Bamenda and Bafoussam Regional Hospitals is 37.4%, and more women were infected than males.

Unique Contribution to Theory, Practice and Policy: We advocated that proper malaria investigation of suspected cases should be carried out before embarking into typhoid fever treatment. This study have saved as an eye opener to medical practitioners to test both typhoid and malaria for all patients presenting with such signs and symptoms.

Keywords: Malaria, Typhoid Fever

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INTRODUCTION

Malaria is caused by *Plasmodium* parasites that are spread to humans through bites of infected anopheles mosquito vectors according to Adegnika AA et al, (2010). There are five parasite species of *Plasmodium* (*falciparum*, *ovale*, *vivax*, *malariae*, and *knowlesi*), *falciparum* is noted to be the most deadly

Adegnika AA et al, (2010). In 2015, the World Health Organisation declared approximately 212 million malaria cases and an estimated 429,000 malaria deaths globally with the greatest burden in sub-Saharan African countries Wahinuddin S, Brian CMK (2016). In 2015, the region was home to 90% of global malaria cases and approximately 92% of global malaria deaths Wahinuddin S, Brian CMK (2016). Typhoid fever is a life threatening illness caused by *Salmonella typhi* and *paratyphi* bacteria. It is estimated that 17 million cases of typhoid with approximately 420,000 deaths globally each year with the greatest incidence in third world countries Alnwich D (2001).

Malaria and Typhoid fever are well known undifferentiated febrile illnesses responsible for varying degrees of morbidity and mortality especially in sub Saharan countries where these diseases are endemic. Despite the known clinical presentation of these infections, concomitant infections with typhoid and malaria fever could affect clinical course of these diseases leading to misdiagnosis. Hence malaria and typhoid fever continues to be a public health challenge Andre VL et al,(2005) and Alhassan HM (2016).

In Cameroon several studies have been done in different parts of the country to determine the prevalence of malaria and typhoid fever co-infection. In the South-West region of Cameroon, precisely in Kumba Health District, malaria and typhoid fever co-infection rate was found to be 6.74% in the year 2015 Alhassan HM (2016).. In 2003, patients with the clinical picture for either malaria or typhoid fever were recruited in three Regions of Cameroon, and the prevalence of malaria and typhoid co-infection was 2.5% Bhutta ZA, Hussein LD (2006) Studies also done in Ghana showed a co-infection rate of 3.9% Dellicour S (2010). In Nigeria, there are wide differences in the prevalence of malaria and typhoid coinfection. For example, in Abia State Nigeria, malaria typhoid co-infection rate was at 31.50% Bardaji A et al (2012) , while in Ikare Akoko, malaria and typhoid co-infection rate was 18.3% Hagmann S, et al (2007).

Due to varying co-infection rate in the world, continuous monitoring and epidemiologic inquiry is very essential because disease pattern or trends does not only vary with geographical location, but seems to change over time with changes in global climatic conditions Alhassan HM et al, (2016). Therefore, in a country like Cameroon where malaria and typhoid fever are considered endemic, individuals are at substantial risks of contracting both diseases either concurrently or as an acute infection superimposed on a chronic one. As such, malaria and typhoid fever continue to be of major public health importance. Moreover, the prevalence rate of malaria and typhoid fever co-infection greatly depends on the diagnostic technique used to determine the presence of disease causing organism.

Statement of the Problem

This study seeks to determine the prevalence of malaria among patients suspected of typhoid fever in Bamenda Regional Hospital located in the North West Region and Bafoussam Regional Hospitals located in the West Region of Cameroon, using the gold standard techniques of diagnosis (Microscopic examination remains the "gold standard" for laboratory

confirmation of malaria) . This is in an attempt to minimize the number of false positive/negative malaria cases put on treatment because many patients have increase their length of stay in the Hospital while being treated for an infection which simply resemble another one (either malaria or typhoid) by means of signs and symptoms.

The similarities in their (malaria and typhoid) signs and symptoms create confusion among clinicians on what to suspect once a patient present with these signs and symptoms. The crises (arm conflict) in the North West Region of Cameroon have further exaggerated the situation as the number of people presenting with these similar signs and symptoms keep increasing and clinicians in most cases just send laboratory investigations indicating ‘widal’ and the patient sometimes is treated just for typhoid while he/she is suffering from malaria or having both infection.



Figure 1: Area View of Bamenda Commercial Avenue as Captured by the Research Team

The dirty nature of Bamenda town is directly link to the crises and the life style of the people such as sleeping in the bushes, eating uncooked food, drinking water just from any source and the none treatment of water cashments in the war situation ,by water supply bodies such as the CAM water is also a factor in the increasing number of malaria cases. This aspect of similarity in the signs and symptoms between malaria and typhoid have caused many people who presented with either of the infections to end up being treated for what they did not come for and thus increasing the rate or duration of hospitalization as the infection causing the ill health of patients have not even been touched ,giving the fact that both infectious have different causative agents thus this confusion is the backbone of this study to show health workers that every patient presenting with signs of typhoid should be tested for malaria and typhoid at once before commencing treatment. If this practice is put in place and nurtured, the rate of mortality and morbidity link to these two infections will be grossly reduced.

METHODOLOGY

Study Setting

The study was conducted at the Bamenda Regional Hospital found in the North West Region and the Bafoussam general Hospital found in the West Region of Cameroon. The West and North-West Regions are all situated in highland areas (> 1000 m above sea level) and characterized by a temperate climate with rainfall lasting up to 8 months and a vegetation dominated by grasslands. These areas are considered as hypoendemic with seasonal malaria

parasite transmission occurring at high levels. Average annual rainfall is estimated at 1800 mm/year. The West and North-West region has each over 1.9 million inhabitants. The West Region covers a surface area of 13,892 km² whereas the North-West covers a surface area of 17,300 km². Since the Bamenda Regional Hospital, was opened in 1956 by Sir Robert the then British high commissioner based in Lagos Nigeria, cases of malaria and typhoid have been reported and treated in the hospital. Bafoussam is the capital and largest city of the West Region of Cameroon, in the Bamboutos Mountains. It is the 3rd most important (financially) city in Cameroon, after Yaounde and Douala.

Study Design

The study was a prospective cross-sectional analytic study, in which participants were recruited consecutively from May 2021 to November 2021.

Study Population

Patients of all ages, both males and females who presented at the hospital with fever, malaise, headache, joint and muscle pains, loss of appetite, chills, vomiting amongst other symptoms, in which the clinician suspected typhoid fever were qualified to be enrolled in the study. Equally we recruited persons coming in from other health centers with request to do typhoid test.

Inclusion Criteria

- Participant of all ages who were suspected of typhoid by the doctor were contacted to participate in the study.
- Fever of at least 37.5°C and above.
- consented to be part of the study.

Exclusion Criteria

- Refused consent to participate in the study.
- Prior use of anti-malaria and or antibiotic in past one month.

Sampling Techniques

The sampling technique was a convenience sampling. All patients who were consulted by the medical doctor and showed signs of having fever suspected to be typhoid fever were approached for the study. Patients were selected in the order they come and their consents gotten after the study procedure was explained to them.

Statistical Analysis

Data was analyzed using SPSS V20.0 for windows statistical software. Descriptive analysis was done and used to present results in frequency distributions tables and bar graphs.. Chi-square test was used to assess the association between result of participants in the Bafoussam General hospital and the Bamenda regional Hospital with a p-value of 0.05 considered significant at 95% confidence interval.

Ethical Considerations

Ethical clearance was gotten from the ethical Institutional Review Board of the University of Douala. Administrative authorizations was obtained from the Regional Delegate of Public Health for the North West/west Region, and Director of the Bamenda/ Bafoussam Regional Hospital. The study procedure (information and samples were collected, on test to be done)

was explained in detail to each participant. They each signed a written consent form in acceptance to be part of the study. No material or financial incentives was given to encourage participation in the study. Participation was out of every ones free wheel and any participant could opt out of the study at any point. Refusal to participate in the study or opting out, neither involved any penalties nor altered the relationship that existed between the participant and their attending physicians, hospitals or study investigators. The data collected was confidential and handled in accordance with the privacy of the participants. This was achieved by assigning codes to participants from the beginning of the study. Any participant diagnosed with malaria during the course was referred to the attending physician for proper management.

RESULTS

Socio Demographic Characteristics of the Participants

In this study we seek to assess malaria infection among patients suspected of typhoid fever at the Bamenda and Bafoussam Regional Hospitals, a total of 356 patients suspected of typhoid fever were contacted for the study and a total of 337 individuals signed the consented form and actively took part in the study from the 2 Regional Hospitals , giving a participation rate of 94.66%. Regarding their ages, the mean age of the participants was 23.93 [± 0.54], with those within the age range 20-29 years recording the highest frequency 144 [42.7%] , most of who were from the Bamenda regional hospital while the age range 10-19years recorded 108[32.0%]. Among the participants, 195[57.9%] were from the Bamenda Regional Hospital while 142[42.1%] were from the Bafoussam Regional hospital. Majority 222[65.9%] of the participants were females recorded in both hospitals.

Table 1: Socio Demographic Characteristic of Participants Base on Hospital, Gender and Age

Measured variable	Regional Hospital			p-value	
	Bamenda	Bafoussam	Total		
Gender	Female	146[43.3%]	76[22.6%]	222[65.9%]	<0.001
	Male	49[14.5%]	66[19.6%]	115[34.1%]	
Age Ranges	0-9yrs	7[2.1%]	3[0.9%]	10[3.0%]	0.2
	10-19yrs	66[19.6%]	42[12.5%]	108[32.0%]	
	20-29yrs	74[22.0%]	70[20.8%]	144[42.7%]	
	30-39yrs	24[7.1%]	19[5.6%]	43[12.8%]	
	40-49yrs	17[5.0%]	6[1.8%]	23[6.8%]	
	50-59yrs	6[1.8%]	2[0.6%]	8[2.4%]	
	60-69yrs	1[0.3%]	0	1[0.3%]	
	Total	195 [57.9%]	142[42.1%]	337[100%]	

Source: Cross Tabulation Generated from SPSS Version 20.

We further investigated the educational level of the respondents, and noted that majority of them had attended up to secondary level of education 181[53.7%] while 130[38.6%] of the patients had gone up to university levels and 4 [1.2%] other individuals who had no former education all of who were from the Bamenda Regional Hospital. Again we checked the body mass index [BMI] of the participants and noted that 129 [38.3%] were overweight, 36.8% had a healthy weight while 60[17.8%] were underweight.

Table 2: Socio Demographic Characteristic of Participants Based on Religion, Educational Level and Body Mass Index

Measured variables	Regional Hospital			p-value	
	Bamenda	Bafoussam	Total		
Educational level	No education	4[1.2%]	0	4[1.2%]	<0.001
	Nursary education	2[0.6%]	1[0.3%]	3[0.9%]	
	Primary education	13[3.9%]	6[1.8%]	19[5.6%]	
	Secondary education	98[29.1%]	83[24.6%]	181[53.7%]	
	Tertiary education	78[23.1%]	52[15.4%]	130[38.6%]	
Religion	Christian	187[55.5%]	134[39.8%]	321[95.3%]	0.5
	Muslim	8[2.4%]	8[2.4%]	16[4.7%]	
Marital	Not married	125[37.1%]	90[26.7%]	215[63.8%]	0.8
	Married	66[19.6%]	50[14.8%]	116[34.4%]	
	Divorced	4[1.2%]	2[0.6%]	6[1.8%]	
BMI Ranges	<18.5kg/m ²	48[14.2%]	12[3.6%]	60[17.8%]	<0.001
	18.5-24.9kg/m ²	85[25.2%]	39[11.6%]	124 [36.8%]	
	25.0-29.9kg/m ²	49[14.5%]	80[23.7%]	129[38.3%]	
	30kg/m ² obese	13[3.9%]	11[3.3%]	24[7.1%]	

Source: Cross Tabulation Generated from SPSS Version 20.

The Prevalence of Malaria Infection among Patients Suspected of Typhoid Fever According to their Bio Data (Age, Sex Etc)

An overall prevalence of 37.4% was recorded in both the Bafoussam and Bamenda regional hospital.

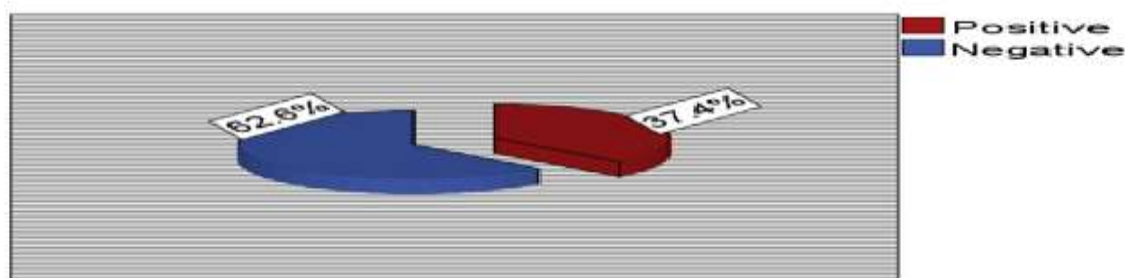


Figure 1: Overall Prevalence of Malaria Infection among Patients Suspected of Typhoid Fever at the Bafoussam And Bamenda Regional Hospitals.

Source: Descriptive Statistics SPSS Version 20

Considering their bio data, more women 89[26.4%] tested positive for malaria infections against 37[11.0%] males who equally tested positive for malaria, thus this findings were statistically significant $p=0.05$. Regarding their age ranges, the greatest number of infected cases was recorded among patients between the age range 10-19years [14.8%], followed by individuals between the age range 20-29years who recorded 13.4% of the total infections recorded in this study [table 3]. Out of 10children who were between the age range 0-9years, 5[1.5%] were positive for malaria infection. Looking through the ages 50-59years, only 8 patients were recorded and 5[1.5%] of the patients were positive for malaria. These findings were how ever not statistically significant $p=0.09$. Full details are presented on the table below[table 3]

Table 3: Prevalence of Malaria Infection According to Patients Bio Data

		Malaria test result		Total	p-value
		Positive	Negative		
Age Ranges	0-9yrs	5[1.5%]	5[1.5%]	10[3.0%]	0.09
	10-19yrs	50[14.8%]	58[17.2%]	108[32.0%]	
	20-29yrs	45[13.4%]	99[29.4%]	144[42.7%]	
	30-39yrs	12[3.6%]	31[9.2%]	43[12.8%]	
	40-49yrs	8[2.4%]	15[4.5%]	23[6.8%]	
	50-59yrs	5[1.5%]	3[0.9%]	8[2.4%]	
	60-69yrs	1[0.3%]	0	1[0.3%]	
Gender	Female	89[26.4%]	133[39.5%]	222[65.9%]	0.05
	Male	37[11.0%]	78[23.1%]	115[34.1%]	
Total		126[37.4%]	211[62.6%]	337(100%)	

Source: Cross Tabulation Generated from SPSS Version 20.

The Different Species of Plasmodium Associated With Malaria in Patience Suspected With Typhoid Fever

This objective opted to bring out the various species of plasmodium parasite present in the samples of patients. Figure 2 below show the various species of plasmodium recorded in this study. Majority of the species detected in this study was p.falciparium [90.2%], another specie of interest which recoded 6.5% of detected malria species in this study was P. vivax and P. malariae which had 3.3% as presented on the figure below.

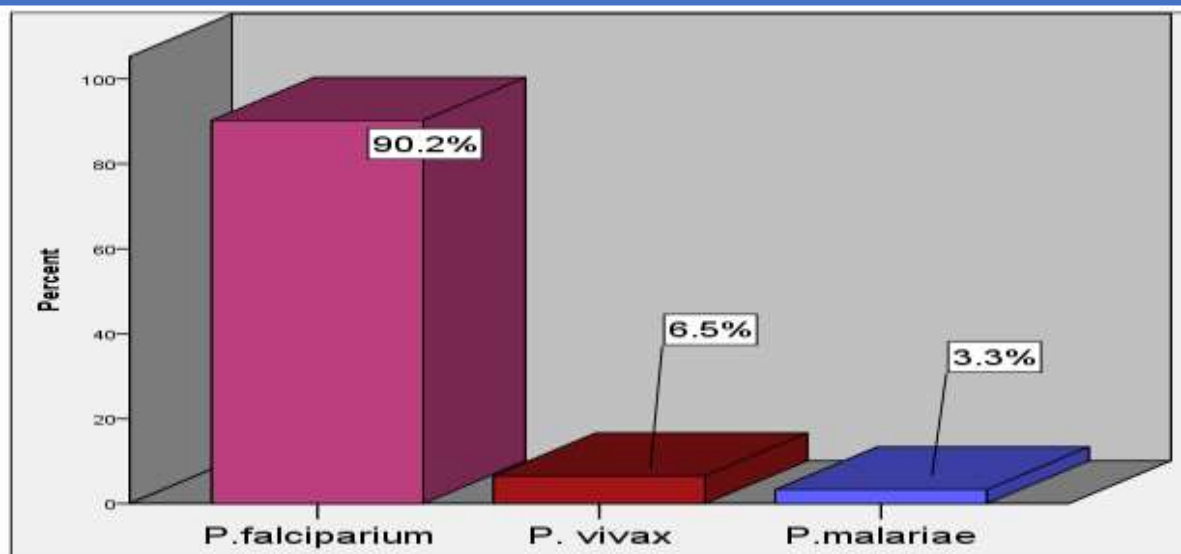


Figure 2: The Arious Species of Plasmodium Identified in the Samples the Different Participants

Microscopic examination of thick blood films in this study was performed to quantify the parasitic in this study. majority of the infections in this study were caused by *P.falciparum* 111[90.2%] while 8[6.5%] was attributed to *P.vivax* and only 4[3.3%] of the infections was caused by *P.malariae*. quantifying the parasitic load, the microscopic examination showed that majority of severely infected cases of malaria were caused by *P.falciparum* with 6.5% recording positive +++ and upto 37.4 with P.F positive +. While most cases of *P.vivax* had just one parasite per field and was registered as ‘positive for *P.vivax*. although some samples[1.6%] both had more than one parasite per field of both *P.falciparum* and *P. malariae* [table 4]

Table 4: Microscopic examination of thick blood films

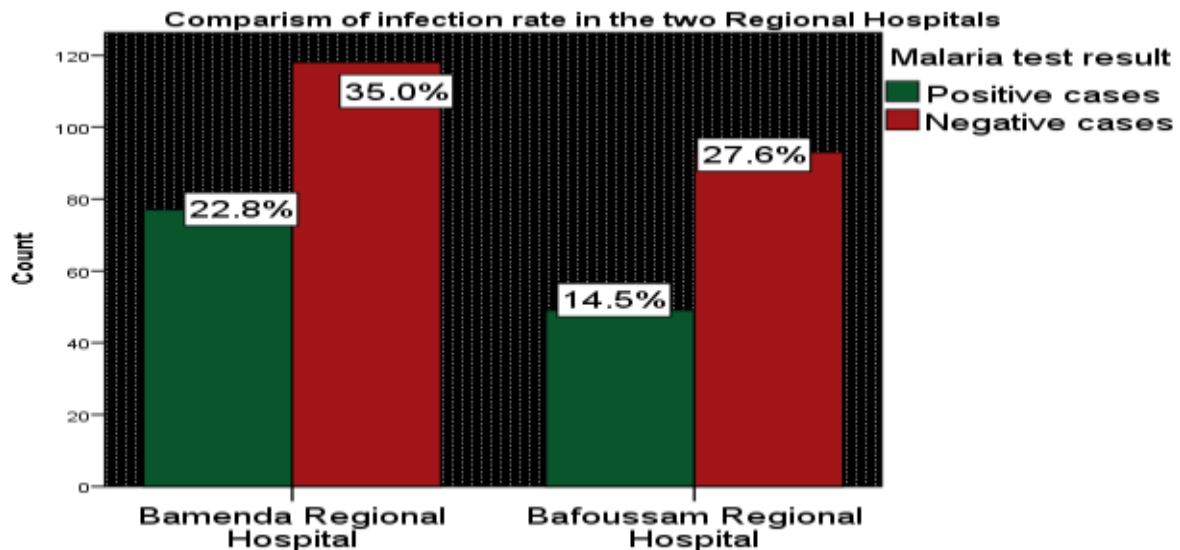
Microscopic examination of thick blood films	Specie of malaria parasite			Total
	<i>P.falciparum</i>	<i>P. vivax</i>	<i>P.malariae</i>	
Positive	44[35.8%]	6[4.9%]	2[1.6%]	52[42.3%]
Negative	8[6.5%]	0	0	8[6.5%]
Positive +	46[37.4%]	2[1.6%]	2[1.6%]	50[40.7%]
Positive ++	5[4.1%]	0	0	5[4.1%]
Positive +++	8[6.5%]	0	0	8[6.5%]
	111 [90.2%]	8 [6.5%]	4 [3.3%]	123 [100.%]

Source: Tabulation Generated from SPSS Version 20.

Comparing the Prevalence of Malaria Infection among Patience Suspected of Typhoid Fever in the Bamenda and Bafoussam Regional Hospital

Although this study recorded more patients in the Bamenda Regional Hospital than the Bafoussam Regional hospital , statistics showed that more infections were recorded at the bamenda Regional Hospital than the Bafoussam Regional Hospital[22.8%] out of the total 37.02 positive malaria cases recorded in this study , while the Bafoussam Regional Hospital

recorded 14.5% of infected cases, there was thus no statistical significant difference between the result gotten from the two Regional Hospitals [p=0.3]. figure 3 displays the detailed result.



Source: SPSS Version 20/ Descriptive Statistics

Figure 3: comparism of malaria infection rate between the Bamenda and Bafoussam Regional Hospitals.

Discussion

Out of the 337 individuals who took part in this, most were those between the ages 10-30years and gender wise, more females were recorded than men.

Assessing the prevalence of malaria among patients suspected of typhoid fever in this study , an overall prevalence of 37.4% was recorded in both the Bafoussam and Bamenda regional hospital. This high prevalence suggest that most patients who present in the hospital with signs of typhoid fever should immediately be tested for malaria as well. It is evident that many strategies are already in place to manage and prevent malaria infection but more is needed to reduce this high prevalence of malaria. One of the main causes of this high prevalence is the Anglophone crisis which has destroyed many health centers and send women and young children leaving in the bushes, increasing the risk of malaria infection by bringing people into direct contact with mosquitoes, giving chance for more infections and no facilities to manage the cases at low levels as well as sleeping with no mosquito bed net. However he prevalence in this study was higher than that reported by Longdoh A et al (2012) and closer to the prevalence of 7.3% and 29.4% reported by Njunda et al. furthermore, Ndong I, et al, (2014) reported in their study that “Between 2006 and 2012 confirmed malaria positive cases of those tested fluctuated, dropping from 53.21% in 2006 to 17.20% in 2008; then rising to 35.00% in 2011 and, finally, dropping to 18.2% of those tested in 2012”, Considering their bio data, more women 26.4% tested positive for malaria infections against 11.0% males who equally tested positive for malaria, this significant difference could be because the females were more in number and the fact that the women and children are mostly prond to infections since they are the once sleeping in the bushes and so on, this result are however not in line with Ndong I, et

al, (2014) who noted that the prevalence of malaria in females and males across all age groups were similar: a slightly higher risk of males to have malaria (OR = 1.08, 95% CI 0.94-1.25) were not practically significant. Our findings were statistically significant $p=0.05$. regarding their age ranges, the greatest number of infected cases was recorded among patients between the age range 10-19years 14.8%, followed by individuals between the age range 20-29years who recorded 13.4% of the total infections recorded in this study [table 3]. Out of 10 children who were between the age range 0-9years, 1.5% were positive for malaria infection.

The different species of plasmodium associated with malaria in patients suspected with typhoid fever were isolated. Figure 2 shows the various species of plasmodium recorded in this study. Majority of the species detected in this study was *P. falciparum* [90.2%], another species of interest which recorded 6.5% of detected malaria species in this study was *P. vivax* and *P. malariae* which had 3.3%. This result however correlates with reports in Cameroon stating that "Four human *Plasmodium* species have been documented in Cameroon, including *P. falciparum*, *P. ovale*, *P. malariae* and *P. vivax*" Fru-Cho J, et al, (2014), Russo G, et al (2017), PNLP, (2012). *Plasmodium falciparum* is by far the predominant species recorded in up to 95% of all infection cases Kwenti ET, et al (2017), Sandeu MM, et al (2017). We suspected that the recent migration from south Africa and equatorial Guinea might be the cause of recent infections in Cameroon involving *P. vivax* and other new species apart from *P. falciparum* which has been noted in Cameroon since the 1900s, as studies have shown that *P. vivax* is highly endemic in the above mentioned areas Rubio J, et al (1999), Mendes C, et al (2011). The number of *Plasmodium malariae* and *P. ovale* represent each 1 and 3% of infection cases, respectively PNLP, (2012) in other studies conducted in the west region of Cameroon. The percentage of *P. vivax* recorded in this study was relatively low compared to a study in the city of Dschang (West Cameroon), where out of 484 blood samples collected consecutively from febrile outpatients attending the main hospital during a 3-month period, *P. vivax* infection was detected by PCR in 5.6% (27/484) patients, representing 38.6% (27/70) of all *Plasmodium* infection cases detected Russo G, et al (2017). The expansion of *P. vivax* in Cameroon could pose important challenges for malaria elimination in the country. *Plasmodium vivax* infections differ from other *Plasmodium* species because the parasites can lie dormant in a person's liver, and reawaken suddenly later to cause relapses of malaria. The number of cases with *P. vivax* infections in this study were relatively higher than a larger study conducted in five locations in the South region of Cameroon, out of 201 malaria positive cases detected, six *P. vivax* and two mixed parasite infections (*P. falciparum* + *P. vivax*), were detected corresponding to a prevalence of 4% Ngassa Mbenda HG, Das A (2014). Quantifying the parasitic load in the present study, the microscopic examination showed that majority of severely infected cases of malaria were caused by *P. falciparum* with 6.5% recording positive +++ and up to 37.4 with *P. F* positive +.

Statistics from this study showed that more infections were recorded at the Bamenda Regional Hospital than the Bafoussam Regional Hospital [22.8%] out of the total 37.02 positive malaria cases recorded in this study, which simply ties with the problem of this research that the persisting crisis in the region may have economic effects on the people, but the greatest part is the health of the people as no one cares about the treatment of people in the war situation. It is evident in the two regions that people who are internally displaced are faced with problems of good housing facilities thus have no time to check out whether they are being bitten by mosquitoes or not but rather co-habit with the potential infectious parasites, while the

Bafoussam Regional Hospital recorded 14.5% of infected cases, there was thus no statistical significant difference between the result gotten from the two Regional Hospitals [$p=0.3$]. since the exclamation of the Anglophone crisis in late 2016, little data has been made public regarding the health situation of the internally displaced persons living in these two regions. This study is in line with studies in the 1990s before the scale-up of LLINs in these settings, indicated parasite prevalence reaching up to 25% in children of less than 15 years-old ($n = 530$) Same Ekobo A, et al (2001), Atangana S, et al (1979).. Entomological inoculation rate in the West region was found to vary from 62.8 to 90.5 infective bites/person/year Tchuinkam T, et al 2010. After long-lasting insecticidal nets[LLINs] scale up, a parasite rate varying from 9.3 to 22.4% ($n = 173$) in febrile children of 2–15 years-old was reported in different health care units of the West region Tchuinkam T, et al 2010, Russo G et al (2017). Retrospective analysis conducted between 2006 and 2012, in the health care district of Mbakong (North-West), showed a decrease in the parasite rate in febrile patients from 53.2% to 18.2% ($n = 4230$) following long-lasting insecticidal nets[LLINs] scaleup and a usage rate of $> 50\%$ Kwenti ET, et al (2017).

Conclusion and Recommendations

Conclusion

The prevalence of malaria infections in patients suspected of typhoid fever in the Bamenda and Bafoussam regional hospitals is 37.4%, and more women are infected than males. And that the age group with the highest prevalence are those within the age 10-29years.

That more than 90% of infections are been caused by plasmodium falciparum while about 3% of the infections is link to plasmodium vivax

And lastly that the prevalence of malaria among patients suspected of typhoid fever at the Bamenda regional hospital is higher than that of patients at the Bafoussam Regional hospital.

Recommendations

1. The population of the northwest region should relay on using mosquito nets to prevent further infection
2. That all hospitals should do malaria test for all outpatience presenting with signs of typhoid fever to avoid miss treatments which most times prolong patients duration of hospitalization
3. The government to consider the health of all persons leaving in these regions as they now have no other option than co-habiting with the infective mosquitoes, by providing free test and treatments to all persons presenting with high fevers, chills lost of consciousness etc.

Limitations of the Study

- a) Most patients were treated for typhoid without pretesting ,and since our population were those send to the laboratory we miss this patients out and as such could not test them. We therefore suggest that another study be taken up which could verify all those who are been treated for typhoid even in medical ward and test them for malaria infection,weather or not.

- b) This study only targeted patients attending the Regional hospitals and might have missed to give a general statistic regarding the exact prevalence of malaria in the crisis hit region and therefore call for a larger study which could assess the prevalence in all health districts of the two regions.

Suggestion for Further Study

- The study suggested the need to associate molecular tools in diagnostics to improve species detection.

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