Malaria Parasite Burden In the University Of Buea and Its Environs

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Abstract

Objective: The purpose of this study was to determine the prevalence of malaria parasite burden among patients attending the University of Buea Health Centre.

Materials and Methods: A longitudinal study was conducted from March 2011 to March 2012 involving 322 adults attending the University Health Centre for various reasons. Only those who approved and signed consent form participated in the study. Malaria parasites were examined in Giemsa-stained thick and thin blood films under 100x objectives and were counted against 200 leukocytes in thick films to obtain the parasite density.

Results: Among the 322 participants, 286 (88.8%) were positive for malaria. There was no significant difference in the prevalence of infection between participants from the university community and those reporting from neighbouring villages (X^2=2.42, P>0.05). There was no difference in prevalence by gender, but there was a statistically significant difference in the prevalence by age of participants (X^2=19.253 P<0.05), and this prevalence was highest (45.7%) in patients aged between 21 and 30 years. Patients with a scanty parasite load (1 – 400 parasites per µL of blood) represented 46% of participants. Parasite loads of 401 – 7000, 7001-14000 and >14000 trophozoites per µL of blood were observed in 77 (26.9%), 29 (10.1%) and 46 (16.1%) participants respectively.

Conclusion: The results of this study have portrayed malaria as an important cause of morbidity among staff, students and the surrounding communities, challenging multidisciplinary efforts which have been implemented by the Cameroonian Ministry of Health to curb down malaria in the country. It is apparent that an in depth situational analysis is necessary to understand the dynamics of malaria and implement more stringent and elaborated measures to control the disease in and out of the university community.

Introduction

Malaria is caused by protozoa of the genus *Plasmodium*. It kills one to three million children worldwide every year, 90% of whom are Africans. It ranks second among the top ten causes of death in Africa [1]. A three-pronged approach has been recommended for fighting the disease, namely rapid detection followed by combination therapy, the use of mosquito bed nets and targeted mosquito destruction [2,3].

In Cameroon malaria is the most important public health problem and the first cause of morbidity in all age groups [4]. Reports show that it accounts for 40.1% morbidity and 2.2% mortality in the general population, and 4.2% mortality in children less than 5 years. Thirty-six per cent (36%) of malaria cases are seen and treated at out-patients consultations [4,5]. Though the disease affects individuals of all ages, and more especially children less than five years old, in Buea, symptomless carrier status at any given time ranges from 60-100 per cent. Inhabitants are often infected with *Plasmodium* species that usually result to asymptomatic forms of malaria, which is an important reason for continuous transmission of the disease in the area [6].

The negative impact of malaria in Cameroon cannot be over emphasized. It affects the time at work and the performance of workers, and is responsible for 60% of absences from work [5]. The cost of its prevention and treatment represents an important economic loss. It slows down flow of trades, foreign investments and tourist activities thus reducing the economic performance of the country. Its high implication in infant mortality incites households to have more children; this contributes to increase the population growth rate and consequently keeps citizens in the vicious circle of poverty. Above all, malaria affects school attendance and performance of individual at all educational levels [5,7,8].

In 2005, Kimbi and colleagues exposed malaria as the greatest health risk to the Buea community and recommended the need for better measures of control [6]. In 2006, local authorities of

Table II: Prevalence of malaria among study participants

Status of the participant	Total N (%)	Number (%) positive for malaria
Students	229 (22.5)	205 (89.5)
Staff	57 (17.7)	48 (84.2)
Neighbouring communities	36 (11.2)	30 (83.3)
Total	**322(100)**	**286 (88.8)**

X^2= 2.42 P>0.05

the Ministry of Health carried out massive sensitisation on the use of impregnated mosquito bed nets, and organised workshops on proper diagnosis and early treatment through the vulgarisation of combination therapy. The present study was designed to serve as an evaluation tool for these retrospective control measures and to set a base line whichwould eventually contribute in decision making on subsequent malaria control policies in the university community in particular and in the whole population in general.

Materials and Methods

This was a longitudinal study conducted from March 2011 to March 2012.

Study site

Table I: Sociodemographic characteristics of the study participants

Age(years)	N (%)	Number(%) of males	Number (%) of females
≤20	61 (18.9)	30(9.3)	31(9.6)
21-30	153 (47.5)	90(28.0)	63(19.6)
31-40	47 (14.6)	28(8.7)	19(5.9)
>40	61 (18.9)	29(9.0)	32(9.9)
Total	**322 (100)**	**177 (54.9)**	**145 (45.1)**

The study was carried out in Buea, the capital of the South West Region of Cameroon. Buea has a population 200.000 inhabitants, situated on the eastern slope of mount Cameroon. Because of the seasonal variation, and the geographical location, the climate of Buea, tends to be humid, giving opportunity to those at higher elevations to enjoy cooler temperatures while the lower neighbourhoods experience a hotter climate [9]. This climatic variation associated to recent increase of the population in the region [10] has increased the likelihood of disease vector survival and malaria transmission. Hygiene and sanitation within the municipality has been severely compromised by the rapid migration of students, who reside in numerous clutters around the university, and generating large quantities of domestic waste. The sudden population increase has also led to permanent water scarcity that is generating other public health problems.

Study subjects

Participants in the study were patients who came for consultation in the University Health Centre for various reasons. After being told that it was not an obligation for them to participate in the study and neither was it a pre-requisite to accessing treatment or other university services publicly available, willing candidates signed the written informed consent form. The study was carried out from March 2011 to March 2012, to include the rainy season (April-September) which has been reported as the peak malaria transmission period in the locality [11].

Laboratory investigations

Prior to collection of blood samples, the age, sex and status (student, staff or patient from a neighbouring village) of participants were recorded. Malaria parasites were examined in Giemsa-stained thick and thin blood films under 100x objectives. Parasites were counted against 200 leukocytes in thick films to obtain the parasite density. This was expressed as the number of parasites per micro litre (µL) of blood assuming an average leukocyte count of 8000 cells per µL of blood [12]. Slides were considered positive when asexual forms and/or gametocytes of any Plasmodium species were observed on the blood film. A slide was declared negative only after having examined at least 100 high power fields [13].

Statistical analysis

Data was entered using Epi-Info 6.04 (CDC) and analysed using the Statistical Package for Social Sciences version 17.0 (SPSS Inc. 2008). The Chi-Square test was used to compare proportions at significant level of 0.05.

Results

A total of 322 adults who visited the University of Buea Health Centre, from March 2011 to March 2012, for various health reasons were enrolled into the study. The age range of the study population was 16 to 70 years, with mean age of 31.5. These ages were stratified into 4 groups with 61 (18.9%) participants < = 20 years, 153 (47.5%) aged between 21 to 30 years, 47 (14.6%) aged between 31 to 40 years and 61 (18.9%) > 40 years as shown in Table I. One hundred and seventy seven (54.9%) of the study population were males while 145 (45.1%) were females.

Table II shows the prevalence of malaria among the study participants. Of the 322 subjects who took part in the study, 286 (88.8 %) where positive for malaria at a confidence interval of 95%. Malaria parasites were found in 89.5% of students, 84.2% of staff and 83.3% of neighbouring community members. There was no significant difference in prevalence by status of participants (X^2=2.42, P>0.05).

Table III shows the prevalence of malaria among participants according to gender. There was no difference in prevalence by gender among staff, students and participants reporting from neighbouring communities (X^2=0.08 P>0.05; X^2=0.95 P>0.05; X^2=0.27 P>0.05respectively).

The prevalence of malaria was highest (45.7%) in patients aged between 21 and 30 years as shown in Table IV. There was a

statistically significant difference in the prevalence of malaria by age (X^2=19.25 $P<0.05$).

Table III: Prevalence of malaria among study participants according to gender

Age(years)	N umber	Number (%)* positive for malaria
<=20	61	54 (16.8)
21-30	153	147 (45.7)
31-40	47	37 (11.5)
>40	61	48 (14.9)
Total	**322**	**286 (88.8)**

X^2=19.253 $P<0.05$

Figure 1 depicts the malaria parasite load among study participants. 134 (46.8%) of participants had a scanty parasite load (1 – 400 parasites per µL of blood). Parasite loads of 401 – 7000, 7001-14000 and >14000 trophozoites per µL of blood were observed in 77 (26.9%), 29 (10.1%) and 46 (16.1%) participants respectively.

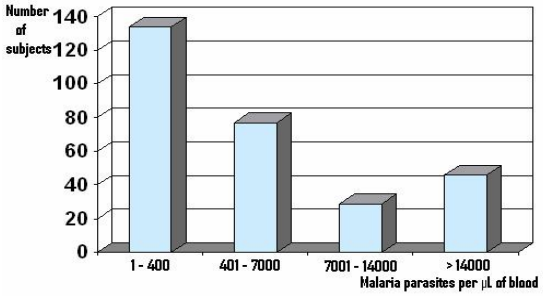

Figure 1: Malaria parasite load among the study population

Discussion

This study aimed at determining the prevalence of malaria parasite burden among patients who consulted in the University of Buea Health Centre during one year period (March 2011 to March 2012). The study recorded a prevalence of 88.8% at 95% confidence interval. This result can be compared with findings from Nkuo- Akenji et al. [11] who conducted a study in a rural community in the same region, and reported a prevalence of 96.2% (326/339) with majority of participants (68.4%) having asymptomatic malaria. Another community survey [6] in Buea revealed a symptomless carrier status ranging from 60 -100%, depending on the period of the year. Unlike the present study which included only adult men and women, the previous surveys carried out in this region have focused mainly on the disease during early childhood [14,15].

The prevalence of malaria among students (89.5%), members of university staff (84.2%) and members of the neighbouring communities (83.3%) who consulted at the Health Centre during the period of study has portrayed

Table IV: Prevalence of malaria among study participants according to age

Gender		Total	Number (%)* positive for malaria	Statistics
	males	126	114 (35.4)	
	Females	103	92 (28.6)	
Students	**Total**	**229**	**206 (64.0)**	$X^2=0.085$ $P>0.05$
	Males	39	34 (10.6)	
	female	18	14 (4.3)	
Staffs	**Total**	**57**	**48(14.9)**	$X^2=0.952$ $P>0.05$
	males	12	9 (2.8)	
	female	24	21 (6.5)	
Neighbouring communities	**Total**	**36**	**30(9.3)**	$X^2=0.277$ $P>0.05$
Grand Total		**322**	**286 (88.8)**	

malaria as an important cause of morbidity in the university community and its environs. As already advocated in previous health survey [5] malaria infection is indeed the most important reason for absences from work or from studies by staff and students respectively and represents the greatest economic loss due to ill health. This is in accordance with other reports [7,8] which suggested that *Plasmodium* infection has a serious impact on the school performance of children, as it may affect the development not only of cerebral malaria (*Plasmodium falciparum*) but also that of other infections [16,17,18,19].

A study carried out in 2008 among school children resident at different altitudes in the south–western Cameroon [15] found that the prevalence of malaria parasite in Buea was 59.3% (156/263), with a geometric mean level of parasitaemia of 565 parasites/ml blood. Considering these figures, one can deduce from our findings that the malaria prevention and control measures put in place in 2006 by the local authorities of the Ministry of Health [14] have not yielded positive results. The rapid population growth in the locality due to in migration of students, including poor environmental hygiene and sanitation have cancelled all intended gains of the malaria prevention and control programmes. The high ratio of candidates with scanty malaria parasite load (46.8%) is a reflection of the high population of symptomless carriers who certainly consulted with different presenting complaints, though some symptomless carriers were diagnosed with parasite load of more than 14,000/µl of blood. This constitutes an additional obstacle in the battle against malaria following the high prevalence of symptomless carrier status in the given community[11,20]. The high prevalence is a reflection of high immunity level in the community against malaria[11], though may also portray high morbidity and mortality levels.

There was no difference by gender of infection among participants. This finding is in accordance with Agboola et

al[21] who reported no significant difference in malaria parasite in relation to gender, in a study on the prevalence of malaria parasite among blood donors in Lagos University Teaching Hospital. It however contrasts with report from china[22] where the gender distribution of malaria cases was striking in the endemic areas. Among the adults over 15 years of age, the sex ratio (male vs. female) reached 5.7. According to Arahman et al. [23], differences in the gender distribution of malaria cases may be attributed to division of labour, leisure patterns, and sleeping arrangements which may lead to different patterns of exposure to mosquitoes for men and women. Our results could therefore be explained by the fact that majority (64.0%) of our participants were students, many of who probably enjoy the same living conditions and likely share the same patterns of exposure to mosquitoes.

There was an association between age and malaria positivity, with highest prevalence among patient aged between 21 and 30 years. This is consistent with a previous report[22]which suggested the predominance of young adult cases in endemic areas, attributed to a large number of non-immune people moving from low-transmission to high-transmission areas. It could be the case in this study, considering the fact that students and staff of the University of Buea who constituted the large portion of our study population are usually migrants from other parts of the country, but the proportion of the number screened for each age group could have also accounted for the observed results.

Conclusion

The results of this study have portrayed malaria as the greatest cause of morbidity among staff, students and the surrounding communities, challenging multidisciplinary efforts which have been implemented by the Ministry of Health to curb down malaria in Cameroon. The climate, the high population density, and the local ecology of the area favour the proliferation of the malaria vector and are largely responsible the epidemic malaria crises during certain periods of the year. This implies that an effective malaria control programme should complement the three-pronged approach with periodic screening and treatment of all inhabitants within university communities. The high economic loss inflicted on countries and communities by malaria alone, is enough reason for the creation of malaria screening and treatment centres in endemic regions as a major initiative to control and subsequently eradicate the disease. It is apparent that an in depth situational analysis is necessary to understand the dynamics of malaria and implement more stringent and elaborated measures to control the disease in and out of the university community. Further studies involving a larger population sample covering a wider geographical area will likely give a clearer view of the findings stated above.

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Conflict of interest

The authors declare having no conflicting interest.

Authors' contributions

NDF, HLFK, NDS and JCNA conceived and designed the study and substantially revised the manuscript, carried out the laboratory investigations and conducted the literature search. IAA and ANL assisted in the design and revised the manuscript. All authors read and approved the final manuscript.

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