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Research Article

Prevalence of Malaria among School Children in Bambili-Tubah Sub Division, North West Region, Cameroon

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ABSTRACT

Background: Malaria is the highest cause of the high infant mortality experienced in Africa, killing 1 in 20 children below the age of 5 years and indeed, killing one child every 30 seconds. The aim of this study was to determine the prevalence of malaria among school children in Bambili.

Methods: Blood samples were collected from 800 subjects all over Bambili, some of them through the health centre to ensure a random selection of subjects since patients all over Bambili consult at the health center. Blood samples were collected from respondents and treated appropriately before mounting on glass slides for microscopic examinations using a light microscope.

Results: Out of these infections screened in 800 persons, only malaria was recorded in 73 persons (9.13%). The highest infection rate (19.23%) was recorded in October and the lowest (1.54%) in January. Risk factors include seasonal changes, the location and hygiene of residences, the level of education, and the non-use of preventive measures.

Conclusion: Malaria appear to be of primary concern thus something must be done by health authorities and sectors responsible for public health issues, in order to effectively control these insect-borne diseases and the nuisance they cause.

Keywords: Prevalence; Risk factors; Blood parasites; Malaria; Plasmodium

INTRODUCTION

Malaria, the leading cause of death in Africa, and transmitted by the *Plasmodium* species; described as the most important infectious disease in humans, difficult to control and very widespread [1]. It is said to constitute the greatest public health problem globally [1].

Of the four common species (*Plasmodium falciparum, Plasmodium vivax, Plasmodium malariae and Plasmodium ovale*) that cause malaria, the most serious is P. *falciparum*, responsible for virtually all deaths, causing fatal disease and as such, is the species targeted in research on anti-malaria drug resistance and attempts to develop a vaccine [2,3].

Malaria has had a greater impact on world history than any other infectious disease, and among all communicable diseases, it is the world's second greatest killer after tuberculosis and afflicting 5% of the world's population [4,5]. More than 500 million people suffer from malaria today over the world, and it is estimated to cause an annual death toll of 2.5 million. In Cameroon, malaria accounts for 40%-45% of medical consultations, 57% of hospitalization days and 40% of mortality among children below 5 years and pregnant mothers [6]. Children are more vulnerable, probably because of their lack of immunity to the disease. The aim of this study was to determine the prevalence of malaria among school children in the different health zones of Bambili and risk factors.

MATERIALS AND METHODS

Area of study

The study was carried out between August, 2012 and January, 2013 in Bambili (Figure 1). This is a village in Tubah sub-division in Mezam division of the North West region of Cameroon. Its

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geographical coordinates are latitude 5° 59′ 0″ N, and longitude 10° 15′ 0″ E. Bambili is divided into twenty-eight quarters, grouped into six health zones namely: Nibie I, Nibie II, Mahmishang, Ngophana, Nibie III and Ntigi/Akou in order of decreasing population.

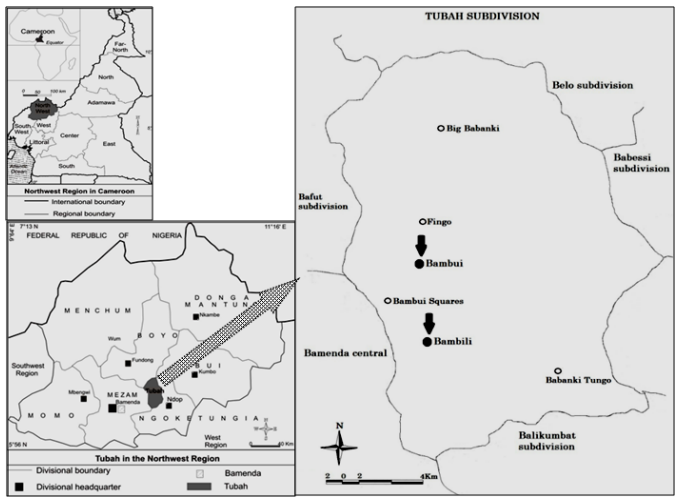

Figure 1: Map of the study area-Bambili.

Sensitization and sampling method

Sensitization was carried out at the Bambili Health Center, to inform patients of the objectives of the research. Interested persons were each given a questionnaire sheet to fill information pertaining to age, sex, health status and quarter of residence, etc. Blood samples were collected from 800 subjects all over Bambili, some of them through the health centre to ensure a random selection of subjects since patients all over Bambili consult at the health center. A similar sensitization carried out to pupils in four primary schools at diverse locations in the village, where the bulk of samples would be obtained. Questionnaires were then distributed to them for onward transmission to their parents who consented by filling the information required of them.

Microscopic observation of Malaria and other haemoparasites

The ball of the respondent's forefinger was chosen as a suitable puncture site. The finger was cleaned with 75% alcohol using cotton, and allowed to air dry. Thick smears were prepared, stained with Giemsa solution and observed under 100X objective. Slides were reported negative for parasites only after observing at least 50 fields. Parasite density was determined by counting the number of malaria parasites against 200 white blood cells and expressing the resultant number of parasites/µl blood assuming a white blood cell count of 8000 per µl of blood [7].

Statistical analysis

Data collected was entered into the Statistical Package for Social Sciences (SPSS) 12.0 for Windows. Chi square was used to compare prevalence with respect to health zones, age and gender and the various risk factors. Chi square was tested at 5% significance level.

RESULTS

Table shows the distribution of pupils in various health zones in Bambili. A total of 800 pupils were sampled, 350 males and 450 females. The largest sample of 200 was recorded from Nibie I and the lowest (80) from Ntigie/Akou (Table 1).

Table 1: Distribution of pupils with respect to various health zones.

Health Zones	Males	Females	Total	Percentage
Nibie I	90	110	200	25
Nibie II	75	85	160	20
Nibie III	40	50	90	11.25
Ntigi/Akoe	35	45	80	10
Ngophana	50	60	110	13.75
Mahmishang	60	100	160	20
Total	350	450	800	100

Distribution of pupils sampled according to schools attended

Table shows the distribution of students based on their schools. The highest number of samples (270) was obtained from Government School Bambili and the lowest (60) from Lady Martha Nursery and Primary School Bambili (Table 2).

Table 2: Distribution of pupils sampled according to schools attended.

School	Male	Female	Total	Percentage
G.S Bambili	130	140	270	33.75
C.S Ntsehwi	80	150	230	28.75
G.S Nchokeng	110	130	240	30
Lady Martha	30	30	60	7.5
Total	350	450	800	100

Age distribution of pupils sampled

The age distribution of pupils is shown. Out of the children examined, 43.75% were of the age group 5-9 years since the study was conducted in primary schools where the age group of 0-4 years is least (18.75%), and children graduate from primary school early in the range 10-14 years (Table 3).

Table 3: Distribution of pupils sampled by age groups.

Age group	Males	Females	Total	Percentage
0-4 years	60	90	150	18.75
5-9 years	150	200	350	43.75
10-14 years	140	160	300	37.5
Total	350	450	800	100

Monthly distribution of pupils sampled

The monthly distribution of pupils sampled is shown. An equal number of samples were made for 3 consecutive months of the wet season and dry season respectively in order to establish the possible effects of seasonal changes (Table 4).

Table 4: Monthly distribution of pupils sampled during the study period.

Month	Nibie I	Nibie II	Nibie III	Ntigi/Akoe	Ngophana	Mahmishang	Total
August	36	26	17	13	17	31	140
September	35	26	15	13	11	30	130
October	30	22	16	11	25	26	130
November	35	27	13	14	16	35	140
December	35	29	15	13	17	21	130
January	29	30	14	16	24	17	130
Total	200	160	90	80	110	160	800

Prevalence of *Plasmodium* in various Health Zones in Bambili

The prevalence of *Plasmodium* infection, malaria is shown, classified in the different health zones. Nibie III has the highest infection rate (13.33%), while Ngophana has the least (4.55%) (Table 5).

Table 5: Prevalence of Plasmodium infections in the health zones of Bambili.

Health Zones	No. examined	No. infected	Percentage
Nibie I	200	16	8
Nibie II	160	9	5.63
Nibie III	90	12	13.33
Ntigi/Akoe	80	14	17.5
Ngophana	110	5	4.55
Mahmishang	160	17	10.63
Total	800	73	

Prevalence of *Plasmodium* during different months of the study period

The monthly prevalence of *Plasmodium* during the study period is shown. The highest infection rate (19.23%) was recorded in October and the lowest (1.54%) in January (Table 6).

Table 6: Monthly prevalence of Plasmodium infection during the study period.

Month	Sampled	Infected	%
August	140	11	7.86
September	130	14	10.77
October	130	25	19.23
November	140	14	10
December	130	7	5.38
January	130	2	1.54
Total	800	73	

Distribution of *Plasmodium* among the age groups studied

The distribution of *Plasmodium* among various age groups is shown. The age group 0-5 years had the highest (20.67%) rate of infection, while those of 11-15 years had the lowest (4.33%) (Table 7).

Table 7: Distribution of Plasmodium infection among age groups.

Age group	Sampled	Infected	%
0-5 years	150	31	20.67
6-10 years	350	29	8.29
11-15 years	300	13	4.33
Total	800	73	

Distribution of *Plasmodium* based on gender of respondents

The sex distribution of *Plasmodium* is shown. It indicates an infection rate of 9.14% for males and 9.11% for females (Table 8).

Table 8: Distribution of Plasmodium infection between genders.

Gender	Sampled	Infected	% infeced
Males	350	32	9.14
Females	450	41	9.11
Total	800	73	

Parasite distribution based on health status of respondents

The distribution of *Plasmodium* based on health status as shown an infection rate of 46.67% among symptomatic cases, and only 0.46% among the asymptomatic ones (Table 9).

Table 9: Distribution of Plasmodium infection according to health status.

Health status	Sampled	Infected	%
Symptomatic	150	70	46.67
Asymptomatic	650	3	0.46
Total	800	73	

Distribution of *Plasmodium* with respect to the use of preventive methods

This table elaborates the prevalence of the parasite with respect to the use or disuse of various preventive measures for the health zones (Table 10). Majority of the respondents (80.82%) used no preventive measures. Prophylaxis (2.74%) was the least preventive method used.

Table 10: Prevalence of Plasmodium with respect to preventive measures used.

Preventive measure	No. sampled	No. infected	No. infected
None	637	59	80.82
Nets	154	12	16.44
Prophylaxis	9	2	2.74

Prevalence of *Plasmodium* relative to guardian's level of education

The prevalence of *Plasmodium* in relation to the guardian's level of education is represented in Table 11. The highest percentage (65.75%) was among those without O - level; and the lowest (2.74%) among those with a university degree.

Table 11: Prevalence of Plasmodium with respect to guardian's level of education.

Guardian's Level of education	Sampled	Infected	% infected
<Ordinary-level	120	48	65.75
Ordinary-level	218	18	24.66
Advanced-level	329	5	6.85
University degree	133	2	2.74

Attitude of respondents to the use of preventive measures

This table illustrates the use of preventive measures in relation to level of education of the guardians of subjects sampled. The highest use of preventive measure (48.88%) was observed among guardians who have a university degree, while the least (5.83%) was noted among those who do not have the O level. The use of preventive measures was seen to increase with higher levels of education as shown in Table 12.

DISCUSSION

The health zones of Ntigi/Akou and Nibie III had the highest infection rates, while Mahmishang and Nibie I had the highest number of infections. A possible explanation is the geography of Bambili. A small stream flows through Ntigi and this area, stretching towards the Bambili palace and Mahmishang is relatively sparsely occupied compared to the others. The unexploited land has bushes in which mosquitoes can reside, from where they can have access to man for a blood meal. Nibie I on its part is the central area of Bambili with a high population density and sporadic refuse heaps from the houses, which constitute very good breeding site for mosquitoes.

The highest infection rates were noticed between the months of September-November, probably because there was moisture enough to leave standing water, and heat enough to favour high mosquito activity and reproductive rate. In the months of December and January the decline in infection rate may be due to increasing temperatures and the consequent drying away of small pools of water and moisture in vegetation; while that of August could be because there is so much rain that it keeps standing water [8].

Table 12: Respondents' attitude towards the use of preventive measures.

Level of education	Variable	Nibie I	Nibie II	Nibie III	Ntigi/ Akou	Ngo-phana	Mahmi-shang	Total (%)
<O-level	None	7	17	10	27	19	33	113 (94.17)
	Nets	2	1	1	0	2	1	7 (5.83)
	prophylaxis	0	0	0	0	0	0	0 (0.00)
O-level	None	6	28	33	27	25	69	188 (86.24)
	Nets	17	1	3	4	3	2	30 (13.76)
	prophylaxis	0	0	0	0	0	0	0 (0.00)
<A-levelc	None	88	78	21	9	33	42	271(82.37)
	Nets	29	3	7	5	7	6	57 (17.33)
	prophylaxis	0	1	0	0	0	0	1 (0.30)
University degree	None	20	26	7	1	11	3	68 (51.13)
	Nets	28	3	6	7	9	4	57 (42.86)
	prophylaxis is	3	2	2	0	1	0	8 (6.02)
		200	160	90	80	110	160	800

Among the age groups there was no significant difference between the age group 0-5 years and 6-10 years, but there was a significant difference between both age groups and that of 11-15 years. This accord with similar studies conducted in Bamenda, Douala and Yaounde and has been attributed to protective immunity as a result of previous exposure to malaria [9]. This may equally be due to lack of or poor immunity amongst them or the poor use of protective dresses, nets or other preventive measures as compared to those of the more advanced age groups.

As for the gender, the almost equal rate of infection between males and females can possibly be due to the fact that both sexes are exposed to the same risk of mosquito bites, and among these age groups, there is about the same activity engaged by them.

When symptoms show up, there is a greater chance that the individual may already have been infected before the test is carried out. This may account for the distinct difference in the infection rate between symptomatic and asymptomatic.

The use of preventive measures was found to have a direct relationship with malaria prevalence. Malaria is transmitted by infected female anopheles mosquito vectors which transmit *Plasmodium* when they bite their victims and allowed to proliferate in the human blood system if no timely therapeutic or preventive measures are employed. The prevention of mosquito bites or stifling of sporozoite multiplication at early stages seems to impede malaria transmission which is a possible explanation to the trend of decreasing malaria prevalence among those who stick to preventive measures. The decrease in the prevalence of malaria parasites may equally be due to the control measures recently implemented by the Cameroon Government through the Ministry of Public Health [1]. The measures include a nationwide free distribution of insecticide-treated bed nets (ITNs) as well as long-lasting insecticidal nets (LLINs) across the national territory. A decline in malaria burden attributed to the use of interventions such as ITNs and LLINs has also been reported in malaria-endemic countries such as Kenya and Tanzania [10,11].

The level of education was found to have positive correlation with the prevalence of malaria. No significant difference ($p>0.05$) existed between those who have Ordinary level and those who never had it, just like between subjects whose guardians have Advance- level and those with a university degree. However, there was a significant

difference ($p<0.05$) between the two groups, probably because greater awareness of risk factors and hence the necessity of taking preventive measures and timely medical intervention existed among those with a higher educational background. This can be seen from the overall trend in the infection rate even among groups with no significant difference between them. The positive correlation between the level of education and use of preventive measures, with malaria prevalence probed a finding into a possible correlation between both factors. The results portrayed clearly that there is an increasingly positive attitude towards malaria prevention from a lower level to a higher one.

CONCLUSION

Application of preventive measures proved to be effective against the spread of malaria; the most common and feasible of them being mosquito nets and fly screens. Therefore mass sensitization must be done periodically through campaign caravans, at the markets and in churches; to ensure that malaria control be given an intellectual fight.

AVAILABILITY OF DATA AND MATERIALS

Data and material are available to other researchers upon request

COMPETING INTEREST

The authors declared that they have no competing interest

FUNDING

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ETHICAL APPROVAL

To carry out this research, an ethical clearance was obtained from the National Ethics Committee of Cameroon, in order to ensure the consent and the confidentiality of the participants.

AUTHOR'S CONTRIBUTION

VKP, MBD, YC, NACN: Contributed to the design of the study, data collection, led the analysis and drafting of the manuscript. All authors read and approved the final manuscript.

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