Original Research Article

Risk Factors of Malaria Infection among School-Aged Children in Jalingo and Sardauna Local Government Area, Taraba State, Nigeria

ABSTRACT

Aims: Malaria parasite among school aged children is a disease that poses a great challenge to human health in Nigeria. Malaria contributes significantly to the burden of disease especially among children less than five years. Efforts aimed in controlling malaria, prevalence is still high.
Study design: This study was designed to investigate the prevalence of malaria infection among school aged children in Jalingo and Sardauna LGAs of Taraba State, Nigeria.
Place and Duration of Study:
Methodology: Structured questionnaire was used to obtain demographic information and Microscopy was also used to determine Parasitaemia level among the school aged children (2-15years). A total of 1000 children less than 15 years old from ten (10) selected communities of the study areas whose parent or guardian gives consent were selected.
Results: The results revealed that out of the 1000 subjects, 359(35.9%) were infected with malaria parasites. Ages between 2-5 year were found to have the highest prevalence of 212(21.2%) while age 11-15 group had least prevalence of 21(2.1%). The highest parasites load generated from the ten communities, revealed that Magami had the highest Parasitaemia of 36(3.6%)+, 19(1.9%)++ and 1(0.1%)+++ while Maisamari community had the lowest parasite intensity of 14(1.4%) + and 1(0.1%) ++, respectively. The overall prevalence of malaria parasite was moderate among the study population. This is probably due to the seasonal variation in malaria parasite intensity and the good knowledge of caregivers on malaria infection and management.
Conclusion: There is therefore the need to sustain the current media and health facility based campaigns on malaria prevention strategy and maintenance of clean environmental condition.

Keywords: Prevalence, Parasitaemia, Microscopy, Sardauna, environmental condition.

1. INTRODUCTION

Malaria is a mosquito born infectious disease of human and other animals caused by parasitic protozoans belonging to the genus *Plasmodium* [1]. Studies in rural areas of Africa where malaria is endemic reveal that over one-third of primary school children had malaria during a school term, more than half of this group had two or more attacks typically missing a week or more of school with each attack [2]. Malaria is responsible for over 300,000 deaths in children annually most of these deaths result from severe and complicated malaria especially in rural areas [3].

Malaria is said to be more prevalent in rural areas due to favourable environmental conditions for parasite transmission [4]. However, there is significant risk of infection in urban areas. Uncontrolled urbanization leads to an increased number of slums simulating a rural environment and results in increased malaria transmission in some third world urban areas especially Nigeria. The presence of swamps, gutters and thick vegetation in the cities enhances the breeding of vectors. Agricultural practices around dwellings also increase the risk of mosquito bites. Practices such as the use of irrigation during rice cultivation, use of ponds for fish farming and storage of water in tanks for livestock that provide suitable breeding ground for anthropophylic mosquitoes [4]. The most common anthropophylic mosquito in Nigeria which causes much of the morbidity and mortality associated with malaria is the *Anopheles* mosquito. Farmers are therefore at high risk of malaria which seriously impacts on agricultural productivity. In Nigeria, malaria risks exist throughout the year in the

entire country including urban areas [5]. The problems of rural–urban migration, the persistence of poverty in the population, environmental degradation and seemingly intractable problems of providing decent housing, potable water, sanitation and transportation are common in many Nigerian cities and they cumulatively encourage the risks of malaria infection and parasite resistance through the use of inconsistent malaria treatment options [5].

2. MATERIAL AND METHODS

2.1 *Study Areas* - This study was conducted in two Local Government Areas, Jalingo and Sardauna Local Government Areas. Jalingo L.G.A lies between Latitude and Longitude of $8^0$9'N and $11^0$36'E respectively at an elevation of 239.82 meters above sea level. Jalingo L.G.A capital is also located in the state Headquarter (Jalingo) as a city in north-eastern Nigeria. It is the capital city of Taraba State. Sardauna LGA, with Gembu as the Headquarter lies roughly between Latitudes 6° 43'N, longitudes 11°15'E sitting at an average elevation of about 1,348 meters (4,423 ft) above sea-level, it is among the high elevated towns in Nigeria.

2.2 *Study Design*- A comparative cross-sectional study was conducted among school aged children between the ages of 2 to 15. Information was collected on the uses of and attitudes of respondents towards prevention and treatment of malaria in the selected communities, with particular reference to study areas.

2.3 *Study population*- The population of this study was drawn from five (5) communities each from the two (2) study areas to obtain 1,000 samples. Exclusion criteria are children who are too sick or on admission in health facilities on account of malaria infection or those whose parent/guardian did not consent. Ethical permission was obtained from the Ministry of Health, Taraba State, Jalingo. Letter of introduction was obtained from Education Secretary, Universal Basic Education Authority, Gembu, Sardauna Local Government Area, Head Teachers and Primary Health Care Agency ethical committees.

2.4 *Sample Size Determination* - Fisher formula was used to determine the sample size [6].

$$n = \frac{z^2 p\,(1-p)}{d^2}$$

Where z = Z score for 95% confidence interval, which will be 1.96, p = Prevalence of malaria was 93% (0.93), d = Tolerable error, which was 5% (0.05).

A minimum sample size (n) of 100 was calculated using Fisher equation. A minimum of 100 samples were collected in ten communities making a total of 1,000 children were selected and screened for malaria parasitaemia.

2.5 *Field and Laboratory Testing and Specimen Source* - Data used in this study were generated from field work through the administration of questionnaires. Three (3mls) of venous blood was collected aseptically from each enrolled child into Potassium ethylene diamine Tetra -Acetate anticoagulant bottles. The blood was used for the assessment of thin and thick films for different forms of malaria Parasitaemia.

2.6 *Immunochromatography RDT cassette Analysis* - An immunochromatography Rapid Diagnostic Tool (RDT) cassette (CareStart™) for *Plasmodium falciparum* that detects histidine-rich protein 2 (HRP2) antigen in the blood was used following the manufacturers instruction as follows, 5 µl of blood was dropped into the sample well in the test device, two drops (60µl) of assay buffer was added into the assay buffer well (A). The test result was read in 20 minutes. The presence of two colour bands (that is, the test (T) and the control (C) indicates a positive result, while the present of only one band (C) within the result window indicates a negative result. The test was considered invalid if the control line does not appear.

2.7 *Microscopic analysis* - Each blood film smeared on the slide was examined microscopically using 100x objectives of a light microscope which is oil immersion objective that gives a brighter and clearer image of the parasites. Malaria parasites were identified to their different species levels [7, 8] as guides.

2.7 *Statistical Analysis* - Descriptive statistics was derived using the Statistical Package for Social Sciences (SPSS version 20) statistical software. Chi square test was conducted as a basis for testing the postulated hypotheses at 0.05 significance levels.

3. RESULTS

Factors associated with malaria among school aged children are shown in table 1. Based on the findings, comparing the factors associated with malaria parasites among school aged children in the two study areas. Out of 498 children in Jalingo LGA, 187 bath and wash in ponds, rivers and streams, while 311 do not. On the presence and absence of malaria parasite, out of the 187 that bath and wash in ponds, rivers and streams, 148(29.6%) were found to be infected with malaria parasite while out of 499 children in Sardauna LGA, 392 bath and wash in ponds, rivers and streams, 83(16.6%) were found to be infected with malaria parasite, while 107 that do not bath and wash in ponds, rivers and streams 24(4.8%) were found to be infected with MP.

Responses on the use of insecticides treated nets (ITN), 258 out of 500 in Jalingo LGA revealed that they use ITN while 242 do not, out of the 258 that use ITN, 39(7.8%) were found to be infected with MP. However, of the 242 that do not use ITN 212(42.4%) were found to be infected with MP. On the other hand, 158 out of 497 in Sardauna LGA showed that they used ITN while 339 do not, out of the 158 that use ITN, 8(1.6%) were found to be infected with MP. However, of the 339 that do not use ITN, 99(19.8%) were found to be infected with MP.

Regarding the practice of preventive medicine against malaria infection, 232 respondents in Jalingo LGA admitted to the use of preventive medicine while 266 do not. Out of 232 that practice preventive medicine against malaria parasites, 32(6.4%) were found to be infected with malaria parasites while out of 266 that do not practice preventive medicine, 218(43.6%) were found to be infected with MP. In contrast, 167 out of 500 children in Sardauna LGA practice preventive medicine against malaria parasites and 333 do not. Out of the 167 that practice preventive medicine against malaria, 7(1.4%) were found to be infected with MP. 333 out of 500 that do not practice preventive medicine against malaria, 100(20.0%) were found to be infected with malaria parasites (Table 1).

Considering clearing/leaving of bushes around their premises as a factor associated with malaria parasite infection, 236 school aged children out of 499 in Jalingo LGA responded to clearing of bushes around their premises while 263 do not. Out of 236 that clear bushes around their premises, 52(10.4%) were found to be infected with malaria parasite while 263 out of 499 that do not clear bushes around their premises, 198(39.6%) were found to be infected with MP. On the other hand, in Sardauna LGA, 198 school aged children out of 497 responded to clearing of bushes around their premises while 299 do not. Out of 198 that clear bushes around their premises, 10(2.0) were found to be infected with malaria parasite while 299 out of 499 that do not clear bushes around their premises, 68(19.2%) were found to be infected with MP.

On the use of indoor residual spray (IRS), 227 out of 487 school aged children in Jalingo LGA responded to the use of IRS while 260 do not. Out of 227 that used IRS, 26(5.2%) were found to be infected with MP. However, out of 260 that do not use IRS 213(42.6%) were found to be infected with MP. In contrast, 180 out of 499 school aged children in Sardauna LGA responded to the used of IRS while 319 do not. Out of 180 that used IRS 5(1.0%) were found to be infected with MP. However, out of 319 that do not use IRS, 102(20.4%) were found to be infected with malaria parasites (Table 1).

Taking factors such as water holds and empty containers around the premises, 250 out of 497 school aged children in Jalingo LGA agreed that they allowed water holds and empty containers around their premises while 247 do not. 250 out of 497 that allowed water holds and empty containers around their premises, 85(17.0%) were found to be infected with malaria parasites while 247 out of 497 that do not allow water holds and empty containers around their premises, 164(32.8%) were found to be infected with MP. On the other hand, 206 out of 493 school aged children in Sardauna LGA responded to keeping water holds and empty containers around their premises while 287 do not. Out of 206 that keep water holds and empty containers around their premises, 21(4.2%) were found to be infected with MP. However, out of 287 that do not keep water holds and empty containers around their premises 85(17.0%) were found to be infected with malaria parasites (Table 1).

Discussion

Despite significant financial investments and efforts made both locally and globally to reduce malaria transmission, the disease continues to be the most serious threat to people's health in Sub-Saharan Africa, specifically in Nigeria. The use of insecticide treated nets is considered one of the parasite's protective mechanisms; nonetheless, the frequency of malaria among individuals who did not use was significantly high.

The main risk factors for malaria infection prevalence in school aged children include bath and wash in ponds, rivers and streams are associated with malaria infection. Also the inability of some house hold to use ITN, cleaning of their surrounding or leaving bushes around their premises seriously exposes them to the vector breeding sites where biting take place and increase the risk of the parasite transmission. The indiscriminate waste disposal practice in Jalingo metropolitan were also observed as some common factors associated with malaria infection.

These findings are consistent with other studies [9]. Some studies have reported an increased prevalance in children living at low altitudes compared to those who lived at high altitudes [10, 15]. The observed increased risk of malaria infection in people living in poor housing is consistent with some studies [11, 12]. Increased risk of malaria infection in older children (the 5–14 year age group) compared to younger children seen in this study is a trend which has been observed in other studies conducted elsewhere in Tanzania [13]. Older children have higher exposure to mosquito bites compared to younger age groups as they may tend to sleep later and less likely to use LLINs in some studies and places [14]. In addition, due to the acquired anti-malarial immunity in older children, most have persistent asymptomatic malaria infections that are less likely to be treated, unlike younger children.

Table 1. Risk Factors of Malaria Infection among School-Aged Children in Jalingo and Sardauna Local Government Area, Taraba State, Nigeria

	Factor	Respond	No. Sampled	Prevalence	χ^2	P
Jalingo	Bath in ponds, rivers and streams	Yes	187(37.4)	148(29.6)	100.34	0.41
		No	311(62.2)	104(20.4)		
		Total	498	**250(50.00)**		
	Use of insecticide treated net	Yes	253(51.6)	39(7.8)	262.45	0.58
		No	242(48.4)	212(42.4)		
		Total	500	**251(50.20)**		
	Preventive medicine against malaria	Yes	232(46.4)	32(6.4)	231.30	0.56
		No	266(53.2)	218(43.6)		
		Total	499	**215(50.00)**		
	Bushes around the premises	Yes	236(47.2)	52(10.4)	141.08	0.46
		No	263(52.6)	198(39.6)		
		Total	499	**250(50.00)**		
	Use of indoor residual spray	Yes	227(45.4)	26(5.2)	240.81	0.57
		No	260(52.00)	213(42.6)		
		Total	**487**	**239(47.8)**		
	Water hold and empty container around the premises	Yes	250(50.00)	85(17.00)	520.16	0.30
		No	247(49.40)	164(32.80)		
		Total	497	**249(49.8)**		

Table 1. continued...

	Factor	Respond	No. Sampled	Prevalence	χ^2	P
Sardauna	Bath in ponds, rivers and streams	Yes	392(78.4)	83(16.6)	47.39	0.27
		No	107(21.4)	24(4.8)		
		Total	499	**107(21.4)**		
	Use of insecticide treated net	Yes	158(31.6)	8(1.6)	37.17	0.27
		No	339(67.8)	99(19.8)		
		Total	497	**107(21.4)**		
	Preventive medicine against malaria	Yes	167(33.4)	7(1.4)	44.4	0.29
		No	333(66.6)	100(20.0)		
		Total	500	**107(21.4)**		

	Bushes around the premises	Yes	198(39.6)	10(2.0)	51.97	0.32
		No	299(59.8)	96(19.2)		
		Total	479	**106(21.4)**		
	Use of indoor residual spray	Yes	180(36.00)	5(1.0)	58.23	0.34
		No	319(63.8)	102(20.4)		
		Total	499	**107(21.4)**		
	Water hold and empty container around the premises	Yes	206(41.2)	21(4.2)	26.80	0.23
		No	287(57.4)	85(17.0)		
		Total	493	**106(21.2)**		

**X2=Chi square, p=0.05*

4. CONCLUSION

Malaria parasite among school aged children is a disease that poses a great challenge to human health in Nigeria. Malaria contributes significantly to the burden of disease especially among school aged children. The risk factors associated with malaria infection among school aged children in Jalingo and Sardauna LGAs of Taraba State, Nigeria. The findings revealed that some factors associated with malaria infection are common with the study areas leading to the transmission of the parasite. The highest prevalence of the infection was found with the children less than five years. Efforts aimed in controlling malaria, prevalence is still high specially in Taraba State. This study was designed to investigate the prevalence ae age group of 2-5 year and lowest in 11-15years. The study reveals that some activities practice by individual serve as risk factor associated with malaria transmission. These factors include bath and wash in ponds, rivers and streams are associated with malaria infection. Also the inability of some house hold to use ITN, cleaning of their surrounding or leaving bushes around their premises seriously exposes them to the vector breeding sites where biting take place and increase the risk of the parasite transmission. The indiscriminate waste disposal practice in Jalingo metropolitan were also observed as some common factors associated with malaria infection. The overall risk of malaria parasite was high among the study population. This is probably due to the seasonal variation, good knowledge of caregivers on malaria infection and management. Therefore, the need to sustain campaigns on malaria prevention strategy and maintenance of clean environmental condition.

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