KNOWLEDGE, ATTITUDE AND PRACTICES ABOUT MALARIA AMONG MEMBERS OF A UNIVERSITY COMMUNITY IN KWARA STATE, NIGERIA

[1]AJAO, Adeyemi Mufutau, [2]IDRIS, Nimat, [1]SUNDAY, Ojo Joseph, [3]POPOOLA, Niyi AbdulGafar, [1]OLADIPO, Segun Olayinka and [2]LADIPO, Emmanuel Femi

[1]Department of Bioscience and Biotechnology, Kwara State University, Malete, Kwara State, Nigeria.
[2]Medical Centre and Environment Safety Unit, Kwara State University, Malete, Kwara State, Nigeria.
[3]School of Allied Health and Environmental Sciences, Kwara State University, Malete, Kwara State, Nigeria.

Corresponding Author: Ajao, A. M. Department of Bioscience and Biotechnology, Kwara State University, Malete, Kwara State, Nigeria. **Email**: adeyemi.ajao@kwasu.edu.ng **Phone:** +234 8035058904

ABSTRACT

Malaria is still the leading cause of morbidity and mortality in many tropical regions despite global efforts towards its eradication. This study investigates knowledge and practices about malaria among members of Kwara State University community, Nigeria. Questionnaires were administered to 518 undergraduate students and 91 staff randomly from the university community. Majority (99.63 %) of students and staff (98.91 %) agreed that malaria is caused by mosquito bite, two hundred and twenty two (42.09 %) of the students and 69.23 % of staff identified the female Anopheles mosquito as the vector of malaria. A total of 32.82 % picked stagnant water; 27.03 % water retaining containers and 38.19 % plant/vegetation as mosquito vector habitat. The majority of students (83.78 %) and staff (97.80 %) also responded that night was the common vector biting period. On malaria symptoms the respondents ranked fever (71.81 %), body pain (31.85 %) and headaches (29.53 %) while staff responses followed similar trends. On the medication employed for the treatment of malaria, ACT, (53.86 %), Artesunate (25.09 %), Sulphadoxine-pyrimethamine (15.44 %) and paracetamol (10.81 %) attested to by the students while those of the staff was in the order 53.84 % ACT, 29.67 % Artesunate and 18.68 % Sulphadoxine-pyrimethamine. The result elucidates that most respondents had fair knowledge about malaria, its vector, habitat, prevention and control, but the majority had poor practices towards malaria. Therefore, education and interventions aimed at social and behaviour change are necessary to address and fill the gaps highlighted, conscious efforts toward enlightenment of the people of the university community and its environment is a necessary step among suggestions proffered.

Keywords: Malaria, Community, Container survey, Knowledge, Practice

INTRODUCTION

Malaria continues to be a leading cause of morbidity and mortality in many tropical regions despite global efforts to eradicate the disease. Despite its preventable, curable and treatable nature, it still remains a big health risk to many communities of the world, especially in Sub-Saharan Africa. Nigeria suffers the world's greatest malaria burden, with approximately 51 million cases and 207,000 deaths reported annually (approximately 30 % of the total malaria burden in Africa), while 97 % of the total population (approximately 173 million) is at risk of infection. Moreover, malaria accounts for 60 % of outpatient visits to hospitals and led to approximately 11 % maternal mortality and 30 % child mortality, especially among children less than 5 years. This devastating disease affects the country's economic productivity, resulting in an estimated monetary loss of approximately 132 billion Naira (~700 million

USD), in treatment costs, prevention, and other indirect costs (WHO, 2015; Dawaki *et al*., 2016). In Nigeria, the economic impact of malaria can be attributed to low gross national income per capital (GNI) of US$260. The Federal Government Policy on Malaria Control in Nigeria focuses on LLINs, IRS, intermittent preventive treatment (IPT) and environmental management. Although advances in terms of new drugs and vaccines has been commendable, malaria eradication is still far from being achieved (Mereta *et al.,* 2013; Amenu, 2014).

Malaria distribution seasons pattern in most parts of Nigeria is from September to December following the rainy season and from June to August with minor transmission season from February to March with some modification depending on specific region, human population and activities (Oduola and Awe, 2006).The most common malaria transmission mode is through the bite of mosquito. About 95 – 99 % of the adult population carries the parasite with less than 30 % of this number coming down with illness. Malaria transmission depends on two key factors which are: location of mosquito breeding sites and clustering of human habitations (Klein *et al.,* 1995; WHO, 2015). In addition, socioeconomic factors such as education, income, housing patterns, social groups, water storage and treatment seeking behavior play an important role in malaria transmission (Reuben, 1993; Penilla *et al.,* 1998).

Mosquitoes exploit almost all types of aquatic environments ranging from slow moving streams to stagnant pools. Available evidence indicated that peri-urban settlement found at the edge of many urban centers in sub-Sahara Africa create conditions favourable to anopheline vector breeding. Mosquitoes exploit almost all types of aquatic environments. *Anopheles* mosquito has been found to use freshwater habitats for breeding, whilst some breed in open, sunlight pools (Okogun *et al.,* 2005). Anopheline species are known to be ground pools breeders (Mafiana *et al.,* 1998; Okogun *et al.,* 2003; NMCP, 2005).

Malaria is a major public health problem in Nigeria where it accounts for more cases and deaths than any other country in the world. Malaria is a risk for 97 % of Nigeria's population. The remaining 3% of the population live in the malaria free highlands. There are an estimated 100 million malaria cases with over 300,000 deaths per year in Nigeria (Mills *et al*., 2008).

Malaria treatment in Nigeria is based almost exclusively on chemotherapy, with the use of the different antimalarial drug. The control of falciparum malaria is becoming increasingly challenging in many endemic areas of the world including Nigeria (Akazili *et al.,* 2007); not only because *Plasmodium falciparum* has developed resistance to commonly used anti-malaria drugs, but also due to individual and household drug use patterns. In West Africa including Nigeria, chloroquine resistance is firmly established (Thanabouasy *et al*., 2009; Hlongwana *et al.,* 2009; Mazigo *et al*., 2010; Appiah-Darkwah and Badu-Nyarko, 2011). Alternative drugs like amodiaquine and sulfadoxine-pyrimethamine are being used in rural northwest Tanzania (Mazigo *et al.,* 2010). However, in Mukono District, Uganda, malaria infected pregnant women have change from these alternatives to combination therapies (Mbonye *et al.,*2006).Chloroquine was the official first line antimalarial drug in Nigeria until February 2005, when the Federal Ministry of Health announced the change to artemisinin and artemisinin combination therapies (Dawaki *et al.,* 2016).

A primary determinant of adult mosquito population density is the types and number of available containers in a given environment. The key types of containers that provide breeding environment for a large proportion of the larval, pupa and adult mosquito include water retaining containers, gutters, ground pools among others (Tyagi *et al.,* 2012). Based on the land use changes, such as agricultural expansion, infrastructure development, urbanization, deforestation, and human population growth contribute to the proliferation of mosquitoes breeding sites (Rejmánková *et al.,* 2013). These environmental or land-use modifications also affect climate processes that are likely to support rapid growth of mosquitoes and parasites in regions where there has previously been a low temperature

restriction on transmission (Vijayakumar *et al*., 2014).

Malaria epidemiology is affected by the interaction among humans, climatic, seasonal and biological factors which contribute to the establishment of the infection in endemic areas (Miller *et al*., 2002). The special effects of each of these factors must be clarified in order to implement much sought effective control measures to reduce the incidence and knowledge about malaria infection in endemic areas. The use of precise diagnostic methods based on individuals taken at random from the population could produce a better understanding of the factors affecting malaria infection (Sachs and Malaney, 2002). However, realization and sustenance of malaria control can only be achieved through sound community understanding and knowledge of the disease given that it requires a focus on malaria transmission at local levels (Klein *et al*., 1995; Thanabouasy *et al*., 2009; Hlongwana *et al.,* 2009).

Researches on entomological and environmental data, community knowledge causes of malaria, vector, transmission, practices, breeding sites, clinical diagnosis of malaria and treatment abounds in literature. This study is an addition to knowledge more specifically for the rural communities and Kwara State University community, North central, Nigeria.

MATERIALS AND METHODS

Study Area: The study was carried out in Kwara State University, Malete and its environs, Moro Local Government Area, North-Central geo-ecological zone, Nigeria. Malete is situated at Longitude8°42'0" N and Latitude 4°28'0" E of the State. Kwara State has a land area of 36,825 square kilometers and a population of 2,591,555 (Wikipedia, 2015). The area experiences two seasons; wet and dry seasons. Both seasons last for about six months. Kwara State is a savanna area, with an annual rainfall range of 1000 mm to 1500 mm with the average annual rainfall at about 107.3 mm. The dry season is from October to March and the wet season is from April to September (Keay, 1953; Ogunwale *et al*., 1999). Temperature is uniformly high and ranges between 25°C and 30°C in the wet season throughout the season except in July – August, while in the dry season it ranges between 33°C to 34°C. The annual temperature range is from 22.8 °C to 34.9°C.

Ethics: Permission from the University Ethical Committee was sought for after explaining the motive of the study. Oral consent of both the undergraduate students and staff living in school hostels and other residents were sought and obtained before commencement of the study.

Cross-Sectional Survey: Five hundred and eighteen (518) undergraduate students and ninety one (91) staff of the university were randomly sampled for the study. The students are resident within the university (on and off campus) hostels while staffs are resident outside the campus. The samples are of different ages, ethnic and religion groups, faculties and colleges. Questionnaire seeking among other things, knowledge and awareness of the disease, previous malaria infection records and symptoms, source of information, medication and treatment, as well as epidemiological variables in the environment were administered.

Clinical Data: To obtain relevant secondary data, the University Medical Centre clinical records of patients that reported for malaria diagnosis and treatment were collected to complement subject's responses to the questionnaire during the period of study. A clinical study was carried out on patients that presented symptoms of uncomplicated malaria infection at the University Medical Centre. Symptoms were studied on clinical grounds and the clinical details of the patients, nature of treatment and medication were recorded.

Mosquito Breeding Sites: Survey of the mosquito breeding sites was carried out at the study area. Vegetation, water retaining containers at student hostels, other residents within and outside the campus, construction

sites and academic areas were surveyed during the study.

Data Analysis: Data obtained were subjected to statistical analyses using the Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistics (frequencies and percentages) was used to summarize the demography of malaria patients that sought treatments from the University Clinic. Paired Sample T-test was used to compare the mean occurrence of malaria between the students and staff. Independent sample T-test was also used to compare the occurrence of malaria in the students and staff between the dry and wet seasons. One way Analysis of Variance (ANOVA) was used to compare the occurrence of mosquito breeding sites between the male and female hostels and the academic areas. Means were separated using the Student-Newman-Keul (SNK). P-value was set at 0.05.

RESULTS

Five hundred and eighteen (518) undergraduate students and ninety one (91) staff (both academics and non-academics)of the university were selected for the study, out of which 420(18.09 %) that responded were between 15 – 25 years of age, while another 89(18.91 %) students that responded were between 26 – 35 years old. For the staff, 63(69.23 %) were above 45 years old, while 26(28.57 %) were between 36 – 45 years old. Two hundred and thirty one, 231(44.58 %) students were resident at the university hostels, 112(21.63 %) were distributed among private hostels, while 175(33.78 %) and 91 staff were resident in other hostels. For the previous malaria episode by students in the last 12 months, 48.65 % had episodes, while 16.41 % had none during the period under study. Sixty four (64) constituting 12.35 % had malaria episodes between 2 – 4times, while 9.26 % had malaria episodes more than 4 times in a year. Fifty (54.96 %) staff had various forms of episodes, while 19.78 % had none. Three hundred and eight, 308(59.46 %) students were treated at the University Medical Centre, 168(32.43 %) students treated malaria infections in other medical centers, while 42(8.11 %) adopted self-treatments (Table 1).

On the respondents knowledge of the severity, causes and prevention of malaria, 218(42.09 %) understood malaria as a deadly disease, 280(54.05 %) as ordinary disease, while 20(3.86 %) of the students had no clear idea about the severity of malaria (Table 2). However, 68(74.73 %), 15(16.48 %) and 8(8.79 %) staff understood malaria as ordinary, deadly disease and had no clear idea on the severity of malaria. Majority, 516(99.62 %) of the students and 90(98.91 %) of the staff agreed that malaria disease was caused by mosquito bite. On malaria vector identity, 222(42.09 %) of the students identified the female *Anopheles* mosquito as the vector of malaria, similarly 69.23 % of staff also agreed that female *Anopheles* mosquito was vector of malaria, although larger percentages of students (44.59 %) and 10.99 % of staff had no idea of the vector identity (Table 2). Out of the 518 students sampled, 32.82 % picked stagnant water, 27.03 % water retaining containers and 38.19 % plant/vegetation as vector habitat respectively. In the same vein staff similarly responded in the order of stagnant water (47.25 %), water retaining containers (40.66 %) and plant/vegetation (12.06 %). The various vector habitats with the university are presented in Figure 1. Majority of students (83.78 %) and staff (97.80 %) responded that night was the prominent vector biting period (Table 2).

On the knowledge of the symptoms of malaria among the students, 71.81 % ranked fever, 31.85 % body pain and 29.53 % headaches as main symptoms of malaria, while fever, headaches and body pain was ranked in the order57.14 %, 48.35 % and24.17 % by the staff of the university community (Table 3). On the medication employed for the treatment of malaria, although multiple choices were made, they were however in the following order for the student; ACT, 53.86 %, Artesunate 25.09 %, Sulphadoxine-pyrimethamine 15.44 % and Paracetamol 10.81 %, while for the staff the ranking was in the order; 53.84 % ACT, 29.67 % Artesunate and 18.68 % Sulphadoxine-pyrimethamine respectively (Table 3).

Table 1: Demographic profile of the patients diagnosed and treated for malaria at Kwara State University Medical Centre

Variables	Students (Undergraduate)		Staff	
	Number	Percentage (%)	Number	Percentage (%)
Age (years)				
15-25	420	81.09	0	0.00
26-35	98	18.91	2	2.20
36-45	0	0.00	26	28.57
>45	0	0.00	63	69.23
Sex				
Male	245	47.30	70	76.92
Female	273	52.70	21	23.08
Students/Colleges				
Agriculture	21	4.05	0	0.00
Education	21	4.05	0	0.00
Engineering	77	14.86	0	0.00
ICT	42	8.11	0	0.00
Humanities	189	36.49	0	0.00
Pure & Applied Sciences	168	32.44	0	0.00
Staff				
Academics	0	0.00	70	76.92
Non-academics	0	0.00	21	23.08
Residence				
University hostel	231	44.59	0	0.00
Private hostel	112	21.63	0	0.00
Others	175	33.78	91	100.0
Previous malaria episode(last 12 months)				
Yes	252	48.65	50	54.96
No	85	16.41	18	19.78
Once	62	11.96	11	12.08
2-4 times	64	12.35	7	7.69
> 4 times	48	9.26	5	5.49
None	7	1.37	0	0.00
Where treated				
University health centre	308	59.46	84	92.31
Others	168	32.43	7	7.69
Self-treatment	42	8.11	0	0.00

Majority of the respondents had various sources of information on nature of vector, habitat, symptoms, prevention and treatment of the disease. Two hundred and eighty two, 282(54.44 %) students were enlightened by the health professionals, 38.22 % by friends, family and relatives, while 17.37 % had their information from other sources. For the staff, 92.30 % got information from health professionals, 51.64 % from friends, family and relatives, while 10.98 % got information from other sources.

Of the ninety one staff, 92.30 % got information from health professionals, 51.64 % from friends, family and relatives while 10.98 % from others. At the University Medical Centre, malaria cases occurs progressively and treated between September 1701(14.72 %), October, 2201 (19.05 %), November, 2436 (21.08 %) and December 2125 (18.39 %) while the least cases were reported between March, 600 (5.19 %) April 76 (0.65 %), May 160 (1.38 %), June 171(1.47 %) and July 77 (0.66 %). Significant differences were observed for the students ($p = 0.01$) and the staff ($p = 0.006$) respectively (Tables 4).

Significantly higher ($p<0.01$) cases of malaria were reported by both students and lecturers during the dry months than the wet months. The month of November (2436) had the highest number of malaria cases reported and treated at Kwara State University Medical Centre, while the month of July (77) had the least (Table 5).

Table 2: Responses on the Knowledge of severity, causes and prevention of malaria among members of a university community in Kwara State, Nigeria

Variables	Students (Undergraduate)		Staff	
	Number	Percentage (%)	Number	Percentage (%)
Severity of malaria				
Deadly disease	218	42.09	15	16.48
Ordinary disease	280	54.05	68	74.73
No idea	20	3.86	8	8.79
Causes				
Mosquito bite	516	99.62	90	98.91
Bad food and drinks	1	0.19	0	0.00
No idea	1	0.19	1	1.09
Vector identity				
Female anopheles mosquito	222	42.85	63	69.23
Male anopheles mosquito	38	7.35	10	10.99
Culex mosquito	27	5.21	8	8.79
No idea	231	44.59	10	10.99
Vector habitat				
Stagnant water	170	32.82	43	47.25
Water retaining containers	140	27.03	37	40.66
Plant/vegetation	203	39.19	11	12.09
No idea	5	0.96	0	0.00
Vector biting period				
Night	434	83.78	89	97.80
Sunset/dusk	48	9.27	2	2.20
No idea	36	6.95	0	0.00

Figure 1: Mosquitoes breeding sites in a university community in Kwara State, Nigeria. (a) Pool of water, (b) discarded metal bucket, (c) discarded plastic container, (d) blocked cistern, (e) discarded tyre and (f) marshy vegetation

On the most common symptoms experienced by the respondents during the last malaria episode headache (29.53 %) by students and 48.35 % by staff was mentioned, whereas cough was the least mentioned by the two groups. Other symptoms mention includes fever, vomiting, weakness and shivering. All the 518 students and 91 staff gave multiple responses including at least one of the common symptoms of malaria (Figure 2).

Five main mosquito breeding sites were encountered at the study area. They included discarded containers occurring 51.00 ± 2.65 at university female hostels, 58.00 ± 25.58 at male hostels and 72.67 ± 15.07 within the academic area. Stagnant water pools (13.00, 11.00 and 22.33) were recorded at females, male hostels and academic area. Other mosquito breeding sites encountered included motor tyres 3.33 ± 1.76 found at female hostels, 7.33 ± 3.71 at male hostels, while 12.67 ± 2.67 at the academic area. Gutters (103.33 ± 23.33) and block cistern (19.33 ± 2.96) constituted the most sited mosquito breeding sites at academic area with lots of building projects going on, and 7.00 ± 1.15 each and 1.67 ± 0.88 and 5.00 ± 2.52 for block cisterns for both female and female hostels (Table 6).

Table 3: Responses on symptoms, treatments and source of malaria education among members of a university community in Kwara State, Nigeria

Variables	Students (Undergraduate)		Staff	
	Number	Percentage (%)	Number	Percentage (%)
Symptoms of malaria				
Fever	372	71.81	52	57.14
Headaches	153	29.53	44	48.35
Body pain	165	31.85	22	24.17
Shivering	6	1.15	13	14.28
No idea	7	1.35	0	0.00
Medication used				
ACT	279	53.86	49	53.84
Artesunate	130	25.09	27	29.67
Sulphadoxine-pyrimethamine	80	15.44	17	18.68
Paracetamol	56	10.81	3	3.30
Others	7	1.35	9	9.89
No idea	3	0.58	0	0.00
Source of information				
Health professionals	282	54.44	84	92.30
Friends; family & relatives	198	38.22	47	51.64
Others	90	17.37	10	10.98
No idea	4	0.77	0	0.00

ACT: Artemisinin combination therapy

Table 4: Occurrence of malaria cases diagnosed and treated at Kwara State University Medical Centre

Months	Students		Staff		Total
	Frequency	%	Frequency	%	
January	860	8.12	77	7.99	937
February	950	8.97	21	2.18	971
March	570	5.38	30	3.11	600
April	74	0.70	2	0.21	76
May	145	1.37	15	1.56	160
June	132	1.25	39	4.05	171
July	60	0.57	17	1.76	77
August	61	0.58	39	4.05	100
September	1637	15.46	64	6.64	1701
October	1983	18.72	218	22.61	2201
November	2209	20.86	227	23.55	2436
December	1910	18.03	215	22.30	2125
Total	**10591**	100.00	**964**	100.00	11555

T-test; t (11) = 3.624; p = 0.004, significant at p<0.01

Table 5: Monthly variation of malaria cases reported and treated at Kwara State University Medical Centre

Months	Students	Staff	Total
January (dry)	860	77	937
February (dry)	1095	21	1116
March (dry)	570	30	600
April (wet)	74	2	76
May (wet)	145	15	160
June (wet)	132	39	171
July (wet)	60	17	77
August (wet)	61	39	100
September (wet)	1637	64	1701
October (wet)	1983	218	2201
November (dry)	2209	227	2436
December (dry)	1910	215	2125

Comparison between seasons: Students - T-test; t (10) = - 3.059; p = 0.01, Staff - T-test; t(10) = - 3. 432; p = 0.006, significant at P < 0.01, seasons in parenthesis

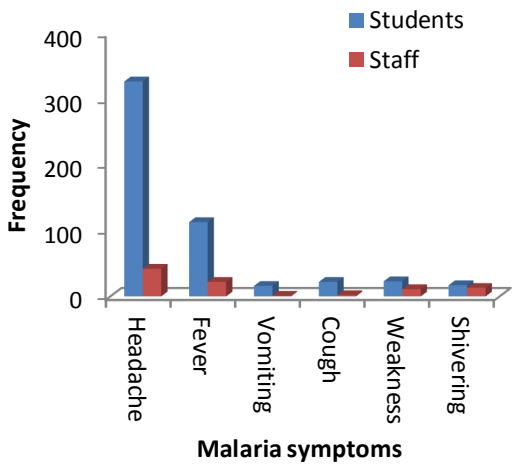

Figure 2: Responses on the symptoms of reported malaria cases at Kwara State University Medical Centre

DISCUSSION

This study documented the knowledge and practices about malaria through survey of residents at the risk of malaria infection, types of mosquito breeding sites and record of clinical examination, diagnosis and treatment of patients presenting with symptoms of uncomplicated malaria among members of Kwara State University Community, Nigeria. The study emphasized the need for sustenance of malaria control which can only be achieved through sound community understanding and knowledge of the disease, and it transmission at local levels (Klein *et al.*, 1995; Thanabouasy *et al.*, 2009; Hlongwana *et al.,* 2009). It has remained quite pertinent to continue to consider community malaria related socio-cultural factors, vector habitat and other demographic profiles of people living in endemic areas.

High proportion of student 54.05 % and staff 74.73 % of the university community rated the severity of malaria as ordinary disease and 3.86 % and 8.79 % not having idea on the disease points to the fact that much information and enlightenment needed be included in the nature of severity of malaria message to be disseminated to the academic community through relevant personnel in the university community.

The result of this study supports the view of other researchers who similarly observed that malaria transmission depends on two key factors which are the location of mosquito breeding sites and clustering of human habitations (Klein *et al.,* 1995). This result revealed occurrence of five very common mosquito breeding sites which included stagnant water pool, discarded containers, motor tyres, gutters and block cisterns maintaining regular growth and development of mosquito larval stages in the study area. In addition the university community provides clustering of human habitations which are prerequisite condition for malaria transmission.

Malaria control in Nigeria is based almost exclusively on chemotherapy with drugs like amodiaquine and sulfadoxine-pyrimethamine being used in many parts. Although advances in terms of new drugs and vaccines have been commendable, malaria eradication is still far from being achieved. The common medication applied for the treatment of malaria in this study and others studies included ACT, Artesunate, Sulphadoxine-pyrimethamine and paracetamol (Mbonye *et al.,* 2006; Mazigo *et al.,* 2010; Mereta *et al.,* 2013; Amenu, 2014),

Mosquito larval habitats were significantly more and diverse at the study area during the wet season than the dry season. This may not be unrelated to the fact that most of the larval breeding habitats identified during the wet season would have dried up during the dry season. The wet season is known to be associated with abundant rainfall and flooding, supporting the retaining of water by various mosquito breeding containers and the growth and development of aquatic larval stages. In addition, lots of building projects are ongoing at academic and hostel areas at the university retaining much water for a longer period during the raining season. A similar finding was reported by Okogun *et al.* (2003) working in Midwestern Nigeria and Onyido *et al.* (2010) in Calabar, Nigeria. The implication of this finding is that efforts at larval control of mosquitoes are required during the wet session when environment is conducive for their development.

Table 6: Occurrence and prevalence of water retaining containers as mosquito breeding sites in a university community in Kwara State, Nigeria

Breeding sites	Females hostels	Males hostels	Academic area
Stagnant water pool	13.00 ± 2.65[a]	11.00 ± 2.31[a]	22.33 ± 3.93[a]
Discarded containers	51.00 ± 22.81[a]	58.00 ± 25.58[a]	72.67 ± 15.07[a]
Motor tyres	3.33 ± 1.76[a]	7.33 ± 3.71[a]	12.67 ± 2.67[a]
Gutters	7.00 ± 1.15[b]	7.00 ± 2.08[b]	103.33 ± 23.33[a]
Block cistern	1.67 ± 0.88[b]	5.00 ± 2.52[b]	19.33 ± 2.96[a]

[ab]Mean ± SEM in the same row having similar superscript are not significantly different at p<0.05

Conclusion: The training of the members of the university community such as caregivers/ community health extension workers and other health personnel, university safety and environmental unit through intervention and education on causal factors of transmission, and general prevention of malaria in the university. Also the provision of Long Lasting Insecticidal Nets (LLITNs), wearing of protective clothing, use of repellents of various forms is suggested. The essence would be for the members of the university community to take responsibility for ownership and be able to self apply these approaches before prompt report of cases at the university medical centre and finally further research on the prevalence of malaria should be conducted to prevent and control the series of incidence and consequence of this disease, especially malaria transmission during the wet season.

ACKNOWLEDGEMENTS

The team of medical personnel at the university medical centre, safety and environmental unit of the university, members that administered the questionnaires and other members of the university community roles in the study is well appreciated.

REFERENCES

AKAZILI, J., AIKINS, M. and BINKA, F. N. (2007). Malaria treatment in Northern Ghana: What is the treatment cost per case to households?. *African Journal of Health Sciences*, 14(1): 70 – 79.

AMENU, D. (2014). Prevalence of malaria among patients visiting Nekemte Hospital. *Journal of Medical Microbiology and Diagnosis*, 3(2): 1.

APPIAH-DARKWAH, I. and BADU-NYARKO, K. (2011). Knowledge of Malaria prevention and control in a sub-urban community in Accra, Ghana. *International Journal of Tropical Medicine,* 6(3): 61 – 69.

DAWAKI, S., AL-MEKHLAFI, H. M., ITHOI, I., IBRAHIM, J., ATROOSH, W. M., ABDULSALAM, A. M., SADY, H., ELYANA, F. N., ADAMU, A. U., YELWA, S. I. and AHMED, A. (2016). Is Nigeria winning the battle against malaria? Prevalence, risk factors and KAP assessment among Hausa communities in Kano State. *Malaria Journal*, 15(1): 351.

HLONGWANA, K. W., MABASO, M. L., KUNENE, S., GOVENDER, D. and MAHARAJ, R. (2009). Community knowledge, attitudes and practices (KAP) on malaria in Swaziland: a country earmarked for malaria elimination. *Malaria Journal*, 8(1): 29.

KEAY, R. W. J. (1953). *An Outline of Nigerian Vegetation*. Federal Department of Forest Research, Federal Government Printer, Lagos.

KLEIN, R. E., WELLER, S. C., ZEISSIG, R., RICHARDS, F. O. and RUEBUSH II, T. K. (1995). Knowledge, beliefs, and practices in relation to malaria transmission and vector control in Guatemala. *The American Journal of Tropical Medicine and Hygiene*, 52(5): 383 – 388.

MAFIANA, C. F., ANAEME, L. and OLATUNDE, G. O. (1998). Breeding sites of larval mosquitoes in Abeokuta, Nigeria. *Nigerian Journal of Entomology*, 15*:* 136 – 143.

MAZIGO, H. D., OBASY, E., MAUKA, W., MANYIRI, P., ZINGA, M., KWEKA, E. J., MNYONE, L. L. and HEUKELBACH, J. (2010). Knowledge, attitudes, and

practices about malaria and its control in rural northwest Tanzania. *Malaria Research and Treatment*, 2010: doi:10.4061/2010/794261

MBONYE, A. K., NEEMA, S. and MAGNUSSEN, P. (2006). Treatment-seeking practices for malaria in pregnancy among rural women in Mukono District, Uganda. *Journal of Biosocial Science*, 38(2): 221 – 237.

MERETA, S. T., YEWHALAW, D., BOETS, P., AHMED, A., DUCHATEAU, L., SPEYBROECK, N., VANWAMBEKE, S.O., LEGESSE, W., DE MEESTER, L. and GOETHALS, P.L. (2013). Physico-chemical and biological characterization of anopheline mosquito larval habitats (Diptera: Culicidae): implications for malaria control. *Parasites and Vectors*, 6(1): 320.

MILLER, L. H., BARUCH, D. I., MARSH, K. and DOUMBO, O. K. (2002). The pathogenic basis of malaria. *Nature*, 415(6872): 673 – 679.

MILLS, A., LUBELL, Y. and HANSON, K. (2008). Malaria eradication: the economic, financial and institutional challenge. *Malaria Journal*, 7(1): S11.

NMCP (2005). *Malaria Annual Report*. National Malaria Control Programme (NMCP) in Nigeria. Abuja, Nigeria.

ODUOLA, A. O. and AWE, O. O. (2006). Behavioural biting preference of *Culex quinquefasciatus* in human host in Lagos metropolis Nigeria. *Journal of Vector Borne Diseases*, 43(1): 16 – 20.

OGUNWALE, J. A., OLANIYAN, J. O. and ADULOJU, M. O. (1999). *Detailed Survey of the University of Ilorin Farm Site.* University of Ilorin Technical Report. Entomology/entfacts/fldcrops/ef102.hm

OKOGUN, G. R., ANOSIKE, J. C., OKERE, A. N. and NWOKE, B. E. (2005).Ecology of mosquitoes of Midwestern Nigeria. *Journal of Vector Borne Diseases*, 42(1): 1 – 8.

OKOGUN, G. R., NWOKE, B. E., OKERE, A. N., ANOSIKE, J. C. and ESEKHEGBE, A. C. (2003). Epidemiological implications of preferences of breeding sites of mosquito species in Midwestern Nigeria. *Annals of Agricultural and Environmental Medicine*, 10(2): 217 – 222.

ONYIDO, A. E., OZUMBA, N. A., NWANKWO, A. C., IKPEZE, O. O and EZIKE, V. I. (2010). Water-breeding mosquito vectors (Diptera: Culicidae) of public health importance in Calabar, southeast Nigeria. *International Journal of Biological Science*, 2(2): 61 – 67.

PENILLA, P. R., RODRIGUEZ, A. D., HEMINGWAY, J., TORRES, J. L., ARREDONDO-JIMÉNEZ, J. I. and RODRIGUEZ, M. H. (1998). Resistance management strategies in malaria vector mosquito control. Baseline data for a large-scale field trial against *Anopheles albimanus* in Mexico. *Medical and Veterinary Entomology*, 12(3): 217 – 233.

REJMÁNKOVÁ, E., GRIECO, J., ACHEE, N. and ROBERTS, D. R. (2013). Ecology of larval habitats. Pages 397 – 446. *In:* MANGUIN, S. (Ed). *Anopheles Mosquitoes- New Insights into Malaria Vectors.* Intech, Janeza Trdine 9, 51000 Rijeka, Croatia.

REUBEN, R. (1993). Women and malaria: special risks and appropriate control strategy. *Social Science and Medicine*, 37(4): 473 – 480.

SACHS, J. and MALANEY, P. (2002).The economic and social burden of malaria. *Nature*, 415(6872): 680 – 685.

THANABOUASY, C., PUMPAIBOOL, T. and NAOWARAT, K. (2009). Assessment of knowledge, attitude, and practice regarding malaria prevention towards population in Paksong District, Champasack Province, LAO PDR, *Journal of Health Research,* 23(suppl):11 – 15.

TYAGI, B. K., MUNIRATHINAM, A., KRISHNAMOORTHY, R. and VENKATESH, A. (2012). A field-based handbook of identification keys to mosquitoes of public health importance in India. CRME, Madurai.

VIJAYAKUMAR, K., KUMAR, T.S., NUJUM, Z.T., UMARUL, F. and KURIAKOSE, A. (2014).

A study on container breeding mosquitoes with special reference to *Aedes (Stegomyia) aegypti* and *Aedes albopictus* in Thiruvananthapuram District, India. *Journal of Vector Borne Diseases*, 51(1): 27 –32.

WHO (2015). *World Malaria Report 2014.* World Health Organization (WHO), Geneva, Switzerland. *Available: http://www. who. int/malaria/publications/world_malaria_report_2014/en/.* Accessed, 24 September 2015.

WIKIPEDIA (2015). *Kwara State*. https:// en.wikipedia.org/wiki/Kwara_State Accessed, 24 September 2015.