Open Access Research Journal of
Biology and Pharmacy
Journals home page: https://oarjbp.com/
ISSN: 2782-9979 (Online)

OARJ OPEN ACCESS RESEARCH JOURNALS

(RESEARCH ARTICLE)

# Antimalarial preference and period prevalence of malaria among students in a University in South-Western, Nigeria

Omolade Olayinka Okwa *, Chimaroke Ihechukwu Onyeaghala, Samiat Monisolah Baruwa, Oluwadamilola Abidemi Olayele and Adebukola Rahmotallah Sulaimon

*Parasitology and Public Health Unit, Department of Zoology and Environmental Biology, Faculty of Science, Lagos State, University Nigeria.*

Open Access Research Journal of Biology and Pharmacy, 2022, 05(01), 016–025

Publication history: Received on 20 April 2022; revised on 01 June 2022; accepted on 03 June 2022

Article DOI: https://doi.org/10.53022/oarjbp.2022.5.1.0045

## Abstract

Malaria is a disease that contributes to low academic performance among students. We investigated the preferred antimalarial drugs and the period prevalence of malaria at exam periods in a University. Structured questionnaires were administered to 120 students who were randomly selected of which 73% were aged 16-25 years. 84% do not use preventive drugs but Fansidar was mostly preferred among 16%. Respondents from Faculties of Science and Social Sciences opted for non-drug preventive measures. The most preferred antimalarial was Amatem (26%) while the least preferred was P-alaxin (0.83%) but 27% preferred injections. 69% did not practice self-medication but 80% used local herbs. The health center records showed that 80% of 146 students tested positive to malaria at exam periods. The prevalence of malaria was higher during exams (83%) than before exams (75 %). Malaria parasitaemia was also higher during exams (47%) than before exams (27%; $p<0.05$). Female students were more infected than male students before exams (23: 20, $p> 0.05$) and during exams (41: 33, $p< 0.05$). Female students had more malaria parasitaemia (26%) than the males before and during exams (26%; 21%, $p> 0.05$). Therefore, female students should always wear protective clothing and students should use safe and effective mosquito repellants while reading in classes at exam periods in order to avoid mosquito's bites. Early reporting of malaria and health education on appropriate use of malaria drugs amongst students is recommended. Accessible health services and affordable Artemisinin- based combination therapies should be made available to students especially at exam periods.

**Keywords:** Antimalarials; Artemisinin-based-combination-therapies; Drugs; Malaria; Low- academic performance; Students

## 1. Introduction

Human malaria is a mosquito -borne disease caused by the protozoon parasite, *Plasmodium* with *P. falciparum* as the most widespread in Nigeria. The disease is holoendemic in rural areas of Nigeria, but mesoendemic in urban areas, accounting for much of the disease burden [1]. Malaria is a big contributor to massive economic losses in the country and accounts for the major cause of hospitalization, morbidity and mortality [2]. The disease is a big threat and a serious impediment to socio -economic development in Nigerian communities [3].

Malaria affects low and middle income countries, where the poorest communities are mostly affected. This is due to their poor socioeconomic and environmental status and inadequate services for prevention, diagnosis and treatment [4]. Socio-economic cost can be measured in terms of drugs purchase, doctor's fees, and transport, opportunity cost of time spent and loss of manpower [2]. Worrall *et al.* [5] concluded that important socio-economic differentials exist in

* Corresponding author: Okwa OO
Parasitology and Public Health Unit Department of Zoology and Environmental Biology Faculty of Science Lagos State University, Nigeria.

access to malaria interventions, increasing the vulnerability of the poorest. However, socio-economic consequences of diseases such as poor academic performance are better understood when the root of the problem is identified.

Najera and Hempel [6], reported that school absenteeism due to malaria among Nigerian students was as high as 70% and an estimated 3-12 school days lost annually. Another study by Erinoso and Bamgboye [7], showed that malaria was the most important health-related cause of school absenteeism in a Nigerian school. Loss in school days represents a huge loss on academic standard and loss on the nation's investments in education. School absenteeism due to malaria affects general performances and leads to poor grades [8]. Mismanagement and misconceptions about malaria exist even in high schools and it has been reported that malaria impairs cognitive ability which contributes to poor school performance leading to underdevelopment in endemic countries [9, 10].

It is pertinent to investigate malaria drug usage by evaluating the antimalarials (preventive and treatment drugs) preferred by students. As a second exploratory approach, this study also examined the prevalence of malaria among students during examination periods which culminates in high hospital visits. This study provides information on the impact of examination periods on malaria prevalence and considered gender differences in prevalence among students.

## 2. Methodology

### 2.1. Study Area

Lagos State, a former capital of Nigeria is the smallest in area of the 36 states and located in the southwestern part of the country but is an economically important state being the major financial centre in the country. It is a state of aquatic splendor with the slogan" Centre of Excellence", with a population of over 15 million [11]. This study was carried out in two campuses of a Lagos multi-campus, collegiate Institution. The two campuses are non-medical and medical with a well-equipped primary health centers which caters for the medical needs of staff and students.

### 2.2. Selection of Study population

A total number of 120 students (male and female) were selected by systematic random sampling with informed consent and willingness to participate in the study. This selection allowed students from several academic backgrounds to be compared. The participants were selected across 5 faculties and the medical college (Faculties of Management Sciences (FMS), Social Sciences (FSS), Education (FOE), Law (FOL), Sciences (FOS) and College of Medicine (COM).

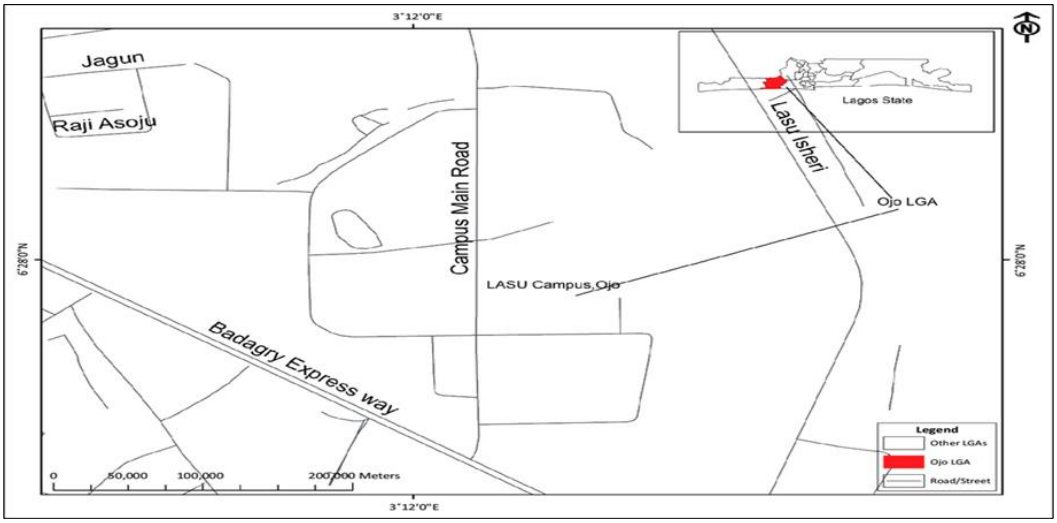


**Figure 1** LASU in Ojo Local government of Lagos State (Lagos bureau of Statistics, 2020)

### 2.3. Administration of Questionnaires

Data collection tools were pretested and validated structured questionnaires. Validation and pretesting was carried out using a draft questionnaire by conducting a pilot survey to refine the questions and authenticate the reliability of the questions. The participants were required to tick their preferred options because the questions were multi-faceted. This design was adopted because of its specificity and appropriateness for the study. The questionnaire had two parts which

comprised of 20 questions each which included the respondent data, perception of malaria, impact of malaria on academic activities and practices associated with malaria treatment.

### 2.4. Sample Size Determination

The determination of the minimum number of students to be recruited into the study was calculated by using a standard sample size formula for estimating a population proportion with specified absolute precision by Lwanga *et al* [12] as follows:

$$\frac{\mathrm{P}\ 100(1-\&)}{\mathrm{d}}\%$$

Where

P is the anticipated Population proportion =25%

100(1-&) % is the Confidence level =95%

d is the absolute precision= (19.7%-20%)

=118, therefore, 120 participants were recruited into the study

### 2.5. Collection of data from the health centre

Data on students who reported ill and were recommended for malaria parasite test were collected from the university health centre within a period of 4 weeks. This collection was first carried out 2 weeks before the start of the semester examinations when students read in unscreened lecture rooms. The second group of data was collected during the examinations which spanned 2 weeks. The data collected was on period prevalence (positive cases within the 4 weeks period) and parasitaemia (measurement of malaria intensity by parasite count).

### 2.6. Statistical Analysis

The responses extracted from the questionnaires were analyzed and represented as tables in numbers and percentages (%). The data information from the health center was grouped into gender and age range and represented in figures. Chi square ($\chi 2$) was used to determine statistical differences in results. Level of significance was estimated at 5% with 95% confidence interval. Probability (p value) was determined by $p< 0.05$ as significant and $p>0$ .05 as not significant.

## 3. Results

### 3.1. Respondents Data

The respondent's data showed that 56% of the 120 respondents were males but this was not statistically significant ($p>0.05$) when compared to females (44%). Most respondents (73%) were within the ages 16-25 years, Muslims were 53% while 47% were Christians ($p > 0.05$). Majority, of the respondents were single (97%) but 3% were married ($p<0.05$). Even though, 31% of respondents were in blood group O, the differences between the blood groups were not statistically significant ($p> 0.05$). Table 1 shows the respondents across the Faculties and COM.

### 3.2. Malaria prevention practices among respondents

Overall, 84% of the respondents do not use preventive drugs but 50% in COM used preventive drugs. Significant differences existed in the choice of preventive drugs ($p< 0.05$) across the faculties. Fansidar was the most preferred preventive drug with the highest choice of 60% in COM, followed by FMS and FOL with (20%) each. FOE respondents opted for other drugs while 20% also chose Maloxine in COM. Overall, 88% preferred non-drug preventive measures such as mosquito repellants and use of bed nets. These included all respondents in FSS and FOS and the least was 70% in FOL. Table 2 shows malaria prevention practices across the Faculties and COM.

### 3.3. Preferred antimalarial treatment drugs among respondents

Among the respondents, the most preferred antimalarial drug was Amatem (26%) while the least was P-alaxin (0.83%). Significant differences existed in the use of treatment drugs across the faculties ($p< 0.05$). The highest choice of Amatem was in FMS (35%) but no one selected the drug in FSS. Lonart-DS was also preferred by 45% in FMS but no one selected Lonart-DS in FOL. Similarly, 40% in FOS chose Arthemether L as their choice of drug but nobody selected the drug in FOE. Lumartem was the drug of choice among 40% in FSS, but none selected the drug in FMS. Coartem (15%) and

Camosunate (10%) were chosen among respondents in FOL and only 5(%) in COM. Table 3 shows preferred antimalarial treatment drugs among respondents across the Faculties and COM.

### 3.4. Efficacy of preferred antimalarial treatment drugs among respondents

The efficacy of treatment drug showed that overall, 59% claimed that their preferred drug was very effective, 84% reported no side effects while 27% preferred injections. There were significant differences in the level of the belief in the efficacy of drugs across the faculties with 90% in FOS and the least (40%) in COM. Reports on side effects of drugs was highest in FOE (25%) and COM (25%). There was no report of side effects in FOL. Most of the respondents who preferred taking injection were from FSS (50%) while drugs were mostly preferred by FOS students (90%). There were significant differences across the faculties regarding preferred drug usage. Table 4 shows the efficacy of preferred antimalarial treatment drugs across the Faculties and COM.

### 3.5. Self-medication and use of herbal mixtures among respondents

Among the 120 respondents, 69% did not practice self-medication while 31% self-treat themselves with malaria drugs ($p<0.05$). Most of the students that practiced self-medication were from FOE (50%) while most of those that did not were from FOS (90%). Overall 80%, of respondents use herbal mixtures and the better option was local herbs (57%). There were significant differences across the faculties in terms of use of herbal mixtures as all respondents in FOL (100%) used herbal mixtures and the least usage reported was (30%) in COM. While local herbs were more opted for in FMS (50%), it was lemon tea that was more preferred in FOL at 55%. Table 5 shows the respondents view on self-medication and use of herbal mixtures across the Faculties and COM

**Table 1** Profile of respondents from the 5 faculties and College of Medicine

| **Profile** | **FMS N (%)** | **FSS N (%)** | **FOE N (%)** | **FOL N (%)** | **FOS N (%)** | **COM N (%)** | **All N (%)** | **P values** |
|---|---|---|---|---|---|---|---|---|
| Gender | | | | | | | | |
| Male | 9(45) | 6(30) | 14(70) | 13(65) | 15(75) | 10(50) | 67(56) | DF=1 |
| Female | 11(55) | 14(70) | 6(30) | 7(35) | 5(43) | 10(50) | 53(44) | P>0.05 |
| Age Range | | | | | | | | |
| 16-25 years | 18(90) | 19(95) | 11(55) | 14(70) | 14(70) | 12(60) | 88(73) | DF=1 |
| 25-30 years | 2(10) | 1(5) | 9(45) | 6(30) | 6(30) | 8(40) | 32(27) | P<0.05 |
| Religion | | | | | | | | |
| Christianity | 10(50) | 8(40) | 6(30) | 11(55) | 12(60) | 9(45) | 56(47) | DF=1 |
| Islam | 10(50) | 12(60) | 14(70) | 9(45) | 8(40) | 11(55) | 64(53) | P> 0.05 |
| Marital Status. | | | | | | | | |
| Single | 20(100) | 20(100) | 17(85) | 20(100) | 20(100) | 20(100) | 117(97) | DF=1 |
| Married | 0(0) | 0(0) | 3(15) | 0(0) | 0(0) | 0(0) | 3(3) | P<0.05 |
| Blood Group. | | | | | | | | |
| A | 7(35) | 6(30) | 8(40) | 4(20) | 3(15) | 6(30) | 34 (28) | |
| B<br>O | 2(10)<br>7(35) | 3(15)<br>5(25) | 4(20)<br>4(20) | 5(25)<br>5(25) | 4(20)<br>8(40) | 6(30)<br>8(40) | 24 (20)<br>37 (31) | DF=3<br>P>0.05 |
| AB | 4(20) | 6 (30) | 4(20) | 6(30) | 5(25) | 0(0) | 25(21) | |
| Population | 20 | 20 | 20 | 20 | 20 | 20 | 120 | |

**Table 2** Malaria prevention practices among respondents

| Questions | FMS N (%) | FSS N (%) | FOE N (%) | FOL N (%) | FOS N (%) | COM N (%) | All 120 | P values |
|---|---|---|---|---|---|---|---|---|
| Do you use preventive drugs? | | | | | | | | |
| Yes | 3(15) | 0(0) | 4(20) | 2(10) | 0(0) | 10(50) | 19(16) | DF=1 |
| No | 17(85) | 20(100) | 16(80) | 18(90) | 20(100) | 10(10) | 101(84) | P<0.05 |
| If yes, which type? | | | | | | | | |
| Fansidar | 2(10) | 0(0) | 0(0) | 2(10) | 0(0) | 6(60) | 10(83) | |
| Malozine | 0(0) | 0(0) | 2(10) | 0(0) | 0(0) | 0(0) | 2(1.6) | |
| Malareich | 0(0) | 0(0) | 1(5) | 0(0) | 0(0) | 1(10) | 2(1.6) | DF=4 |
| Capuine | 0(0) | 0(0) | 1(5) | 0(0) | 0(0) | 2(20) | 4(3.3) | P<0.05 |
| Others | 1(5) | 0(0) | 0(0) | 0(0) | 0(0) | 1(10) | 1(0.8) | |
| Do you use non-drug preventive measures? | | | | | | | | |
| Yes | 18(90) | 20(100) | 19(95) | 14(70) | 20(100) | 15(75) | 106(88) | DF=1 |
| No | 2(10) | 0(0) | 1(5) | 6(30) | 0(0) | 5 (25) | 14(12) | P<0.05 |
| Population | 20 | 20 | 20 | 20 | 20 | 20 | 120 | |

**Table 3** Preferred antimalarial treatment drugs among respondents

| Preferred drugs | FMS N (%) | FSS N (%) | FOE N (%) | FOL N (%) | FOS N (%) | COM N (%) | All N (%) | P values |
|---|---|---|---|---|---|---|---|---|
| Amatem | 7(35) | 0(0) | 10(50) | 4(20) | 2(10) | 8(40) | 31 (26) | DF=7 P<0.05 |
| Lonart-DS | 9(45) | 5(25) | 5(25) | 0(0) | 6(30) | 3(15) | 28 (23) | |
| P.alaxin | 0(0) | 0(0) | 0(0) | 0(0) | 0(0) | 1 (5) | 01(0.83) | |
| Arthemeter L | 4(20) | 7(35) | 0(0) | 6(30) | 8(40) | 1 (5) | 26 (22) | |
| Artesunate | 0(0) | 0(0) | 0(0) | 0(0) | 0(0) | 5 (25) | 5 (4.1) | |
| Lumartem | 0(0) | 8(40) | 5(25) | 5(25) | 4(20) | 1(5) | 23(19.1) | |
| Coartem | 0(0) | 0(0) | 0(0) | 3(15) | 0(0) | 1(5) | 4(3.33) | |
| Camosunate | 0(0) | 0(0) | 0(0) | 2(10) | 0(0) | 0 (0) | 2 (1.66) | |
| Population | 20 | 20 | 20 | 20 | 20 | 20 | 120 | |

**Table 4** Efficacy of antimalarial treatment drugs used among respondents

| Questions | FMS N (%) | FSS N (%) | FOE N (%) | FOL N (%) | FOS N (%) | COM N (%) | ALL N (%) | P values |
|---|---|---|---|---|---|---|---|---|
| Level of efficacy of drugs | | | | | | | | |
| Effective | 8(40) | 10(50) | 11(55) | 6(30) | 2(10) | 12 (60) | 49 (41) | DF=1 |
| Very effective | 12(60) | 10(50) | 9(45) | 14(70) | 18(90) | 8 (40) | 71(59) | P<0.05 |
| Any side effects? | | | | | | | | |
| Yes | 2(10) | 3(15) | 5(25) | 0(0) | 4(20) | 5(25) | 19(16) | DF=1 |
| No | 18(90) | 17(85) | 15(75) | 20(100) | 16(18) | 15 (75) | 101(84) | P< 0.05 |
| I prefer taking injections to drugs? | | | | | | | | |
| Yes | 5(25) | 8(40) | 10(50) | 3(15) | 2(10) | 4(20) | 32(27) | DF=1 |
| No | 15(75) | 12(60) | 10(50) | 17(85) | 18(90) | 16 (80) | 88 (73) | P< 0.05 |
| Population | 20 | 20 | 20 | 20 | 20 | 20 | 120 | |

**Table 5** Respondents view on self-medication and herbal mixtures

| Questions | FMS N (%) | FSS N (%) | FOE N (%) | FOL N (%) | FOS N (%) | COM N (%) | ALL N (%) | P values |
|---|---|---|---|---|---|---|---|---|
| Do you practice self-medication? | | | | | | | | |
| Yes | 5(25) | 8(40) | 10(50) | 3(15) | 2(10) | 9(45) | 37(31) | DF= 1 |
| No | 15(75) | 12(60) | 10(50) | 17(85) | 18(90) | 11(55) | 83(69) | P< 0.05 |
| Do you use herbal mixtures? | | | | | | | | |
| Yes | 14(70) | 12(60) | 18(90) | 20(100) | 12(60) | 6(30) | 82(80) | DF= 1 |
| No | 6(30) | 8(40) | 2(10) | 0(0) | 8(40) | 14(70) | 24(20) | P< 0.05 |
| If yes which type? | | | | | | | | |
| Local herbs | 10(50) | 6(30) | 9(45) | 9(45) | 8(40) | 2(10) | 44 (57) | DF= 1 |
| Lemon tea | 4(20) | 6(30) | 9(45) | 11(55) | 4(20) | 4 (20) | 38 (46) | P>0.05 |
| Total (Yes) | 14(70) | 12(60) | 18(90) | 20(100) | 12(60) | 6(30) | 82 (80) | |

### 3.6. Malaria cases before and during examinations at the health centre

The data collected from the health centre indicated that there were 57 students who reported ill before exams. Of this, 28 were male and 20 (71.4%) tested positive to malaria (Figure 1). Of these, 18 (90%) were within the age range of (16-25), while 2 (10 %) were within the age range (26-30). On the other hand, there were 29 female students who reported ill but 23 of them (79.3%) were positive for malaria (Figure 1). They were all within the age range (16-25). Therefore, 43 (75%) students tested positive to malaria before exams.

During exams, 89 students reported ill and 39 were male, of which 33 (84.6%) tested positive to malaria and were all within the age range of (16-25). On the other hand, there were 50 female students who reported ill but 41 (82%) were positive for malaria (Figure 1). Of this positive females, 40 (97.5%) were within the age range (16-25), while only 1 (2.4%) was above 25 years. Therefore, 74 (83%) of the students tested positive to malaria during exams. Overall, 117 (80%) of the students had malaria before and during exams.

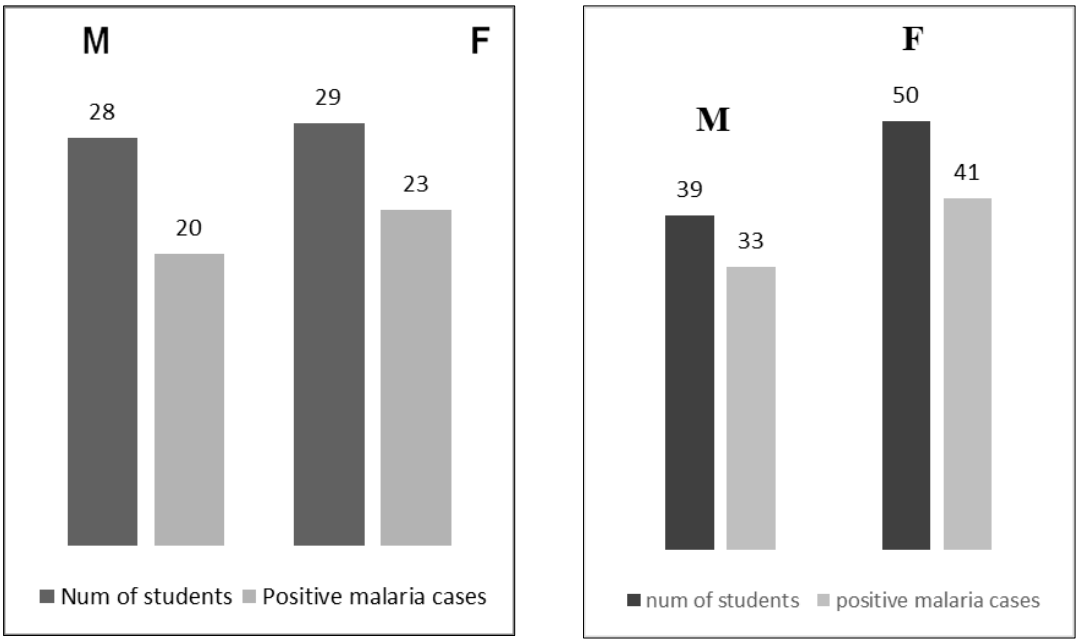


**Figure 2** Malaria cases among students reporting in health centre before and during exams

### 3.7. Malaria parasitaemia among students before and during Examinations

Before exams, out of the 20 malaria positive males, there were 4 (20%) with few malaria parasite counts (+), 3(15%) with scanty malaria parasite counts (++), 13(65%) males with high malaria parasite counts (+++), but none with very high malaria parasite count. On the other hand, among 23 positive females, there were 4 (16.7%) with few malaria parasite count, 6 (25%) with scanty malaria parasite count, 11 (45.8%) with high malaria parasite count and 3 (12.5%) with very high malaria parasite count (>+++) (Figure 2).

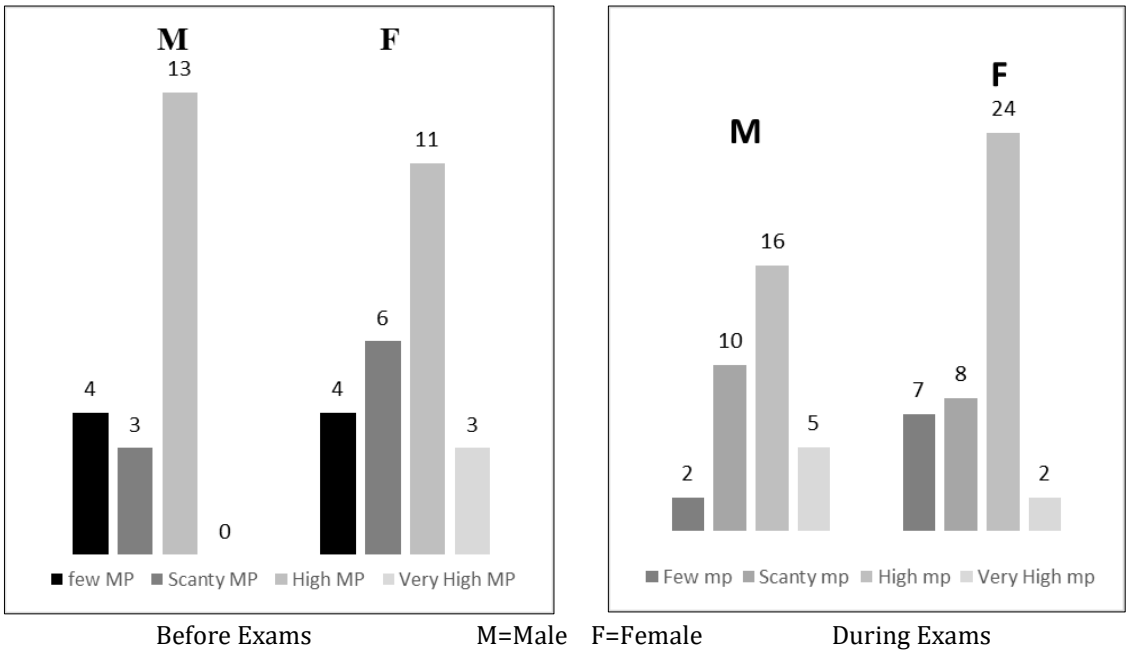


**Figure 3** Malaria parasitaemia among students before and during exams

During exams, of the 33 malaria positive males, there were 2 (6%) with few malaria parasite count, 10 (30%) with scanty malaria parasite count, 16 (48.5%) males with high malaria parasite count, and 5 (15.15%) males with very high malaria parasite count. On the other hand, among 41 positive females, there were 7 (17.1%) with few malaria parasite

count, 8 (19.5%) with scanty malaria parasite count, 24 (58.5%) with high malaria parasite count and 2 (4.9%) with very high malaria parasite count (Figure 2).

## 4. Discussion

Malaria is a disease with public health challenges affecting everyone irrespective of sex, age, blood group or marital status [13]. The disease is one of the causes of student's absenteeism and low academic performance in Nigeria [7, 14]. Studies have reported that the prevalence of malaria infection amongst students is very high but many of the students are misinformed on the predisposing factors or the management of the disease [8, 15, 16].

Many studies had reported on the prevalences, knowledge, attitude and practices (KAP) associated with malaria and predisposing risk factors among students [15, 17]. In this survey, the age range (16-25 years) and single status of most of the respondents are usually the profile of students in higher institutions in Nigeria and may impact on the responses.

Age is an important variable in health studies and is influenced by population structure while marital status can operate as a protective or selective factor in frequency, exposure and pattern of diseases [18]. This is true in this study as age and marital status were significant ($p<0.05$).

Results from this study showed that 84% of the students did not use chemopreventives while Fansidar at unit price of ₦300 was the preferred chemoprophylaxis among the few. Majority (73%) preferred the use of Artemisinin based combination therapies (ACTS) such as Amatem and Lonart-DS to taking malaria injections when ill. At the time of the study, these two drugs were at a unit price of ₦1600 and ₦1300 respectively. ACTs which replaced Chloroquine and Sulphadoxine/ Pyrimethamine have been a vital tool in efforts to treat and eliminate uncomplicated malaria in endemic regions [19, 20].

The survey also showed that (31%) of the students practiced self-medication with malaria drugs and (80%) used herbal mixtures. Medical students appeared to use more of preventive drugs (50%), recognized side effects of drugs (25%) and used less of herbal mixtures (30%) than students from other faculties. Medical students seemed to prefer orthodox drugs to herbal mixtures in this study. This is in line with a survey on Medical students' knowledge and attitude towards complementary and alternative medicine (CAMS) in Ghana. In that study, medical students were deficient in knowledge of CAMS but their attitude and usage was good enough. Ameade *et al* [21] was of the opinion that future physicians should possess adequate knowledge and better attitudes for CAMS.

Most of the students (90%) that preferred antimalarial drugs to injection and do not practice self-medication were Science students. This may be due to their scientific background which provided more health information. The result of this work is similar to the study of Morenikeji [9] in which 47% of the students in an institution in Oyo State practiced self-medication. Such medications included herbs, analgesic, antipyretic and antibiotics. This should not be encouraged among students who have the habit of taking wrong dosages and delaying treatment until critically ill as also reported in a study by Vilay *et al* [22].

Further investigations based on the data from the health centre revealed that, more students reported ill during exams (89) than before exams (57). However, only 80% tested positive to Malaria and this imply that the 20% could have assumed that they had malaria. Based on gender, the female students had more positive cases than males before and during exams. Similarly, the female students (26%) also had more severe cases than the males (21%) before and during exams. Malaria parasitaemia was higher during exams (47%) than before exams (27%) and this may be due to more exposure of students to mosquito bites during exam periods. The females have more malaria cases because they were probably more exposed to mosquito bites as a result of less protective mode of dressing. The result of this present work is in line with a past survey carried out by Okwa and Ibidapo [23] where an overall prevalence of 83.3% was reported among students and female students were more infected than the males. This gender-based result is similar to the result of by Okonko *et al.* [24] who reported that 55.2% of the samples from females tested positive for malaria parasitaemia while 44.2% of the samples from males tested positive among patients in Ibadan, southwestern Nigeria.

## 5. Conclusion

We recommend that female students should always wear protective clothing and students should use safe and effective mosquito repellants while reading in unscreened classes before and during examinations. The study recommends early reporting of malaria for prompt treatment and health education on the use of antimalarial chemoprophylaxis drugs amongst students. There should also be more knowledge towards complementary and alternative medicine especially

among medical students. However, indiscriminate use of herbal mixtures should be regulated among students. There is need for intensified health education on risks associated with malaria incorporated into schools orientation programs. Accessible health care services and affordable ACTS should always be made available for students especially during examination periods at their health care facilities. All these measures falls in line with the goals of the National malaria strategic plan to ensure the elimination of malaria in Nigeria.

## Compliance with ethical standards

### *Acknowledgments*

We thank the students who participated for their time in filling the questionnaires. We are grateful to the medical director of the University health service and the medical laboratory personnel for the permission and access to anonymous data on malaria test respectively.

### *Disclosure of conflict of interest*

The authors: Okwa Omolade O, Onyeaghala Chimaroke I, Baruwa Samiat, M, Olayele Oluwadamilola and Sulaimon, Adebukola R declare that there is no conflict of interest.

### *Statement of informed consent*

Informed consent and approval were obtained from all the students who willingly participated in the study

### *Contributions*

Omolade O Okwa designed the research, validated the questionnaire, and interpreted the results and proof read the manuscript. Chimaroke I Onyeaghala, Samiat M, Baruwa. Oluwadamilola Olayele and Adebukola R Sulaimon designed, pretested and administered the questionnaires, compiled the work and carried out the data analysis.

### *Ethical consideration*

We were guided by the ethical principles that are based on human rights and protection of respondents during this survey such as voluntary participation, safety and respect of persons. . Confidentiality and anonymity of information was strictly ensured in all cases.

## References

[1] Okwa OO. Nipping the malaria vectors in the bud: Focus on Nigeria: In: Fyson Kasenga (ed) Malaria: In tech Open access publishers, UK. ISBN: 978-1-789-84-122-0. 2019. p 91-98. Doi: 10.5772/Intechopen. 83554

[2] Onwujekwe O, Chima R, Okonkwo P. Economic Burden of Malaria illness on Households versus that of all other illness Episodes: A Study in Five Malaria holo-endemic Nigerian Communities. Health-Policy. 2000. 54: 143-159.

[3] Leighton C, Foster R. Economic Impact of Malaria in Kenya and Nigeria," Applied Research Paper, No. 6, Abt Associates Inc. in Collaboration with Vector Biology Control Project, Medical Services Corporation International, Health Financing and Sustainability (HFS) Project, Bethesda, 1993.

[4] World Health Organization. Malaria Control Unit & United Nations Children's Fund (UNICEF). (2003). The Africa malaria report 2003. World Health Organization. https://apps.who.int/iris/handle/10665/67869 WHO/CDS/MAL/2003.1093. 120 p

[5] Worrall E, Basu S, Hanson K. Is malaria a disease of poverty? A review of the literature. Tropical Medical International Health. 2005. 10(10): 1047–1098. **https://doi.org/10.1111/j.1365-3156.2005.01476.x**

[6] Nájera, JA, Hempel J, World Health Organization. The burden of malaria. / José A. Nájera and Joachim Hempel. World Health Organization. https://apps.who.int/iris/handle/10665/69677 1996 CTD/MAL/96.10 58 p.

[7] Erinoso AO, Bamgboye EA. Sickness Absenteeism in a Nigerian Polytechnic. African Journal of Medical Sciences. 1988. Mar 17(1): 57-61. PMID: 2834935.

[8] Okwa, OO, Bello BA, Oludegun SA. Social Aspects of Malaria among Students in-two Tertiary Institutions in Lagos, Nigeria. Sierra Leone Journal of Biomedical Research. 2011. 3(2): 97-103. https://doi.org/10.4314/sljbr.v3i2.7 1810

[9] Morenikeji, OA. Perception and management of malaria in Secondary schools in a Nigerian University, (Special Communication) Pakistan Journal of Medical Science. 2009. 25(3): 508-511.

[10] Vitor-Silva S, Reyes-Lecca RC, Pinheiro TRA, Lacerda MVC. Malaria is associated with poor school performance in an endemic area of Brazilian Amazon. Malaria Journal. 2009. 8: 230. doi:10.1186/1475-2875-8-230

[11] Lagos Bureau of Statistics. Vital data: LGA statistics for 2020. https://lagosstate.gov.ng/vital-data-lagos-bureau-of-statistics-2/.

[12] Lwanga SK, Lemeshow, S, World Health Organisation. Sample size determination in health studies: a practical manual/S.K Lwanga and S. Lemeshow. https://apps.who.int/iris/handle/10665/40062. ISBN: 9241544058. 1991. 80pp

[13] Centers for Disease Control and Prevention: Human factors and malaria. http://medbox.iiab.me/modules/en-cdc/www.cdc/gov/malaria/about/biology/human_factors.html.

[14] Adesina OO. Subclinical malaria Infection among University of Maiduguri students: Prevalence and Parasite Density. Bornu Medical Journal. 2013. 10(1): 6-11.

[15] Adeyemo FO, Okpala PU, Oyana, EN, Imoukhuede MO. Malaria Infection among Students of the University of Benin, Edo state, Nigeria. International Journal of Recent Scientific Research. 2014. 5(9): 1529-1532.

[16] Ibrahim A, Oluberu OA, Usman SO, Akintayo UNO, Isola IN, Ojediran, TE. Oyo State Students and Malaria Management. Turkish Journal of Family Medicine and Primary Care. 2016. 10(3): 126–30. Corpus ID: 78324905

[17] Oluyemi FO, Oluyemi AK. A study on the awareness, knowledge and perception of malaria among selected secondary school students in Akure metropolis, Nigeria. The Open Public Health Journal. 2017. 10: 1-6. DOI: 10.2174/1874944501710010001

[18] Otubanjo OA. Elements of Parasitology (revised edition): Lagos, Nigeria. Tunsgam Nigeria Enterprises Limited (Publisher). ISBN: 978-978-37049-7-4, 2020. p269

[19] Eastman RT, Fidock DA. Artemisinin-based combination therapies: a vital tool in efforts to eliminate malaria. National Review on Microbiology. 2019. Dec 7: 864–74. DOI: 10.1038/nrmicro2239

[20] Chukwu LC, Agbasi PU, Unekwe PC, Oguwike FN. Revisiting the Evaluation of the Effectiveness of Artemether-Lumefantrine Combination in the Treatment of Uncomplicated Malaria in Elele, a Malaria Endemic Area in Rivers State Nigeria. Journal of Biosciences and Medicines. 2019. 7: 59-72. Corpus ID: 196552025

[21] Ameade EPK, Amalba A, Helegbe GK, Mohammed BS. Medical students' knowledge and attitude towards complementary and alternative medicine – A survey in Ghana, Journal of Traditional and Complementary Medicine. 2015. 6: 230-236. http://dx. doi.org/10.1016/j.jtcme.2015.03.004

[22] Vilay P, Nonaka D, Senamonty P, Lao M, Iwagami,M, Kobayashi J, Hernandez K, Phrasisobath K, Kounavong B, Hongavauhung B, Brey PT, Kano S. Malaria prevalence, knowledge, perception, preventive and treatment behavior among military in Champasak and Attaheu provinces, Lao PDR: a mixed method study. Tropical Medicine and Health. 2019. 47:11. doi.org/10.1186/s41182-019-0138-9

[23] Okwa OO, Ibidapo CA. Malaria Situation, Perception of Cause and Treatment in a Nigerian University. Journal of Medicine and Medical Sciences. 2010. 1(6): 213-222. http://www.interesjournals.org/JMMS

[24] Okonko IO, Donbraye-Emmanuel OB, Abubakar MJ, Fowotade A, Fadeyi A, Babalola ET, Ojezele MO, Adeyi AO. Malaria parasitaemia among patients in Ibadan, Southwestern Nigeria. Journal of Applied Biosciences. 2010. 29: 1774-1780. Corpus ID: 55744945