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# Plasmodium Falciparum Screening among Individuals Purchasing Antimalarial Drugs for Self-Medication

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***Abstract***

*The objective of this study was to ascertain the pattern and reliability of self-diagnosis and self-medication with antimalarial drugs. The sample size was 470 comprising 264 men and 206 women. There is a significant difference between the screening results for men and for women (P=0.01186). 71.49% of participants purchasing antimalarial drugs for self-medication in the study area had no parasite antigen in their blood stream. Self-medication practices with antimalarial drugs was found to be more prevalent in the age group 31-40, which accounted for 171 (36.36 %) of participants. Individuals >60 years of age were the least involved in the practice of self-medication practice with antimalarial drugs. Age was found to be significantly associated with self-medication practices with antimalarial drugs (P=0.028156). More single individuals were engaged in the practice of self-medication with anti-malarial drugs 235(50%) as compared to married participants 206(43.83%). The results show that individuals with formal education were the most engaged in self -medication practices with anti-malarial drug as tertiary educated participants accounted for 257(54.68%) as compared with individuals with no formal education (53 or 11.28%). The level of accuracy of self–diagnosis for malaria was higher in women 30.58% as compared to men (21.97%). The precision of self-diagnosis was also highest among participants aged > 60(41.82%) while the lowest was level of accuracy was recorded among participants aged 18-30(15.14%). Based on the level of education, the accuracy of malaria diagnosis was higher in tertiary educated participants (29.18%) and lowest among participants with no formal education (15.09%).*

***Keywords:*** *Antimalaria, Self-Medication, Malaria, Prevalence, Self-Diagnosis.*

## Introduction

***Plasmodium falciparum*** is one of the six protozoan parasite, belonging to the species *Plasmodium* which causes malaria in humans. This parasite is transmitted to humans through the bites of infected female *Anopheles* mosquitoes. The organism is responsible for a vast majority of the mortality and morbidity associated with malaria infection, it accounts for about 80% of malaria infections in sub-Saharan Africa and almost every death due to malaria is caused by the same organism (World Health Organization, 2008).

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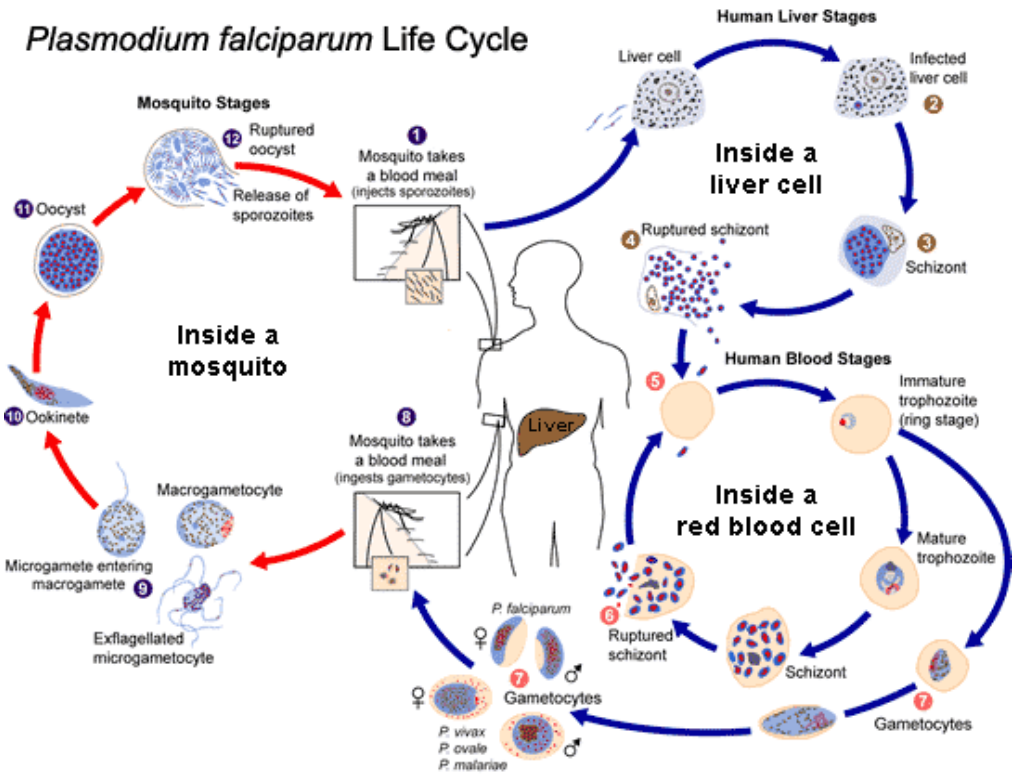


Figure 1. Photo credit: http://www.parasitesinhumans.org

**Self-medication** refers to the use, administration or consumption of medicinal substances in an attempt to treat certain self-recognized disorders, conditions or symptoms, this also includes the practice of using over-the-counter drugs and or prescription drugs which have not been prescribed by a medical practitioner on self in order to treat or alleviate certain conditions.

**Rapid Diagnostic Tests (RDT)** are immunochromatographic tests that detect specific parasite antigens in blood. The Malaria antigen detection tests are conducted using the (RDT). The kits assay and detect malaria antigen in the blood sample and are intended to allow simple, swift, and precise diagnosis of malaria in areas where standard laboratory diagnosis is not available. In standard conditions these devices offer high sensitivity, specificity, rapidity, ease of performance and interpretation. The ability of the kit to differentiate species, allows for quantitative analysis. The endemic nature of malaria in Nigeria, has made the rapid, and reliable diagnosis of the fundamentals effective to the management and control of the disease, the introduction of malaria rapid diagnostic devices opened a new era of diagnosis that was expected to challenge the existent limitations of other diagnostic tests.

## Background of study

Despite the discovery of Artemisinin Combination Therapy (ACTs) which is currently the drug of choice in the treatments and management of P. *falciparum* infection, the condition remains one of the most devastating infectious diseases in the world and Africa's greatest public health challenge, because despite many successes recorded with the advent of this new therapy, the emerging trend of resistance continues to pose a serious cause for concern. Self-medication on the other hand is gradually becoming a way of life in virtually every community in Nigeria, largely due to long waiting time in government owned health centers and the exorbitant charges and fees at private health facilities. What is not known however are the accuracy of these self-diagnosing practices and the prevalence rate of *Plasmodium falciparum* among those purchasing antimalarial drugs to treat incidence of malaria.

### Statement of the problem

The importance of proper diagnosis of disease conditions especially malaria in communities across Nigeria has been relegated to the background, with widespread use and indiscriminate administration of antimalarial drugs including injectable antimalarial agents without diagnosis of real or perceived conditions.

### Basic research questions

This study was expected to answer the following basic research questions:

1. What percentage of individuals purchasing antimalarial drugs for self-medication are actually infected with *Plasmodium falciparum.*
2. What percentage of individuals purchasing antimalarial for self-medication are free from the parasite.
3. What are the demographical distribution of those engaged in the practice of self-medication.

### Objectives of the research

The objective of this study is to ascertain the reliability of self-diagnosis and medication in malaria management and medication practices by screening individuals purchasing antimalarial drugs for self-medication with a view to determining the level of reliability of such practices, the demographical pattern/ structure of the individuals who are engaged in the practice, which will in the end provide valuable information for key stakeholders, the Community and government and assist in enlightenment programmes , policy change advocacy and programs/ clinical projects geared towards stemming the tide of relapse and the rising incidence of drug resistance in the management of malaria.

### Significance of the study

This study is hugely significant because of the burden malaria places on communities' families and individuals especially in developing countries where treatment of the disease account for a significant percentage of the health budgets of the population. Determining the appropriateness or otherwise of these practices could prevent loss of lives, provide important information on the practices and present a clear picture of the situation to policy makers, advocacy groups and public health practitioners.

### Hypothesis

#### Null hypothesis H0

Most individuals purchasing antimalarial for self-medication do not have *P. falciparum* parasite in their blood stream.

#### Alternative hypothesis H1

Most individuals purchasing antimalarial for self- medication have *P. falciparum* parasite in their blood stream.

## Limitation of study

This research was carried out specifically in community pharmacy outlets and drugs stores in Kogi state and cannot the directly extrapolated.

## Review of literature

Although malaria is preventable it has remained one of the biggest medical burden in developing countries especially in sub-Saharan Africa where thirty countries account for 90% of global malaria death. Uganda, Ethiopia, Democratic Republic of Congo (DRC), and Nigeria account for nearly 50% of global malaria deaths, Despite the high prevalence rate of the disease, the condition is often misdiagnosed because its symptoms such as fever, nausea and fatigue sometimes mimic the symptoms of other infectious diseases, such as influenza and typhoid fever, this misdiagnosis often leads to the administration or consumption of unnecessary medication which raises the cost of healthcare and increases the likelihood of the development

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of parasite drug-resistance. In sub Saharan Africa were an estimated 80 to 90% of all malaria deaths occur, It is estimated that malaria costs Africa US$12 billion per year in direct costs and reduces GDP growth by 1.3 percent annually, The burden is carried mostly by poor and vulnerable families whose access to current prevention and treatment options are limited (Rowe *et al.*,2006).

Self-medication is becoming an increasingly important area within the healthcare. Because it moves patients towards greater independence in making decisions about management of minor illnesses and diseases thereby promoting empowerment. Self-medication also has advantages for healthcare systems as it facilitates better use of clinical skills, provides increased access to medication and may contribute to reducing prescribed drug costs associated with private health care providers and publicly funded health programmes (Omolase *et al.*,2007). However, self-medication is associated with risks such as misdiagnosis, use of excessive drug dosage, prolonged duration of use, drug interactions and polypharmacy. The latter may be particularly problematic in the elderly (Hughes *et al.*, 2001). A research conducted by Montastruc *et al* on the Pharmacovigilance of self-medication reported that, the side effects of self-medication are relatively frequent and can be serious. It also showed that these side effects occurred more often in women than in men (Montastruc *et al.*, 1996).

A study which investigated Self-medication and non-doctor prescribing of drugs in Pokhara Valley, Western Nepal described self-medication as a common practice in developing countries. The study reported that, the common reasons given for self-medication were mild illness, previous experience of treating a similar illness, and non-availability of health personnel. 70% of respondents sampled in the study were prescribed allopathic drugs by a non-allopathic doctor. The compounder and health assistant were common sources of medicines. Paracetamol and antimicrobials were the drugs most commonly prescribed. A significantly higher proportion of young (<40 years) male respondents had used self-medication than other groups in the study population (Shankar et al.,2002). Similarly, a study published in the Ethiopian journal of health and development which reviewed Self-medication practices in three towns of North West Ethiopia, agreed with the submission that most illnesses in developing countries do not come to the attention of physicians; as many of these are either tolerated or self-medicated. The retrospective study assessed the magnitude, type and factors of self-medication in three towns of Northwest Ethiopia using a community-based cross-sectional survey with two-week illness recall with the aid of an open-ended questionnaire consisting of general demographic and socioeconomic questions as well as questions on illness in the last two weeks prior to the interview and treatment strategies. The results showed that, of a total of 1880 households evaluated 1190 (11.6%) individuals in 984 households reported at least one episode of an illness and of whom 324 (27.5%) conducted self-medication. Self-medication was conducted using both modern pharmaceuticals and traditional medicines. Financial reasons and the triviality of illnesses were also the top-two reported factors of self-medication (Abula & Worku 2017).There appears to be also widespread self-medication practices among health care personnel, a study on self-medication among health workers in tertiary institutions conducted in South-West Nigeria reported that, the prevalence of self-medication is relatively high and inappropriate self-medication results in wastage of resources, resistance to pathogen and generally entails serious health hazards (Babatunde *et al.,* 2016).

In recent years, there appears to be an emerging trend which shows that there is an increasing impulse for individuals to self-administer anti-malarial drugs whenever they feel unwell, a recent study conducted in Nigeria reported that (85%) of respondents admitted to self-medication. According to the research, drugs utilized could be single, usually analgesics (26.5%) and anti-malaria (15.9%) or in combinations, usually antimalarial-analgesics (22.4%), antimalarial analgesic-antibiotic (15.3%) and antibiotic-analgesic (10.0%). The major reason cited for self-medication by the respondents in the study were their perception (Babatunde *et al.*, 2016). Another study which evaluated the prevalence of self-medication with antibiotics and antimalarials in Khartoum State, Sudan as well as the factors linked with self-medication sampled 600 households (1750 adult persons), using a stratified clustered sampling technique, results from the study shows that 1,293 adults which represents (73.9%) of the study population had used antimalarial or antibiotic without a prescription within one month prior to the study. Eight hundred and forty-one (48.1%) of the

respondents agreed that they have used antibiotics, 43.4% used antimalarial, while 17.5% used both. The main reason that was indicated for the self-medication in this study was financial constraints. The main source of medicines was the private pharmacies, which were regarded as a cheaper alternative to other primary healthcare sources (Awad *et al.,* 2017).

Presumptive treatment can increase 'drug-induced disease', death and inflect a negative impact on individual and family finances. This growing trend, have been attributed to the wide spread availability of over-the counter (OTC) drugs, urge of self-care, extensive advertisement of drugs, lack of functional health care services, poverty, ignorance, availability of drugs in places other than drug shops , high fees at health facilities and inadequate family support , a study which evaluated the risk of self-medication practices listed, incorrect self-diagnosis of conditions, delays in seeking medical advice when needed, dangerous drug interactions, incorrect manner of administration, infrequent but severe adverse reactions, incorrect choice of therapy, incorrect dosage, masking of a severe disease and risk of dependence and abuse as many of the risks involved in self-medication (Ruiz, 2010). However, there is scarcity of data and information on misdiagnosed *Plasmodium falciparum* cases among self-medication and presumptive treatment practitioners. Furthermore, the advent of rapid diagnosis provided a platform to evaluate the claim and perceptions espoused by adherents of self-medication (Murray *et al*, 2003).

A review of malaria diagnostic tools: microscopy and rapid diagnostic test (RDT) published in *The American journal of tropical medicine and hygiene*, stated that Giemsa microscopy and rapid diagnostic tests (RDTs) represent the two diagnostics most likely to have the largest impact on malaria control today. These two methods, each with characteristic strengths and limitations, together represent the best hope for accurate diagnosis as a key component of successful malaria control (Wongsrichanalai *et al.*,2007). Despite this advance, self-medication has been on the rise without recourse to any diagnostic tool. A study conducted in Enugu State, southeast Nigeria reported that self-medication was responsible for the highest percentage of drug prescriptions (46.1%), while prescriptions from health centers accounted for 18.2%. The study also observed that although Nigeria's malaria treatment policy recommends a regular monitoring of drug utilization in order to generate critical information on the effective use of anti-malarial drugs the information at the retail end which constitute a major part of its drug distribution and consumption network is currently limited. The study further observed a significant level of inappropriate use of drug at the retail end (Ezenduka *et al*., 2014).

On the other hand, another study which evaluated the economic burden of malaria in Nigeria using the willingness to pay approach in 2007 indicated that households were prepared to pay an average of about 1,112 Nigerian Naira (USD 9.3) per month for malaria treatment this figure is about Naira 427 (USD 3.6) in excess of their current average expenditure on malaria on a monthly basis. Another important finding from this study was the willingness of households to pay an average sum of 7,324 Nigerian Naira (USD 61) per month for the control of malaria. Again, this figure represents an excess of about 2,715 Nigerian naira (USD 22.6) over their current cost of managing the disease (protection, treatment and indirect costs), bringing the individual into perspective this figure represents 611.7 Nigerian Naira (USD 5.1) per head per month and 7,340 Nigerian Naira (USD 61.2) each year, for a country with a population of about 120 million this figure translates to Naira 880,801 million per annum representing about 12.0 per cent of Gross Domestic Product (GDP) (Jimoh *et al*.,2007) using the country's last recorded Gross domestic product of 481.1 billion USD (2015) (Trading economics, 2017) ,this translates into a whopping 57.72 Billion USD dollars per annum , as such any action that will help alleviate economic burden of malaria in Nigeria is likely to have a significant impact of the socio economic wellbeing of the country's citizens hence the need for a study to unearth critical data that will provide valuable information for critical stakeholders and policy makers in the country that will enable them take decisions that will reduce the burden on communities and enhance the living standards of the people

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# Methodology

## Design and duration of study

A cross-sectional study was conducted between July- October 2017 at the peak of the rainy season when the incidence of malaria is at its highest due to increase in the number of mosquito breeding sites as a result of widespread pools of stagnant or slow flowing water bodies during the period.

## Study area

This study was conducted in Lokoja, Lokoja is located in North central Nigeria, and it lies at the confluence of the Niger and Benue rivers on 7.80 latitude and longitude 6.74 at an elevation of 53 meters above sea level. The city has a population of 195,261 *as* at the 2006 census.

Built-up area, sand bars and vacant land occupy least land cover (28.31%) while urban agricultural land, vegetation and water bodies covered 344.33km2 (59.72%), 41.98km2 (7.28%) and 18.51km2 (3.21%), respectively. The land surface temperature (LST) value ranges from 0.92 to 0.989 with an average of 0.955 whereas the highest emissivity is recorded where vegetation is very dense and the lowest recorded for Sand bars. The LST for sand bars, vacant land and built-up area has the highest average temperatures of 41.13°C, 35.66°C and 34.56°C, respectively (Ifatimehin & Ujoh, 2014).

## Target study population

Adults Purchasing Antimalarial drugs for self-administration/ medication in Community Pharmacies in Lokoja Metropolis

## Sampling technique

Blood samples for analysis was collected by from volunteers by employing the convenience sampling approach. This non-probability sampling method relies on data collection from members of the population who were conveniently accessible or available to take part in the study.

## Inclusion criteria

All customers, clients and patients purchasing antimalarials at community pharmacies for self-medication aged 18 years and above who consented to participate in the study were included.

## Exclusion criteria

All customers, clients and patients who were not purchasing antimalarials at community pharmacies for self-medication were excluded from the study, also excluded were the very ill, and those below age of 18 and customers who declined consent.

## Sample size

The desired sample size was determined using the Fishers formula of sample determination (Ngwenyi, 2012), using the prevalence rate of malaria in Kogi state Nigeria at 54.75 (Ifatimehin, Falola, & Odogbo, 2014). The sample size to studied during this research will be;

$$N = \frac{Z^2 p X q}{d^2}$$

N = the sample size (assuming the population n is greater than 10,000)
z = the standard normal deviation, set at 1.96, which corresponds to 95% confidence level
p = Prevalence of the disease in the area 54.75
q = 1.0 – p
d = the degree of accuracy desired, here set at 0.05 corresponding to the 1.96.

$$\text{Sample size } N = \frac{1.96^2 \text{ x } 0.547 \text{ x } (1 - 0.5) =}{0.05^2}$$

**3.8416X0.2735 =420**
**0.0025**

Because attrition can occur when participants have missing data at one or more point (Dumville, Torgerson, & Hewitt,2006), 10 percent attrition rate was included and 42 was added and the entire sample size was rounded up to 470. Four hundred and seventy participants (470) was the study population for this research

## Ethical considerations

Ethical approval was obtained from the Ministry of Health Headquarters Lokoja body (Appendix 2) the body charged with the responsibility for compliance with ethical standards in the state. The following ethical considerations were performed during this research

1. The aim and objectives of the study was clearly outlined for all respondents in the language and manner they understand.
2. The respondents were informed of the possible implication in terms of pain, time and resource they might incur during the test
3. All participants were informed about their right to participate or to decline from participating in the study.
4. An informed consent was obtained from all participants.

## Instrument of data collection

Blood samples collected from the study participants was tested for *Plasmodium* f*alciparum* parasites using a rapid diagnostic (RDT} kit that detects specific parasite antigens in blood.

## Specificity and sensitivity of instrument

Research has shown that the Rapid Diagnostic Test kit (RDT) to be a very reliable tool for diagnosis of malaria. A study to assess the reliability of the RDT for Malaria diagnosis conducted in the forested belt of central India showed that For *P. falciparum*, the sensitivity and specificity of the test were 96% and 95% respectively, with a positive predictive value (PPV) of 85% and a negative predictive value (NPV) of 99% and concluded that the RDTs were reliable for malaria diagnosis ( Bharti, 2008)

## Procedure for sample collection

The process was carried out according to the standard operating procedure described by (UNITAID, 2017), the procedure involves 7 steps

1. Explaining to the patient what the test is for and procedure before proceeding to open the package tearing containing the test cassette, buffer and dropper.
2. The next step involved putting on protective covering and a pair of new gloves before proceeding to disinfect the finger with alcohol swab and the puncture site by pricking at the tip of the 4th finger of the non - dominant hand using a lancet.
3. By gently applying pressure to the finger the first drop of blood emerged which was wiped out using a dry piece of cotton wool leaving no cotton strand, tissue fluids or other contaminants that may affect the results.
4. Applying gentle pressure on the finger a second time led to the expression of a new blood drop which was collected using the blood collection device (pipette, dropper or capillary tube) provided in the RDT kit, to collect the required volume of blood (5 µl) in accordance to manufacturer ‘s instructions
5. After the sample collection the blood was transferred into the appropriate compartment of the on the RDT cassette as stipulated by the manufacturer after which the exact amount of buffer drops as stipulated by the manufacturer (two drops) at the appropriate portion of the test device was added.
6. The test was timed as recommended by the manufacturer( 15minutes) before the reading were taken by viewing the result window of the cassette for color band(s) appearance indicating either Negative was recorded for the presence of only a control band and positive result was recorded for P. *falciparum*

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by the appearance of both the test color band and the control band. an Invalid result was recorded when test band and the control does not appear or the test band appears and the control band does not, the results were recorded in the data entry sheet. (appendix 1)

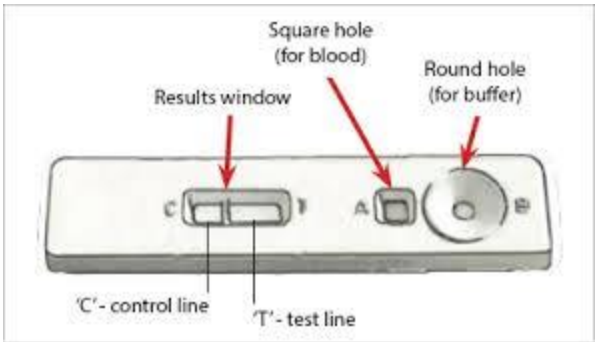


**Figure 2.** Photo credit: World Health Organization (WHO)


**Figure 3.** An RDT kit showing negative result for Plasmodium falciparum


**Figure 4.** An RDT kit showing positive result for *Plasmodium falciparum*

## Results and data analysis

### Socio- demographic characteristics

**Table 1 a**

| **Sex** | Number | Percentage |
|---|---|---|
| Male | 264 | 56.17% |
| Female | 206 | 43.83% |
| **Total** | **470** | **100%** |

**Table 1 b**

| **Age (years)** | **Number** | **Percentage** |
|---|---|---|
| 18-30 | 86 | 18.30% |
| 31-40 | 171 | 36.38% |
| 41-50 | 83 | 17.66% |
| 51-60 | 75 | 15.96% |
| >60 | 55 | 11.70% |
| **Total** | **420** | **100%** |

**Table 1 c**

| **Religion** | Number | Percentage |
|---|---|---|
| Christianity | 238 | 50.64% |
| Islam | 225 | 47.87% |
| Others | 7 | 1.49% |
| **Total** | **470** | **100%** |

**Table 1 d**

| **Marital Status** | **Number** | **Percentage** |
|---|---|---|
| Single | 235 | 50.00% |
| Married | 206 | 43.83% |
| Separated | 29 | 6.17% |
| **Total** | **470** | **100%** |

**Table 1 e**

| **Education** | **Number** | **Percentage** |
|---|---|---|
| Primary | 58 | 12.34% |
| Secondary | 102 | 21.70% |
| Tertiary | 257 | 54.68% |
| None | 53 | 11.28% |
| **Total** | **470** | **470** |

Shows the frequency distribution of the participants based on demographic characteristics. The study population comprises of 264 men representing 56.17 percent and 206 women representing 43.83 % of these figures those in the age bracket 18-30 were 86 (18.30%), 31-40 were 171(36.38%), 41-50 were 83(17.66%), 51-60 were 75(15.96%) and those whose age was greater than 60 were 55(11.70%). The religious distribution showed that there were 238 Christians representing 50.64 % Muslims 225 representing 47.87% and other religious adherents were 7 or 1.47%. Based on educational qualification there were 58 (12.34%)

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participants who had primary education, 102 (21.70%) were educated up to secondary level, 257 participants or 54.68% of the population had tertiary level of education while 53 or 11.28% of the study population had no formal education.

**Table 2 a.** Plasmodium falciparum screening results based on sex of the participants

| **Sex** | **Negative** | **Positive** | **Invalid** | **Total** |
|---|---|---|---|---|
| Male | 202(76.52%) | 58(21.97%) | 4(1.51%) | 264 (100%) |
| Female | 134(65.05%) | 63(30.58%) | 9(4.37%) | 206 (100%) |
| **Total** | **336** | **121** | **13** | **470(100%)** |

The chi-square statistic is 8.8692. The *p*-value is 0.01186. The result shows that there is a significant difference between the *Plasmodium falciparum* screening results for men and for women.

**Table 2 b.** Plasmodium falciparum screening results based on age (years) of the participants

| **Age (years)** | **Negative** | **Positive** | **Invalid** | **Total** |
|---|---|---|---|---|
| 18-30 | 70(81.40% | 13(15.14%) | 3(3.49%) | 86(100%) |
| 31-40 | 116(67.84%) | 49(28.65%) | 6(3.51%) | 171(100%) |
| 41-50 | 66(79.52%) | 15(18.07%) | 2(2.41%) | 83(100%) |
| 51-60 | 53(70.67%) | 21(28.00%) | 1(1.33%) | 75(100%) |
| >60 | 31(56.36%) | 23(41.82%) | 1(1.82%) | 55(100%) |
| **Total** | **336** | **121** | **13** | **470 (100%)** |

The chi-square statistic is 17.1935. The *p*-value is 0.028156. The result shows that there is a significant association between the *Plasmodium falciparum* screening results for the different age groups

**Table 2 c.** Plasmodium falciparum screening results based on religion of the participants

| **Religion** | **Negative** | **Positive** | **Invalid** | Total |
|---|---|---|---|---|
| Christianity | 169(71.01%) | 62(26.05%) | 7(2.94%) | 238(100%) |
| Islam | 162(72.00%) | 58(25.78%) | 5(2.22%) | 225(100%) |
| Others | 5(71.44%) | 1(14.28%) | 1(14.28%) | 7(100%) |
| **Total** | 336 | 121 | 13 | 470(100%) |

The chi-square statistic is 4.007. The *p*-value is 0.405053. The result shows that there is a no significant difference between the *Plasmodium falciparum* screening results between Muslims Christians and other religions.

**Table 2 d.** Plasmodium falciparum screening results based on the marital status of the individuals

| **Marital Status** | **Negative** | Positive | Invalid | Total |
|---|---|---|---|---|
| Single | 170(72.34%) | 57(24.26%) | 8(3.400%) | 235(100%) |
| Married | 146(70.78%) | 55(26.70%) | 5(2.43%) | 206(100%) |
| Separated | 20(68.97%) | 9(31.03%) | 0(0.00%) | 29(100%) |
| **Total** | **336** | **121** | **13** | 470 (100%) |

The chi-square statistic is 1.885. The *p*-value is 0.7569 The result shows that there is a no significant difference between the *Plasmodium falciparum* screening results for participants based on their marital status.

**Table 2 e.** Plasmodium falciparum screening results based on the educational level of the participants.

| **Education** | Negative | Positive | Invalid | Total |
|---|---|---|---|---|
| Primary | 41(70.69%) | 15(25.86%) | 2(3.45%) | 58(100%) |
| Secondary | 76(74.51%) | 23(22.55%) | 3(2.94%) | 102(100%) |

| | | | | |
|---|---|---|---|---|
| Tertiary | 175(68.10%) | 75(29.18%) | 7(2.94%) | 257100%) |
| None | 44(83.02%) | 8(15.09%) | 1(1.89%) | 53(100%) |
| **Total** | **336** | **121** | **13** | **470(100%)** |

The chi-square statistic is 5.7143. The *p*-value is .455944. The result shows that there is a no significant difference between the *Plasmodium falciparum* screening results for participants based on their educational qualifications.

**Table 3a.** Frequency distribution of Plasmodium falciparum screening results for the whole study population

| **Result** | **Number** | **Percentage** |
|---|---|---|
| Negative | 336 | 71.49% |
| Positive | 121 | 25.74% |
| Invalid | 13 | 2.77% |
| Total | 470 | 100% |

Overall 336 participants representing 71.49% tested negative to *Plasmodium falciparum* antigen, 121 participants or 25.74% tested positive while 13 test results were invalid.

## Observations and findings

One the major findings from this research is the pattern of frequency distribution of *Plasmodium falciparum* screening results which showed that most of the participants 336 representing 71.49% Purchasing Antimalarial Drugs for Self-Medication in the study area had no *Plasmodium falciparum* antigen within their blood stream. This is almost three times the number of individuals who actually tested positive for *Plasmodium falciparum* which were 121 or 25.74%. Self-medication practices with antimalarial drugs was also found to be more prevalent in the age group 31-40, they accounted for 171 or 36.36 % of the individuals purchasing drugs for antimalarials. This was closely followed the age group 18- 30 which recorded 86 individuals. Individuals >60 years of age were the least involved in the practice of self-medication practice with antimalarial drugs.

Another important observation that was noted from this research was that, men and women, Christians and Muslims are almost equally engaged in the practice of self-medication with no much difference in the frequency of their engagement in the practice with anti-malaria drugs within the location of study. This research also noted that more single individuals were engaged in the practice of self-medication with anti-malaria drugs 235(50%) as compared to married participants 206(43.83%) and participants who were separated from their spouses (divorced, widowed, widower, separated) which were 29 or 6.17% of the study population. Another key finding from this study with ramifications for health promotion activities is the observation on self-medication practices based on educational qualifications. The results show that individuals with formal education were the most engaged in self -medication practices with anti-malaria drugs, tertiary educated participants accounted for 257 or 54.68%, secondary level educated participants 21.7% and participants educated up to primary school level were 58 or 12.34%. Individuals with no formal education were 53 representing 11.28 percent of the entire study population.

The level of accuracy of self–diagnosis for malaria was higher in women 30.58% as compared to men who recorded 21.97%. The precision of self-diagnosis was also highest among participants aged > 60 who recorded 41.82% and while the lowest was level of precision or accuracy was recorded among participants aged 18-30(15.14%). Based on the level of education the accuracy of malaria diagnosis was higher in tertiary educated participants 29.18% and lowest among participants with no formal education 15.09%.

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## Discussion

In the entire study population, male made up a larger percentage with 56.17% as compared to women who account for 43.83 %. This is similar to a prevalence study on malaria parasites in adults and its determinants in malaria endemic area conducted in the Kisumu County, Kenya which reported that, men were 514 or 53.21% as compared to women who were 452 or 46.795 (Jenkins *et al.*,2015), and another study conducted by (Erhun , Agbani, , & Adesanya, 2005) on Malaria prevention: knowledge, attitude and practice conducted in Southwestern Nigerian communities which involved a study population of 231 participants was made up 146 men representing 63.20% and 85 women or 36.80%. This is in contrast with another study conducted in Gboko, Benue state, North central Nigeria, which evaluated malarial infection among patients attending a semi-urban based hospital and performance of HRP-2 pf Rapid diagnostic Test (RDT) in screening clinical cases of Plasmodium falciparum malaria reported. The study involved 258 participants comprising 158 women (61.24%) and 100 men (38.76%) (Houmsou *et al*., 2011). this variation may be largely due to the fixed hospital location in which the study was conducted. There was a statistical significance in the distribution ($p$=0 .01186) indicating that sex significantly associated *Plasmodium falciparum* screening results.

Self-medication practices with antimalarial drugs was also found to be more prevalent in the age group 31-40, they accounted for 171 or 36.36 % they also recorded the highest number of positive *Plasmodium falciparum* screening results. This agrees with the findings of a *Plasmodium falciparum* prevalence study in Amerindians inhabiting the Venezuelan amazon. The study conducted by Sanchez *et al* reported that 96.9% of the adults aged 31-40 years exhibited high ELISA values to P. falciparum (Sanchez, Perez, & Martinez,1990). This also agrees with a retrospective study conducted in the Kersa Woreda, area of Ethiopia which evaluated the Prevalence of malaria from peripheral blood smears which reported that patients aged 31-40 accounted for highest number of positive *Plasmodium falciparum* smears among 8 age categories with 104(14.9%) out of 698 (Karunamoorthi & Bekele, 2009) this is however in contrast with another study in Columbia on the epidemiology and control of malaria which stated that, young adults between the ages of 18–30 years of were the most affected ( Rodríguez *et al.*, 2011). This variation may be as a result of the design of this particular study which involved 3 species of plasmodium (*Plasmodium vivax*, *Plasmodium falciparum*, Plasmodium *malariae*). There was a statistical significance between the screening results and age ($p$=0 .028156) indicating that age range is significantly associated *Plasmodium falciparum* screening results.

Religion of the participants appear to have no major difference in terms on frequency and statistical significance. There was no statistical significance between the screening results and religion ($p$=0. 405053) indicating that religion is not significantly associated *Plasmodium falciparum* screening results which shows that adherents of both religions had equal chances of being infected with the parasite. This is agreement with a study conducted by Mavis Dako - Gyeke and Humphrey M Kofie on the factors Influencing prevention and control of malaria among Pregnant Women Resident in Urban Slums in Southern Ghana which reported that, there was no significant relationship between religious beliefs of participants and their malaria prevention and control practices (P = .53) (Dako-Gyeke & Kofie, 2015). However, this is in contrast with the finding of a research conducted in south western Nigeria which reported that 89.3% *of* pregnant women refused to take malaria drugs due to their religious inclination (Adefioye *et al.*, 2007).

Participants educated up to tertiary level appear to be the most involved in self-medication practices with anti-malaria drugs (54.68%) this agrees with the findings of a study by KP Osemene and Lamikanra in their study published in the *Tropical Journal of Pharmaceutical Research* which revealed that age, gender and students' level in the university influenced self-medication practices (Osemene& Lamikanra, 2012).This is in contrast with another study which evaluated self-medication practices in rural Sahaswan at Northern India which reported that the prevalence of self-medication was high primarily among illiterate males aged above 15 years with a low income (Ahmad *et al.*, 2014). This variation could also be as a result of the difference in population (rural and urban) as in this case with this research. The marital status and

educational qualification of the participants also does not appear to have any significant correlation with screening for *Plasmodium falciparum* for individuals purchasing anti-malaria drugs for self-medication (p=0 .7569) which indicates no significant statistical difference between them. This result is at variance with a similar study conducted in Ghana on the burden of malaria in mobile populations in the Greater Accra which showed that marital status, occupation and educational level were significantly associated with malaria (Diallo *et al*., 2017) This could be due to the category of the population studied in this case mobile population. However, another research published in the *Tanzania Malaria journal*, reported that Education level was associated with higher score for preventive action against malaria agrees with the findings of this study (Spjeldnæs, Kitua, & Blomberg, 2014). The level of accuracy of self–diagnosis for malaria was higher in women 30.58% as compared to men who recorded 21.97%. this could be largely due to experience from symptoms in the children they nurse and the fact that pregnant women are more susceptible to malaria than men (Duffy & Fried, 2005). The precision of self-diagnosis was also highest among participants aged > 60 who recorded 41.82% and while the lowest was level of precision or accuracy was recorded among participants aged 18-30(15.14%).

## Conclusion

According to the *Nigerian Medical Journal* Four species of plasmodium are responsible for malaria infestation in the country namely Plasmodium *falciparum, Plasmodium malariae, Plasmodium ovale* and *Plasmodium vivax*. Of these species, Plasmodium falciparum is the commonest in Africa and responsible for up to 98% of malaria cases in Nigeria (Nwali et al.,2015). with a large percentage of the participants purchasing anti malaria drug for self-medication testing negative to the parasite 336 (71.49%) it is evident from the finding of this research that a significant amount of resources which could have been used for other profitable activities is being wasted on unnecessary medication due to wrong diagnosis. The practice of consuming antimalarial for the treatment self-diagnosed cases of malaria appear not to be effective or efficient in the diagnosis of the condition .in addition it is also clear that education attainment is linked with higher frequencies of self-medication largely due to previous prescriptions, adverts, online and online literatures consulted. Self-medication practices with antimalarial drugs are more prevalent in the age group 31-40 years (36.38 %) while Individuals >60 years of age are the least involved in the practice of self-medication practice with antimalarial drugs with 1170%. The major conclusion from this research is the fact that, the Null Hypothesis $H_0$ which stated that most individuals purchasing antimalarial for self-medication do not have P. falciparum parasite in their blood stream is upheld.

## Recommendations

Based on the finding of this study, the following recommendations will be useful in reducing the financial, economic and emotional burden of malaria on the population

1. There is an urgent need for policy makers in the public health sector to take a second look at the crisis of self-medication in malaria treatment especially in developing countries
2. Governments at all levels need to provide frameworks, guidelines or laws to stream line the practice and sales of malaria drugs for self- medication as the haphazard nature of the current system especially in Nigeria is complicating the crisis.
3. There is an urgent need to improve sensitization of the public on the financial loss, health hazards and clinical complications associated with self-medication practices.
4. The availability of rapid diagnostic kits should be increased and the possibility of self-testing with RDT as a pre requisite for purchase of antimalarial medications could be considered in the near future.
5. Drug stores and their operators including community pharmacies and patent medicine stores should be encouraged to stock and conduct RDT on customers purchasing antimalarial drugs for self-medication to promote the practice.
6. There is the need to subsidize the price of RDT kits especially in rural areas to promote the practice.

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7. Further research on this topic is recommended to uncover other underlying factors associated with these findings

## Summary

This research was conducted to measure the efficiency self-diagnosing practices and the prevalence rate of *Plasmodium falciparum* among those purchasing antimalarial drugs to treat malaria due to the indiscriminate administration of antimalarial drugs including injectable antimalarial agents without diagnosis of real or perceived conditions. This study answered the following basic research questions.

1. The percentage of individuals purchasing antimalarial drugs for self-medication that are actually infected with *Plasmodium falciparum*
2. The percentage of individuals purchasing antimalarial for self-medication that are free from the parasite.
3. The demographical distribution of those engaged in the practice of self-medication with anti-malarial drugs.

The study ascertained efficiency and reliability of self-diagnosis and medication in malaria management and medication practices by screening individuals purchasing antimalarial drugs for self-medication and provided valuable information that will enable the government of Nigerian and key stakeholders make informed decision of self-medication practices for malaria infection in Nigeria. The findings of this research if embraced by critical stakeholders will also assist in enlightenment programs, policy change advocacy and programs/ clinical projects geared towards stemming the tide of relapse and the rising incidence of drug resistance in the management of malaria.

If the recommendations of This study are implemented, the burden malaria places on communities' families and individuals especially in developing countries where treatment of the disease account for a significant percentage of health budgets will be significantly reduced.

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