

## Research Article

### Investigation on Malaria Parasitaemia, Knowledge and Attitudes towards Mosquito Control among Residents of Wukari Metropolis

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#### ABSTRACT

This study was conducted to investigate malaria parasitaemia, knowledge and attitudes towards mosquito control. 162 subjects were selected at random from different locations in Wukari Metropolis and were examined for malaria parasitaemia. Blood samples from each of the subjects were collected by finger pricking for the determination of malaria parasite using the Rapid Diagnostic Test method. Out of 162 samples examined, the prevalence of malaria parasitaemia was 91(56.17%). Female subjects had the highest prevalence of malaria parasitaemia of (72.0%), while the male had (35.0%) and the difference was statistically significant ( $p < 0.05$ ) between the rate of infection and gender. Age group  $\geq 20$  years recorded the highest infection rate of (62.12%), age group 14-16 years had the lowest infection rate of (48.94%), and there was no significant difference  $p > 0.05$  between malaria prevalence and age groups. The hospital location had the highest prevalence of malaria parasitaemia at (64.44%) and (31.89%) within malaria, while the Fuwukari location had the least prevalence of malaria parasitaemia of (47.22%) and (18.68%) within malaria. The test on knowledge and awareness of malaria indicates that (31.48%) of the subjects have erroneous perception about the cause and means through which malaria is transmitted. It can be concluded that despite the high infectivity rate of malaria in the study area there is much knowledge and awareness of malaria in the study. There is a need for a comprehensive strategy for preventing malaria transmission such as effective use of insecticide-treated nets, public awareness campaigns, proper environmental sanitation and use of drugs.

**Keywords:** Malaria, Parasitaemia, knowledge, Attitude, Mosquito

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#### INTRODUCTION

Malaria is a life threatening disease caused by plasmodium species that are transmitted to people through the bite of infected female anopheles mosquitoes (Okorie *et al.*, 2015). After infection, the parasites travel through the blood stream and infect the red blood cells (WHO, 2015). About five species of Plasmodium have been found to commonly infect man. These are *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae*, *Plasmodium ovale*, and *Plasmodium knwolensi*. The most serious type is *Plasmodium falciparum* malaria which can be life threatening. The other species of malaria *P. vivax*, *P.*

*malaria*, *P. ovale* and *P. knwolensi* are generally less serious in life threatening (Ogbu *et al.*, 2015).

Malaria is a major public health problem in Nigeria, which is sometimes not given serious consideration by the public. Malaria affects 3.3 billion people globally and countries in the sub-Saharan Africa accounts for most deaths. It is an important cause of morbidity and mortality especially among children and pregnant women in sub-Saharan Africa and prompt access to diagnosis and treatment with effective anti-malaria drugs is a central component of the World Health Organization strategy of malaria control. (WHO, 2015).

The menacing impact of malaria especially *P. falciparum* has lingered for a long while. Residents of Wukari are not been spared from the scourge of this very devastating protozoan infection. Despite the available treatment and preventive regimen to abate the horrendous effect of *P. falciparum*, the disease does not seem to have lost steam in its rampage. This study is considered necessary to investigate malaria parasitaemia among residents of Wukari local government. Their knowledge and attitude towards mosquito control with emphasis on insecticide treated net ownership and utilization to create more awareness on how seriously mosquito borne disease can negatively affect an individual's health and productivity as well as national development and focus attention on how mosquito control can be best achieved in Wukari metropolis.

The disease is transmitted from one person to another through the bites of infected female *anopheles* mosquito vectors during blood meal (Abbey, 2010). Over 40% of the global population lives in areas where malaria transmission occurs, it is estimated that 300 – 500 million cases of malaria occurs each year resulting to over two million deaths (WHO, 2011). The burden of malaria is largely borne by Africa; Nigeria accounted for the highest proportion of malaria cases globally with (27%), followed by the Democratic Republic of the Congo with (10%), India with (6%), and Mozambique with (4%) (WHO, 2017). Despite the amount of resources spent in the control of malaria for past many years 57% of African population lives in areas at risks of malaria, but there is decrease in malaria infection from 2000 to 2010 and for now more than 100 million people lives in areas where malaria transmission is low, there is decrease in the prevalence of malaria infection in children from 40 out of the 44 countries in Africa from 2000 to 2010. There is success in the malaria control programmes in some African countries such as South African, Ethiopia e.t.c. these countries have joined other African countries where malaria can be eradicated. Countries of the world have increased the amount of resources they spent in malaria control programmes from 100 million dollars to 200 billion dollars. But there is need to increase effort in malaria control programmes especially distribution of free ITNs (WHO, 2014).

The World Malaria Report of 2022 by WHO stated that despite the continued impact of COVID-19, Malaria cases and deaths remained stable in 2021. The 2022 edition of the report finds that, despite disruptions to prevention, diagnostic and treatment

services during the pandemic, countries around the world have largely held the line against further setbacks to malaria control. There were estimated 619,000 malaria deaths globally in 2021 compared to 625,000 in the first year of the pandemic in 2019, before the pandemic struck, the number of deaths stood at 568,000. Malaria cases continued to rise between 2020 and 2021 but at a slower rate than from 2019 to 2020. The global tally of malaria cases reached 247 million in 2021, compared to 245 million in 2020 and 232 million in 2019 (WHO, 2022).

World Health Organization (WHO) Roll Back Malaria (RBM) Partnership are to reduce global malaria cases by 75% from 2000 to 2015 and to reduce malaria deaths to nearly zero percent through universal coverage by effective prevention and treatment interventions. Among other preventive interventions, WHO recommends the use of Insecticide-Treated Nets (ITNs), particularly long-lasting insecticidal nets, which have been shown to be cost-effective, to reduce malaria episodes and mortality among children under-five. Universal coverage with ITNs is defined as used by > 80% of individuals in population at risk. ITN reduces the need for treatment and the pressure on health services. This is one of the cardinal points of global malaria control programme (Barbara *et. al.*, 2012). Long-lasting insecticidal nets (LLINs) have been strongly advocated for use to prevent malaria in sub-Saharan Africa and have significantly reduced human-vector contact. PermaNet® 2.0 is among the five LLINs brands which have been given full approval by the WHO Pesticide Evaluation Scheme (WHOPES). The LLINs are expected to protect the malaria endemic communities, but a number of factors within the community can affect their durability and efficacy. At present, malaria endemic countries in Africa are reported to have a wider coverage of LLINs with some countries reporting coverage of more than 60%. The wide coverage is attributed to the willingness of African Government and donors to fund the scale up of LLINs distribution (Eliningaya *et. al.*, 2011).

Knowledge and overall beliefs about ITNs is a considerable barrier to ITNs usage (i.e. cause of malaria, symptoms used to classify malaria, acknowledgement of a causal link between mosquitoes and malaria, traditional mosquito prevention practices, reservations about use of insecticide). This sentiment was echoed by the findings that oftentimes, cost is not the only barrier against ownership; lack of value attached to ITNs products plays a large role. Without proper

knowledge, people are unable to connect malaria prevention and ITNs. Thus, it is necessary, not only to clarify that ITNs solely prevent malaria, but also to illuminate the direct benefits of ITNs use in terms of the financial costs averted through less hospital visits (Kachur, 2007).

Malaria infection is a severe health problem among people, most especially pregnant women and children under five because of their low immunity. Nigeria is known for high prevalence of the disease and it is the leading cause of morbidity and mortality to the country. Different methods of vector control have been proposed by researchers. An important innovation during the past decade is the wide spread distribution of ITNs for prevention of malaria transmission Olasehinde *et al.*, 2010).

Insecticide-treated bed nets (ITNs) are currently distributed free of charge to vulnerable groups in Nigeria, for malaria control. Consistent use of the nets is required for maximum effectiveness; but studies indicate that the nets are often jettisoned in periods of low mosquito activity and high night temperature. Insecticide treated bed nets provision to children under five and pregnant women are major goals of malaria control activities, but the use in Africa remains low because of cost and logistic. However, certain significance factors still prevent the use of ITNs even among those who possess the ITNs (Ordinilo, 2012).

## **MATERIALS AND METHODS**

### **Study Area**

This study was carried out in Wukari local government area of Taraba state, which is located on latitude 7° 51'N or 9° 47'E and longitude 7.850°N and 9.783° E. Wukari Local Government Area is in the Southern Senatorial District of Taraba State. Its headquarter is in the town of Wukari on the A4 highway (Wikipedia, 2018). The town is divided into three wards namely Avyi, Puje and Hospital (Ishaku *et al.*, 2010). The Donga River flows through the area and the Benue River forms a boundary with Nassarawa State to the northwest. It has an area of 4,308 km<sup>2</sup> and a population of 241,546 at the 2006 census (Wikipedia, 2018). The occupation of the inhabitants of the area is farming. Although some are civil servants while others are involved in one form of trade or the other.

### **Sample size determination**

The sample size was calculated using the prevalence rate of malaria in Wukari, Taraba State, Nigeria was

found to be 88% as reported by (Andefiki *et al.* 2017). A standard epidemiological formula (Fisher's formula for cross-sectional descriptive study) described by Nas *et al.* (2017) was used to calculate the sample size as follows;

$$N = \frac{Z^2 pq}{d^2}$$

Where N = Sample size

Z = standard normal distribution at 95% confidence level = 1.96

Therefore  $Z^2 = 1.96^2 = 3.8416$

P = prevalence rate of 88% = 0.88

q = 1 - p, therefore q = 1 - 0.88 = 0.12

d = maximum value of probability (allowable error taken as 5%) = 5/100 = 0.05

Therefore  $d^2 = 0.05^2 = 0.0025$

$$N = \frac{3.8416 \times 0.88 \times 0.12}{0.0025}$$

$$N = \frac{0.40567296}{0.0025}$$

Therefore, N = 162.27 ≈ 162

162 is the minimum sample size for the study.

### **Study Population**

One hundred and sixty two (162) persons were randomly selected across the three different wards (Avyi, Puje and Hospital) of Wukari town. A malaria test was conducted on them using the RDT kits method and structured questionnaire were administered to the subjects covering information such as sex, age, knowledge on prevention and control of malaria disease.

### **Sample collection and Laboratory Procedures**

Blood samples were aseptically collected from the left thumb of the respondents using a sterile lancet. Before collection, the thumb was cleaned with cotton wool dampened with 70% ethanol to remove dirt and oils from the ball of the finger. Then the thumb was stroked to stimulate blood circulation and gentle pressure was applied on the finger before it was gently punctured by the sterile lancet (Cheesbrough, 2006). Rapid diagnostic test kit was used to examine blood samples for Plasmodium parasites using the manufacturer's guidelines. The kit works on the

principle of immunochromatographic methods capturing *Plasmodium* antigen in the blood against its specific antibody in the buffer.

#### **Administration of questionnaires**

One hundred and sixty-two (162) questionnaires were administered to each of the respondents from whom the samples were collected. The questionnaires contain data about age group, educational level, occupation, modes of transmission and control measures of the mosquitoes/malaria. The Rapid Diagnostic Kits (RDT) were then labelled following the number of questionnaires.

#### **Consent**

A letter of introduction was obtained from the Department of Biological Sciences Federal University Wukari before the sample collection. All the subjects were verbally notified before sample collection, and their informed consent was duly obtained. For children in the study, the consent of their parents was obtained before blood collection.

#### **Data Analysis**

The data collected were analysed using Statistical Package for Social Sciences (SPSS) version 21. Pearson product-moment correlation coefficient tool was used to determine if there is a significant relationship in infection between location, sex and age with a significance level of  $p < 0.05$ .

### **RESULTS AND DISCUSSIONS**

#### **Overall prevalence of malaria parasite infection**

The result as depicted in figure 1 shows that out of the 162 subjects tested for malaria, 91(56.17%) suffered from malaria parasitaemia. This result shows a high prevalence rate of malaria infection among the residents.

#### **Prevalence of malaria parasites in relation to sex**

**Figure 2** shows that 67 females were malaria positive showing a prevalence of 72% while 24 of 69 males surveyed were positive for malaria showing a prevalence of 35%.

#### **Prevalence of malaria parasites in relation to age**

**Figure 3** shows that malaria prevalence was highest among those within the age group  $\geq 20$  representing (62.12%) prevalence, followed by age group 10-13 (57.89%), 0-9 (55.56%), 17-19 (52.38%) and 14-16 (48.94%).

#### **Most Commonly Used Malaria Control Method (s)**

Figure 4 shows that 72 (44.44%) of the respondents use insecticides (spray and coil) to control and prevent mosquitoes, 40 (24.69%) use proper environmental sanitation practices, 31(19.14%) use treated mosquito nets while 19(11.73%) make use of antimalarial drugs. This underpins that the most used or widely used mosquito control methods among the people are insecticide followed by sanitation, use of mosquito nets and antimalarial drugs.

#### **Malaria Prevalence and Location**

Malaria prevalence according to locations is shown in Table 1, The Hospital had the highest prevalence of malaria parasitaemia (64.44%) and (31.89%) within malaria, while Fuwukari had the lowest prevalence of malaria parasitaemia of 47.22% and 18.68% malaria.

#### **Level of Malaria and malaria control methods among the respondents**

Table 2 shows that on the average 111(68.52%) of the respondents have good knowledge of the causes and means through which malaria is communicated while 51(31.48%) of the respondents do not know what actually causes malaria. However, 126(77.78%) of them know exactly where mosquito breeds while just 36 (22.22%) are not aware of the site for mosquito breeding.

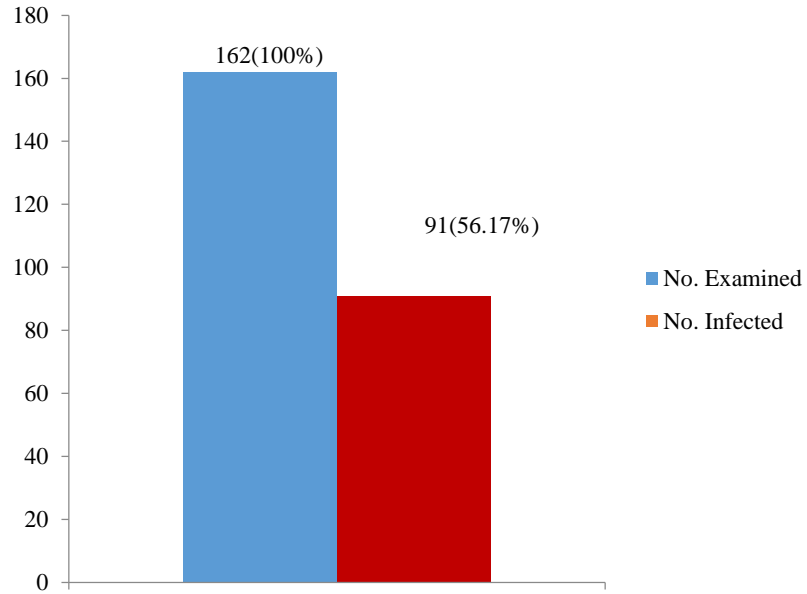


Figure 1: Overall prevalence (%) of malaria parasite infection

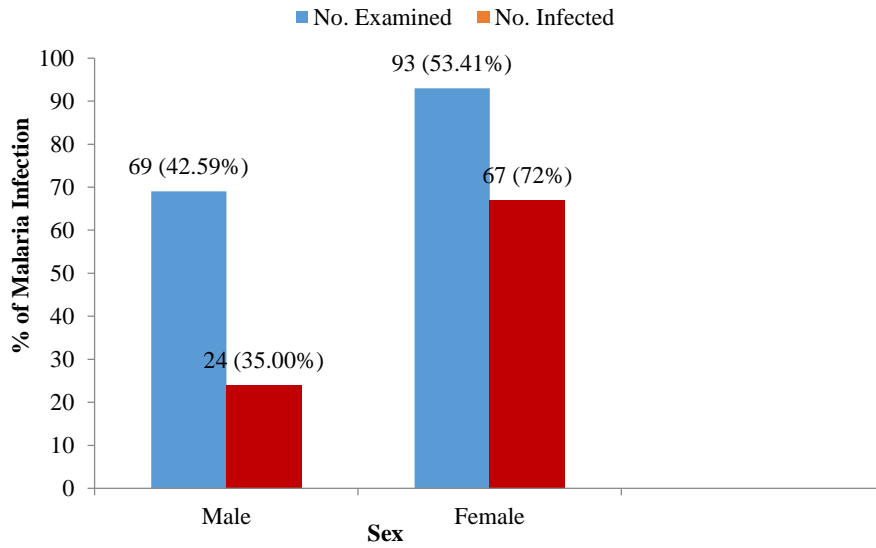


Figure 2: The prevalence (%) of Malaria parasites in relation to sex

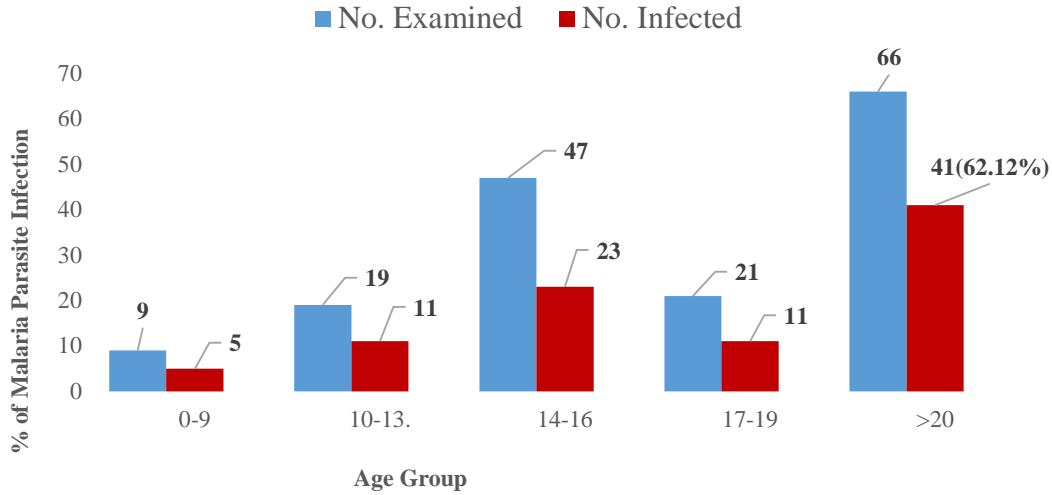


Figure 3: The prevalence (%) of malaria parasite in relation to age

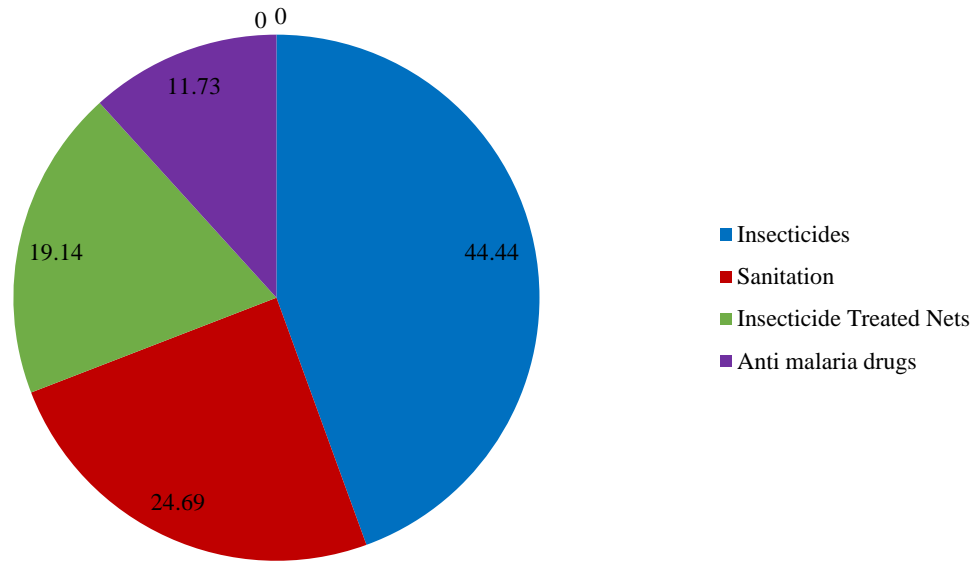


Figure 4: Most commonly used malaria control methods

Table 1: Malaria prevalence and locations

Locations	No Examined	No Infected	% Infected	Total % Infected
Wapan Aku	43	21	48.84	23.08
Fuwukari	36	17	47.22	18.68
Hospital	45	29	64.44	31.89
Ayvi	39	24	61.54	26.37
<b>Total</b>	<b>162</b>	<b>91</b>	<b>56.17</b>	<b>100</b>

Table 2: Knowledge level of Malaria among the subjects

Research Question	Correct answer	Wrong answer
What causes malaria	95 (58.64%)	67 (41.36%)
Where do mosquitoes breed?	126 (77.78%)	36 (22.22%)
Average Total	111 (68.52%)	51 (31.48%)

## DISCUSSION

In this study, the prevalence of malaria parasitaemia among residents in Wukari metropolis was found to be (56.17%). This finding was lower when compared to Andefiki *et al.* (2017) who reported a prevalence of (88%) in the same Wukari. However, while Andefiki *et al.* (2017) worked on Hospital patients, the subjects in this study were residents of Wukari metropolis. The findings of this research is also lower when compared to Ukwubile *et al.* (2018) who reported (64%) in Takum local government area of Taraba State and Nas *et al.* (2017) who reported (84%) prevalence among fever related patients in Kano city, Nigeria. The prevalence of malaria parasitaemia in this study is however higher when compared with other findings by Kunihya *et al.* (2016) who reported (50.6%) in Yola, Adamawa State, Jombo *et al.* (2010) reported (32.3%) in Makurdi city, North Central Nigeria, Umaru and Uyaiabasi (2015) reported (35.7%) in North Western Nigeria. The prevalence rate in this study was quite high indicating a high level of malaria infection among residents of the Wukari metropolis. This could be attributed to the fact that the study was conducted during the raining season when mosquitoes are actively breeding.

In this study, prevalence based on gender showed that more female participants were screened and had higher prevalence of the infection. The female subjects are 93 (57.41%) with a prevalence rate of (72%) while male subjects are 69 (42.59%) with a prevalence rate of (35%). The higher prevalence rate for the females in this study corroborates with the findings of several other researchers (Nas *et al.*, 2017; Andefiki *et al.*, 2017; Obimakinde and Simon-Oke, 2017; Kunihya *et al.*, 2016; Udeze *et al.*, 2013). This is also consistent with the assertion that African females are considered more vulnerable to the disease (WHO, 2004). In addition, their exposure to their immediate environment could be a predisposing factor since females are always in constant touch with the immediate environment through their daily chores or activities. However, findings from other studies have reported a higher prevalence among the males than the females (Abah *et al.*, 2017; Umaru and Uyaiabasi, 2015; Mamman *et al.*, 2014). There appears to be no scientific evidence linking malaria prevalence to gender (Udeze *et al.*, 2013) as susceptibility to malaria infection depends on ones exposure to infectious bites of the mosquito parasite.

Prevalence of malaria by age shows that the highest rate of infection (62.12%) was recorded among those in the age group  $\geq 20$ , followed by age group 10-13

(57.89%), 0-9 (55.56%), 17-19 (52.38%) and 14-16 (48.94%). The high rate of infection among the  $\geq 20$  age group could be due to constant exposure to the vector and subsequently resulting in high prevalence of malaria infection. There was however, no significant difference ( $P > 0.05$ ) in malaria prevalence across the age group

The test on knowledge and awareness of malaria indicates that (31.48%) of the subjects has erroneous perception about the cause and means through which malaria is transmitted, this findings is similar to the finding of (Abah *et al.*, 2017) who reported (33.72%) among some residents of Port Harcourt metropolis, Rivers State, Nigeria.

The findings from this study revealed that Hospital had the highest prevalence of malaria parasitaemia of (64.44%) and (31.89%) within malaria while FuWukari had least prevalence of malaria parasitaemia of (47.22%) and (18.68%) within malaria.. The difference in prevalence among the locations could be attributed to the fact that the Hospital and Avyi had lots of vegetation, indiscriminate dumping of used cans, unkempt environments, and improper disposal of refuse that lead to blockage of the drainage. In addition, the lackadaisical attitude of some residents towards the use of insecticide-treated nets or spray could be a predisposing factor.

## CONCLUSION

From this research, it can be concluded that the 56.17% prevalence of malaria parasitaemia among residents of Wukari metropolis is high. The infection was higher in females (72%) than males (35%). The age range 20 and above recorded the highest prevalence rate of infection (62.12%). There was no significant difference ( $P > 0.05$ ) among the age groups however, there was a strong correlation between malaria infection and location. Insecticide spray is the most widely used malaria control method (44.4%) in the Wukari metropolis followed by sanitation (24.69%), treated nets (19.14%) and anti-malarial drugs (11.73%). A majority (68.52%) of the subjects of this study had a good knowledge of the cause and means through which malaria is communicated while (31.48%) did not know what exactly causes malaria.

From this research, proper management of waste and environmental sanitation should be encouraged among Wukari residents to prevent breeding sites of mosquitoes. Distribution of insecticide treated nets should be encouraged by the ministry of Health. People whose occupation requires them to wake up

very early and retire late to bed should endeavour to wear clothes that offer ample protection against mosquito bites. Public enlightenment seminars about the risks and predisposing factors on malaria among residents of Wukari should be organized.

#### **Conflict of Interest**

There were not any conflicts of interest between the authors from the beginning of the study to the end. Everything went well as design and agrees on the research.

#### **Author Contributions:**

Conceptualization, A.O.J. and M.K.; methodology, A.O.J.; validation, A.O.J. and M.K.; formal analysis, A.O.J. and M.K.; investigation, M.K.; resources, A.O.J. and M.K.; data curation, A.O.J. and M.K.; writing original draft preparation, A.O.J; writing review and editing, A.O.J. and M.K.;

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