



# Prevalence of *Plasmodium* Species Infection Among Private Security Guards in Kaduna Metropolis, Kaduna State-Nigeria

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**Abstract:** Private security guards play an important role in providing security to the citizenry especially in a developing country like Nigeria. They are however many at times exposed to vector borne diseases such as malaria. To determine the prevalence of *Plasmodium* species infections among private security guards in Kaduna metropolis, Kaduna-Nigeria, two hundred and sixty-one (261) blood samples were collected and screened for malaria parasite using Malaria Ag P.f and Malaria Ag P.f/Pan kits (SD BIOLINE, Cat. No: SD05FK50 and SD05FK60 respectively). Demography information on guards were collected using structured questionnaires. Result obtained showed an overall prevalence of 17.62% *Plasmodium* infection among guards screened using both kits. Age, sex and season were found to significantly influence the prevalence of *P. falciparum* infection among guards in Kaduna metropolis ( $P < 0.05$ ). It is recommended that managements of private security outfits should provide their staff with adequate protective measures against mosquito transmitted diseases for improved workers efficiency and reduce man hour loss.

**Keywords:** Prevalence, Malaria, *Plasmodium* Species, Guards

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## 1. Introduction

Malaria caused by *Plasmodium* species is the most common protozoan parasitic disease in the tropical and subtropical regions of the world and is transmitted to man through the bites of infected female anopheline mosquito [1, 2, 3]. *Plasmodium falciparum*, *P. ovale*, *P. vivax*, and *P. malariae* are reported to cause disease in man in different parts of the world [4]. However, infections due to *P. falciparum* is the most common and deadly [5].

Malaria is a major public health problem with over 3.2 billion of the world's population at risk and an estimated global mortality rates of 42% since 2000 [6, 7]. Of these deaths, Africa accounts more than 80% with most cases occurring in Democratic Republic of Congo and Nigeria [8].

In Nigeria morbidity and mortality due to malaria has enormous consequences on the economy. It is a major cause of increased man hour loss, increased rate of absenteeism, low performance among primary school children and

workers including security guards. Transmission of malaria among different populations temporarily outside the home due to occupational and recreational reasons play a significant role in the epidemiology of malaria.

In the words of the commander in chief of British forces in Burma during World War II, Field Marshal Viscount Sir Archibald Wavell, "We must be prepared to meet malaria by training as strict and earnest as that against enemy troops. We must be as practiced in our weapons against it as we are with a rifle". This statement underlines the reality that losses to malaria and other preventable diseases far exceeded the number of casualties inflicted by enemy action [9].

The present study is aimed at determining the prevalence of *P. falciparum* infection among private security guards in Kaduna metropolis, Nigeria. This is to provide information to relevant government agencies involved in the control of malaria, and managers of private security outfits to take appropriate policy decision for maximum efficiency.

## 2. Materials and Methods

### 2.1. Study Area

Kaduna metropolis is the capital of Kaduna State and is located in the North-West geopolitical zone of Nigeria. It lies between latitude 10°20'N and 10.33°N, and longitude 7°45'E and 7.75°E. The state shares borders with Kano, Katsina and Zamfara states to the North, Plateau and Bauchi states to the East, Nasarawa state and the Federal Capital Territory (FCT) to the South and Niger state to the West [10]. Kaduna State have distinct dry and wet seasons and is characterised by Guinea savannah type of vegetation [11].

### 2.2. Study Population/Sample Size

The study population was made up of 234 male and 27 female private security guards keeping watch on private and public properties in Kaduna Metropolis, Nigeria and have consented to participate in the study.

### 2.3. Ethical Permission

Approval to conduct the study was obtained from the Kaduna State Ministry of Health Ethical Committee before sample collection commenced among the guards. Code of ethics on the use of human subjects in research as outlined in the NDA Research and Development Policy, 2016 was also adhere to strictly.

### 2.4. Blood Collection and Screening

Screening for malaria parasite was done using SD BIOLINE Malaria Ag P.f and SD BIOLINE Malaria Ag P.f/Pan kit (Standard Diagnostics, Inc., Republic of Korea. Cat. No: SD05FK50 and SD05FK60 respectively) adhering to manufacturer's guide. Fingertips of individual guards was cleaned thoroughly with alcohol swap and pricked with a sterile lancet. Using 5µl capillary pipette provided with the kits, blood was drawn by capillary action to a black line and carefully transferred into a sample well on the kit and pressed gently. To the diluent well, 4 drops of assay diluent (buffer) provided with the kit was added, allowed to stand for 15min and result was read.

### 2.5. Questionnaire Administration

Structured questionnaire was administered to obtain information on the demographic characteristics of respondents. Each questionnaire was assigned a code to enable tracking of respondents.

### 2.6. Statistical Analysis

Data was processed using EpiData version 3.1 and each dataset subsequently exported to SPSS version 20 for analysis. Datasets were analysed and interpreted using descriptive statistics. Chi-Square test was used to test association between risk factors and *Plasmodium falciparum* infection. Five (5%) level of probability was considered significant ( $P < 0.05$ ).

## 3. Result

Out of the 261 security guards screened for *P. falciparum* infection, 46 (17.62%) were found to be positive using either of the Malaria immunodiagnostic kits (Table 1). However, male guards recorded significantly higher prevalence (18.38%) than female guards who recorded 11.11% ( $P < 0.05$ ) (Table 2).

**Table 1.** Overall prevalence of *Plasmodium falciparum* infection among private security guards in Kaduna metropolis, Nigeria.

Diagnostic Kit	Number of Individuals Examined	Number of Individuals Positive	Percentage (%) Positive
P.f	261	46	17.62
P.f/Pan	261	46	17.62

**Table 2.** Prevalence of *Plasmodium falciparum* infection among private security guards in relation to sex.

Sex	Number of Individuals Examined	Number of Individuals Positive	Percentage (%) Positive
Male	234	43	18.38
Female	27	03	11.11
Total	261	46	17.62

$$X^2 = 34.783; DF = 1; P = 0.000$$

Prevalence of *Plasmodium* infection was found to be significantly influenced by age of guards surveyed ( $P < 0.05$ ). Guards aged 41–50 yrs recorded the highest prevalence of *P. falciparum* infection (26.32%), followed by guards within 51–60, 21–30 and 31–40 yrs age groups with prevalence rates of 18.92%, 16.87% and 14.52% respectively. However, guards aged 15–20 yrs showed no evidence of *P. falciparum* using both Malaria Ag P.f and Malaria Ag P.f/Pan kits (Table 3).

The seasonal prevalence of *Plasmodium* infection among private security guards survey in Kaduna metropolis is presented in Table 4. Out of the 130 security guards screened during the dry season, 34 (26.15%) were found to be positive for *P. falciparum* infection. However, significantly lower cases of *P. falciparum* infection were detected during wet season (9.16%) ( $P < 0.05$ ).

**Table 3.** Prevalence of *Plasmodium falciparum* infection among private security guards in relation to age.

Age (Yrs)	Number of Individuals Examined	Number of Individuals Positive	Percentage (%) Positive
15-20	09	00	00
21-30	83	14	16.87
31-40	62	09	14.52
41-50	57	15	26.32
51-60	37	07	18.92
Above 60	13	01	07.69
Total	261	46	17.62

$$X^2 = 14.000; DF = 4; P = 0.007$$

**Table 4.** Seasonal prevalence of *Plasmodium falciparum* infection among private security guards.

Season	Number of Individuals Examined	Number of Individuals Positive	Percentage (%) Positive
Dry	130	34	26.15
Wet	131	12	9.16
Total	261	46	17.62

$X^2 = 10.522$ ; DF = 1; P-value = 0.001

**Table 5.** Prevalence of *Plasmodium falciparum* infection among private security guards in relation to level of education.

Education	Number of Individuals Examined	Number of Individuals Positive	Percentage (%) Positive
No formal schooling	16	04	25.00
Primary school dropouts	10	01	10.00
Complete primary school	47	11	23.40
Secondary school dropouts	13	03	23.08
Complete secondary school	124	20	16.13
Post-secondary	42	07	16.67
Degree and above	09	00	00
Total	261	46	17.62

$X^2 = 31.739$ ; DF = 5; P = 0.000

## 4. Discussion

Malaria parasite prevalence studies among security guards are rare in Nigeria, but ample among other population. The overall prevalence of 17.62% reported in this study was quite low. Previous studies among other population by [12] reported a prevalence of 14.7% while a prevalence of 35.7% was reported by [11]. This study revealed that *P. falciparum* infection prevalence was higher among the men (18.38%) than the women (11.11%) although more male participants were screened, the males had a higher prevalence of the disease which was statistically significant; this suggests that males may be more prone to the disease than females.

The highest prevalence was recorded within the age group of 41–50 years (26.32%) while the age group of 15–20 years have no *P. falciparum* infection prevalence and this could probably be associated with their immunological factor [13, 14]. As observed, the high prevalence rate of *P. falciparum* infection prevalence among higher age group may have been attributed to premunition which is a state of balance between host and infectious agent, as a parasite, such that the immune defence of the host is sufficient to resist further infection but insufficient to destroy the agent. When such individuals are screened, parasite detection is possible.

The seasonal prevalence for dry and wet season were 26.15% and 9.16% respectively. Factors that determine malaria incidence are diverse and complex but it is known that the environment plays an important role in the transmission of infectious diseases. The environmental factors that affect the distribution and incidence of malaria are rainfall, temperature and humidity [15, 16, 17]. The low incidence noted throughout the wet season in this study is reinforced by similar resolutions of various researchers alike who found that malaria occurrence is usually absent or low during rainy season. During heavy rainfall, the water flow

Similarly, level of educational attainment is found to significantly influence the prevalence of *P. falciparum* infection among the guards ( $P < 0.05$ ) (Table 5). Security guards with no formal education recorded the highest prevalence (25%), followed by guards who have completed primary school (23.4%), secondary school dropouts (23.08%) and post-secondary school (16.67%). Graduate guards (Degree and above) recorded no case of *P. falciparum* infection.

washes out the pools and other mosquito breeding places [18, 19]. In Tanzania, [20] connected rainfall with low incidence of malaria. It was suggested also by [21] that the suitability of vectors habitat is determined by the minimum precipitation level. Ponds dug to counter water problem in living areas that experience difficulty with water during the dry season can become new mosquito breeding site. Irrigated water can also serve as mosquito breeding site and further lessen their dependency on rainfall and this is one of the possible factors that can explain why the malaria incidence can still increase during the dry season.

In relation to level of education, the group of guards with no formal education have the highest prevalence (25%) while the group with university degrees or equivalent qualifications have no prevalence, and this suggests that the group with highest level of education put their wealth of knowledge and experience to prevent malaria parasite prevalence and due to the security outfit organogram, this group is the least exposed and only does supervisory duties.

The predominant *Plasmodium spp.* identified in this study was *P. falciparum*, which is the most virulent and also has the greatest tendency for developing resistance [22], these findings are consistent with other reported studies [11, 12, 23].

## 5. Conclusion

Prevalence of *P. falciparum* infection is relatively low compared to reports by other authors in other parts of Nigeria. However, it may play a significant role in reducing work output of security guards in the study area considering the complications associated with *falciparum* malaria. In addition, malaria Ag P.f and malaria Ag P.f/Pan lateral flow immunochromatographic antigen detection kits are both effective in detection of *P. falciparum* infection.

## Recommendations

Management of private security outfits in Kaduna State should provide guards with personal protective measures against vector borne diseases such as malaria coupled with regular screening of guards to enable early treatment for maximum productivity. Malaria Ag P.f immunochromatographic test kit could be used as substitute to malaria Ag P.f/Pan test kit for detection of *P. falciparum* infection to save cost.

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