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Prevalence of Malaria Infection among People Living with HIV/AIDS at Federal Medical Center Keffi (Nassarawa State), Nigeria

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Authors' contributions

Author ID designed the study and wrote the protocol. Author BB carried out the experiment and wrote the first draft of the manuscript. Both authors performed the statistical analysis, read and approved the final draft.

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ABSTRACT

Background: Malaria and HIV are among the most important health problems of our time overlap extensively and co-infecting large numbers of people. The study was designed to determine the prevalence of malaria infection among those living with HIV/AIDS within age and sex groups.
Methods: A total of 200 blood samples of patients within the age range of 1 to 60 years old, attending Federal Medical Center, Keffi were examined for the presence of malaria parasites by thick blood film using Geimsa stain. Standard laboratory procedures were used for HIV screening and plasmodium parasites identification.
Results: The results showed that there was a significant difference ($P<0.05$) among age groups; with (1-10), (11-20) and (41-50) have the highest prevalence rate of infection (71.4%), while age (51-60) have the lowest prevalence (40%). In relation to gender female have the higher prevalence rate of (67.2%), while male have (61.5%). The research also revealed that patients with CD4 cell count less than 200 cells $\mu\ell^{-1}$ has the higher prevalence rate of malaria infection (36.1%).
Conclusion: This indicates that HIV/AIDS patients have the highest rate of malaria and this could

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be as a result of immune compromised among the sample group. Which showed that female has the highest malaria infection rate together with age (0-10), (11-20) and (41-50) among age groups.

Keywords: Malaria; HIV/AIDS; infection; prevalence.

1. INTRODUCTION

Human immunodeficiency virus (HIV) and malaria are among the most important health problems of our time, overlap in the most endemic region and co-infecting large numbers of people. Together, they cause more than 4 million deaths each year [1]. Two of the greatest challenges facing Africa today are human immunodeficiency virus (HIV) infection and malaria, yet the interaction between these two infections has been given little emphasis by researchers and government. An interaction between HIV infection and malaria could work in either direction. HIV infection leads to immune compromise, resulting in more frequent malaria infection among the semi-immune and non-immune, or malaria might enhance the progression of HIV infection [2,3].

Sub Saharan - Africa has more than 70% of the over 42 million persons infected with HIV/AIDS worldwide and it is now the leading cause of death in the region [4]. Nigeria, the most populous country in Africa of over 150 million, has over 4.6% million persons living with HIV/AIDS and a national sero-prevalence of 5.8%, with the north-central region harbouring the highest HIV infection levels in the country [2, 5]. Malaria and HIV/AIDS overlap geographically, primarily in sub-Saharan Africa, Southeast Asia and South America. Globally, malaria is responsible for more than one million deaths per year, with 90% of these deaths in sub-Saharan Africa [6,7]. In 2003, HIV/AIDS caused the deaths of an estimated 2.9 million people worldwide, of whom 2.4 million lived in Africa [8].

Infection with either malaria or HIV/AIDS can cause illness and death, infection with one can make an infection with the other worse and/or more difficult to treat. The two diseases have particularly devastating effects for those living in malaria-endemic regions throughout the world [9]. Pregnant women and children less than 5 years suffer particularly serious consequences when infected with both HIV/AIDS and malaria. HIV/AIDS can increase the adverse effects of malaria, including anaemia and placental malaria infection. As a result, a pregnant woman is more likely to give birth to a low-birth-weight baby, which may subsequently die during infancy [2,7].

There are a number of interventions available for people living with HIV/AIDS that can prevent the devastating effects of malaria such as sleeping under an insecticide-treated bed net (ITN), which repels and kills malaria-transmitting mosquitoes; receiving treatment with effective antimalarial medications, such as anti-malaria combination therapy (ACTs); and, for pregnant women living with HIV/AIDS, taking at least three doses of intermittent preventive treatment (IPT). IPT helps lessen the harmful effects of malaria in pregnancy by reducing malarial infection of the placenta and preventing anaemia [1]. Fighting malaria improves the lives of people living with HIV/AIDS. A comprehensive malaria program must be a priority for malarious countries with a high prevalence of HIV/AIDS [1].

This study was designed to determine (i) prevalence of malaria infection among HIV/AIDS patients, (ii) prevalence among age group and sex.

2. MATERIALS AND METHODS

2.1 Study Area and Population

The study was conducted at Federal Medical Center, Keffi, Nassarawa state, Nigeria between the period of February to August (2013). This study was approved by the ethical committee of federal medical centre, Keffi, Nigeria. The study population was 200 patients confirmed to be HIV seropositive by standard laboratory techniques in addition to presenting clinical signs and symptoms of malaria.

2.2 Study Design and Type

Cross-sectional prevalence study or Cross-sectional transverse study or Cross-sectional observational study.

The sample size was determined using this simple formula used for calculating the adequate sample size in prevalence study as described by Pourhoseingholi et al. [10].

$$n = \frac{Z^2 P (1-P)}{d^2}$$

Where

n = Sample size
Z = statistic corresponding to level of confidence
P = expected prevalence obtained from the previous study conducted
D = precision (corresponding to effect size).

All enrolled subject were patients on their first hospital visit before the commencement of high active anti-retro viral therapy (HAART). Consent was obtained from each patient before specimen collection. The following criteria were used for the selection of the study participants: (i) patients must have clinical signs of malaria; (iii) patients must be between 1-60yrs of age; (iv) patients must have been screened as positive for HIV using HIV1/2 STAT-PAKTM (Manufactured by CHEMBIO, 3661 Horseblock Road, NY, USA) and further confirmed by Determine HIV1/2 (Abbott Laboratory, Minato-Ku, Tokyo, Japan). The patients' age and sex were also obtained. Five millilitres (5mL) of blood sample was obtained by vein-puncture from each of these patients into (EDTA) anticoagulant bottles.

2.3 Examination of Samples

Thick blood films were prepared from each subject's blood sample according to the standard procedure described by Cheesbrough [11]. Briefly, a drop of blood sample was placed on a glass slide and smeared in cyclic form of 2cm diameter and allowed to air dry. The slide is then flooded with Giemsa stain solution for 30 minutes, then rinsed in tap water and allow to air dry. A drop of normal saline was put on the slide to allow clear examination of the slide. The slide was examined microscopically with oil immersion under x100 objective. A total of 200 fields per film were examined. The parasite counts in relation to the leucocytes count were converted to parasite per microliter of blood using the following mathematical formula.

Parasitaemia ($\mu\ell^{-1}$) = Number of asexual parasites x 8000/Number of leucocytes

Where 8000 = Putative mean number of leucocytes/ µℓ blood.

The number of parasites was counted against 200 leucocytes and expressed as number of leucocytes/ µℓ of blood.

Records of the CD4 cells count in (cells $\mu\ell^{-1}$) of the patients were recorded.

2.4 Data Analysis

Data were recorded and tabulated; chi-square and z test of proportion were used to determine percentage prevalence and association between and among the sex and age groups using SPSS statistical package.

3. RESULTS

A total of 200 samples were examined out of which 130 (65.0%) have malaria (Table 1). Age (0-10), (11-20) and (41-50) has the highest rate of malaria infection (71.4%, 71.4% and 71.1% respectively), while age (51-60) has the lowest rate of infection (40%). There was a significant difference (P<0.05) of the prevalence rate of malaria infection among age groups (Table 1).

Table 1. Prevalence of malaria infection, among age groups living with HIV/AIDS attending Federal Medical Center, Keffi

Age groups	Number of patients	Number of infected patients	Prevalence rate (%)
0-10	14	10	71.4
11-20	14	10	71.4
21-30	57	35	61.4
31-40	50	35	70.0
41-50	45	32	71.1
51-60	20	8	40.0
Total	200	130	65.0

**There was a significant difference (P<0.05) among age group*

The prevalence rate of malaria infection among females was higher (67.2%) when compared with that of males (61.5%). There was no significant difference (P>0.05) between sex groups (Table 2).

There was a significant difference (P<0.05) among the CD4 cells counts of patients between 200 to 1000 cells/µℓ. The prevalence rate of malaria infection was higher among patients with less CD4 cells count (<200 cells/µℓ). Out of the 130 malaria-infected patients, those with CD4 cells count between 1-200 cells/µℓ had the highest infective rate 47 (36.1%). Those with CD4 cells counts 201-400 cells/µℓ had 36 (27.1%) of infective rate. While those with CD4 counts above 1000 had the lowest infective rate 2(1.5%) (Table 3).

Table 2. Prevalence of malaria infection between sex groups living with HIV/AIDS attending the Federal Medical Centre, Keffi

Sex	Number of patients	Number of infective patients	Prevalence rate %
Male	78	48	61.5
Female	122	82	67.2
Total	200	130	65.0

**Therefore there was no significant difference (P>0.05) between sex group*

Table 3. Prevalence of malaria infection in relation to CD4 cells count among HIV/AIDS patients attending Federal Medical Center, Keffi

Age groups	Number of patients infected	CD4 cells counts					
		1-200	201-400	4051-600	601-800	801-1000	1000 above
0-10	10	6	4	-	-	-	-
11-20	10	3	3	2	2	-	-
21-30	35	15	6	8	4	2	-
31-40	35	13	12	5	4	-	-
41-50	32	10	8	4	7	2	1
51-60	8	-	3	2	3	-	1
Total	130	47	36	21	20	4	2
% rate		36.1	27.1	16.2	15.4	3.1	1.5

**(-) Indicates no record found*

**There was a significant difference (P<0.05) among CD4 cells counts of age group*

4. DISCUSSION

HIV/AIDs infected patients are at high risk of malaria infection and clinical diseases in endemic areas, as a result of their weakened immune response. WHO (2004) reported that sub Saharan Africa carries the high burden of both malaria and HIV/AIDS thus co-infection is common in many areas. This study focused on determining the prevalence of malaria infection among HIV infected age and sex group's patients as well as CD4 cells counts in relation to the severity of the infection. The overall prevalence of malaria infection among HIV infected patients was 65%. The relatively high prevalence recorded in this study may be due to poor malaria control measures coupled with a low immune response due to HIV/AIDS infection. Our finding is almost similar to that of Saracino, Nacarapa et al. [12] which reported a prevalence of 61.7% malaria infection among HIV/AID patient in Mozambique, while Cohen et al. [13] reported a prevalence of 36% in a randomized clinical study in South Africa.

The high prevalence of malaria infection (71.4% and 71.1%) recorded among 0-20 and 41-50 year-old HIV/IDS age groups could be as a result of immature immunes organs as in the case of age 0-20 year-old, while in the case of 41-50 high prevalence rate could be as a result of their active economic productive age which could compromised immune production as reported by Chennaveerappa et al. [14] and Ebonyi [15]. The lowest prevalence rate (40%) of malaria infection was recorded among 51-60 year-old HIV/AIDS patients; this could be as a result of active immune response coupled with decreased economic activities that may interfere with immune compromise.

Females patients were found to be more infected with malaria (67.2%) as compared to their males counterparts (61.5%), this could be as a result of their late evening cooking which is common around the locality where the research was conducted as such they were exposed to more mosquitoes bite leading to the transmission as also reported by Gosellea et al. [16], Nkuo-Akenji et al. [17]. CD4 counts are used as a measure of degree immunity and HIV/AIDS level progression [18]. CD4 count less than 200 cells/µℓ increases the risk factor of opportunistic infections. In this study, CD4 cells count less than 200 cells/µℓ was associated with an increased risk of malaria infection among HIV/AIDS infected patients. This was in agreement with the findings of Whithworth et al. [19], Laufer et al. [9].

5. CONCLUSION

In conclusion, the overall prevalence rate of (65%) malaria infection among HIV/AIDS patients attending the federal medical centre, Keffi, was recorded within 5 months of study

duration. The prevalence was higher in female than male, but there was age group variation among the target study population. It was also observed that HIV/AIDS infected patients are more likely to develop malaria infection, and the risk of malaria infection increases with a decline in CD4 counts below 200 cells/μℓ.

6. RECOMMENDATION

There is a need for an effective control program to prevent the high prevalence of malaria infection among HIV/AIDS infected patients through the following measures: Establishing mechanisms for collaboration and joint programming at various levels to control malaria infection and their vectors. The collaborative programs should be taken into consideration for providing quality and adhere to antimalarial and antiretroviral treatment together, including establishing drug resistance surveillance programs. The use of rapid diagnostic testing and other methods for malaria diagnoses should be assured in the context of HIV/AIDS. Routine monitoring of antimalarial drug effectiveness should include the assessment of the effect of HIV/AIDS on antimalarial treatment outcome.

CONSENT AND ETHICAL APPROVAL

This study was approved by the ethical committee of federal medical center, Keffi, Nigeria. Consent was obtained from each patient before specimen collection.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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