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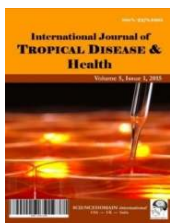
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Prevalence of Human Immunodeficiency Virus and *Plasmodium falciparum* Dual Infection amongst Residents of Kaduna South in North Western Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Authors UOE, RUBE and CAE did the study design and wrote the protocol. Authors UOE and LCN did the statistical analysis and literature searches, respectively. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

The possibility of co-infection between malaria and HIV in Nigeria is of tremendous public health concern. The study was designed to investigate the prevalence of malaria and HIV dual infection. A total of one hundred and fifty persons (150) showing signs and symptoms of malaria and HIV were recruited for this study following informed consent. Socio-demographic and predisposing factors were evaluated using open ended structured questionnaires. Malaria was diagnosed using Giemsa stained thick and thin blood films while antibodies to HIV type 1 and 2 HIV were detected using Abbott Determine™. A total of 85 participants (56.67%) were females while 65(43.33%) were males. Awareness to the etiological agents of malaria and HIV was 89(59.33%) and 65(43.33%), respectively. Out of the 150 participants, 83(55.33%) tested positive while 67(44.67%) tested negative to HIV, respectively and this was not significant ($P = 0.40$). The prevalence of malaria was 67(44.67%) and was not significant ($P = 0.40$). The prevalence of malaria and HIV co-infection was 53(63.86%). Although the prevalence of the dual infection was high, it was not significant ($p = 0.50$).

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There should be an integration of both HIV and malaria control and prevention programmes in the states and country at large.

Keywords: Prevalence; HIV; malaria; Kaduna and dual infection.

1. INTRODUCTION

Malaria is a life threatening disease caused by *Plasmodium* parasites and transmitted to human via the bite of an infected female Anopheles mosquito. In 2015 alone, there were approximately 214 million cases of malaria and Sub-Saharan Africa was home to about 90% of the estimated 438,000 deaths in the same year [1]. On the other hand, Human Immunodeficiency Virus (HIV) still remains one of the world's most significant public health challenge and 70% of infected persons live in Sub-Saharan Africa [2]. The WHO global technical strategy for malaria for 2016-2030 adopted by the World Health Assembly in May 2015 set a number of ambitious but achievable global targets and these include reducing malaria cases incidence and mortality by 90%, prevent resurgence in malaria free countries and eliminate malaria in atleast 35 countries. The strategies although achievable should take into consideration the fact that a number of studies have shown that HIV and malaria could be co-infecting thus making person living with HIV more vulnerable to malaria. HIV co-infection with malaria is assumed to be due to a number of reasons and one of them is the geographical overlap of both infections [3].

HIV and Malaria interactions have been shown to be synergistic and in the same direction [4,5]. Furthermore, malaria have been shown to be associated with high viral load via CD4+ cell activation and increase in pro-inflammatory cytokines which creates an ideal environment for viral replication [6,7]. Such individuals with increased HIV-1 RNA load have been shown to be more effective at transmitting the virus via coition and also have faster HIV progression to AIDs [8]. Antibody response and antimalarial efficacy have been shown to be impaired by HIV infection [9,10].

Over the last 10 years, data are beginning to emerge in Nigeria and they indicate that malaria parasite and the HIV virus could indeed be co-infecting. Onyenekwe et al. [3] reported malaria prevalence of 33% and 11% in symptomatic and asymptomatic HIV carriers in Anambra State in south eastern Nigeria. Another study in Edo State placed malaria prevalence at 74.3% among HIV subjects [11]. Uneke et al. [12] reported a

prevalence of 21% in Plateau state. Liyasu et al. [13] reported 32.2% in Kano state. Furthermore, the rate of prevalence for Port Harcourt City is reported to be 22.9% [14]. The aim of this study was to determine the prevalence of malaria in HIV infected persons in Kaduna State and also to determine their socio-demographic and predisposing factors to both infections.

2. MATERIALS AND METHODS

2.1 Study Site and Sample Size

The research was carried out at Bio-Karfred Medical Diagnostic Laboratory in Kaduna South Local Government Area. Kaduna State has a population of more than 6 million as at 2006 census and occupies an area of approximately 48,473.2 km². The area has a mixed population but its dominant ethnic group is Hausa and the major religion is Islam [15]. A total of one hundred and fifty (150) persons that visited Bio-Karfred laboratory in Kaduna south between August 2014 and January 2015 and were presented with both signs and symptoms of malaria or HIV were recruited for this study.

2.2 Preparation of Thick Film and Microscopy

For each patient, both thick and thin blood films were prepared and examined as described by WHO [16].

2.3 HIV Test

The presence of antibodies to HIV 1 and 2 were detected using Abbott Determine™ which is a qualitative *in-vitro*, easy to read immunoassay and immunochromatographic test. The procedure of the manufacturer was carefully followed.

2.4 Design and Administration of Questionnaires

A total of a hundred and fifty (150) questionnaires were designed using open ended questions to provide information about the socio-demographic of participants and predisposing factors to both infections. Informed consents were obtained from all participants before inclusion.

2.5 Data Analysis

The resulting data from the study were analysed using basic descriptive statistics such as percentages and bar charts. Spearman Correlation and significance were also examined at 95% probability level. All analyses were done using Statistical Package for Social Science (SPSS) Version 21.

3. RESULTS

A total of a hundred and fifty participants took part in this study of which 85(57%) were females and 65(43%) males. The highest number of participants were in the age bracket of ≥ 40 years and they make up about 50(33.37%). The overall prevalence of HIV amongst the study group stood at 83(55.35%) while 67(44.67%) tested negative to the virus. About half of the participants were of the age range 20 – 29 years and a total of 122(81.33%) were either single or married (Table 1). From Table 2, about 87(58.00%) and 66 (44.00%) admitted to having unprotected sex and use of sharp unsterilized objects, respectively. Despite 89(59.33%) and 85(56.67%) having accurate knowledge of malaria and on either recent local or orthodox antimalarial therapy, a total of 67(44.67%) (Fig. 1) tested positive malaria and 83(55.33%) (Fig. 2) tested positive to HIV. However, the prevalence of malaria and HIV co-infection was quite high (62.40%) (Fig. 3).

4. DISCUSSION

The possibility of dual malaria and HIV infection is of tremendous public health concern especially in areas where both infections are endemic like in Nigeria. The possible reasons for the co-infection such as geographical overlap and immunological interactions are well established [17]. Given these concerns, the aim of this study was to determine the prevalence of malaria and HIV dual infections. According to the National AIDS reproductive health survey of 2013 [18], the rate of prevalence of HIV for Kaduna State is 9.2%, making it the third highest in the country. However, amongst the participants in our study, the rate of prevalence of HIV was 55.33% which was over five times higher than. This high prevalence could be explained by the low level of awareness to the causative agent of HIV infection was stood at 65(43.33%) coupled with the high level of unprotected sex which was 87(58%). This was further compounded by the high level of

sharing of unsterilized objects which stood at 66(44%).

Table 1. Socio-demographic factors of the participants according to sex

Parameters	Male (%)	Female (%)
Sex	65(43.00)	85(57.00)
Age range		
<20	20(13.30)	13(8.70)
21-29	19(12.70)	21(14.00)
30-39	7(4.67)	20(13.30)
≥ 40	19(12.70)	31(20.67)
Marital status		
Single	19(12.70)	44(29.33)
Married	31(20.67)	28(18.67)
Widow	0(0.00)	11(7.33)
Widower	10(6.70)	-
Divorced	5(3.33)	2(1.33)
Occupation		
Civil Servants	14(9.33)	14(9.33)
Business	8(5.33)	31(20.67)
Education level		
Non-formal	0(0)	2(1.33)
Primary	6(4.00)	8(5.33)
Secondary	19(12.67)	29(19.33)
Tertiary	40(26.67)	46(30.66)
Ethnicity		
Igbo	16(10.67)	23(15.33)
Hausa	21(14.00)	35(23.33)
Yoruba	17(11.33)	19(12.67)
Ibibio/Efik	11(7.33)	10(6.70)
Total participants	150	

On the other hand, the prevalence of malaria infection in the study was placed at 67(44.67%) and this was lower than HIV by about 13%. This reduction in prevalence reflected the higher level of awareness of 89(59.33%) shown by the participants to aetiological agent to malaria and the increased use of nets 115 (76.67%) to screen doors and windows. According to Malaria Fact Sheet [19], the prevalence of malaria in the North West, North Central and South West is 41-50% and this supports our finding of 44.67%. Analysis of both malaria and HIV did not show any significance at $p = 0.05$.

Studies that have emerged in Nigeria over the last decade indicate that malaria parasite and HIV virus could indeed be co-infecting. The prevalence of co-infection stood at 60.24% in our study. This was lower than the 76.1% and 74.3% earlier reported by Etusim et al. [20] and Omoti et al. [11] for Abia State in South Eastern Nigeria and in Benin, respectively. Moreover, it was

higher than the 22.8% reported by Adeoti et al. [21] in Oyo State amongst pregnant women and their babies post delivery. This was equally higher than the 47.7% reported in Lagos state by Sanyaolu et al. [22]. Onyenekwe et al. [3] in their study observed malaria prevalence of 33% and

11% in symptomatic and asymptomatic HIV carriers in Anambra State in south eastern Nigeria which was less than the 35%. Uneke et al. [12] reported a prevalence of 21% in Plateau State and Liyasu et al. [13] 32.2% in Kano State. Both were less than our findings.

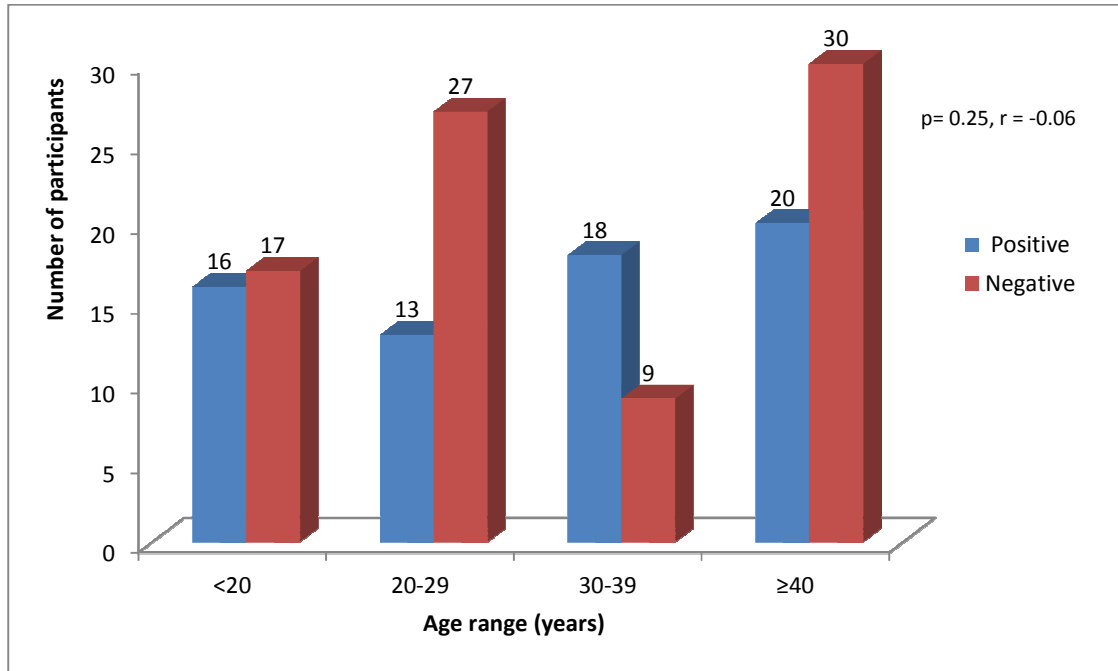


Fig. 1. Prevalence of malaria according to age range (positive n =67; negative n= 83)

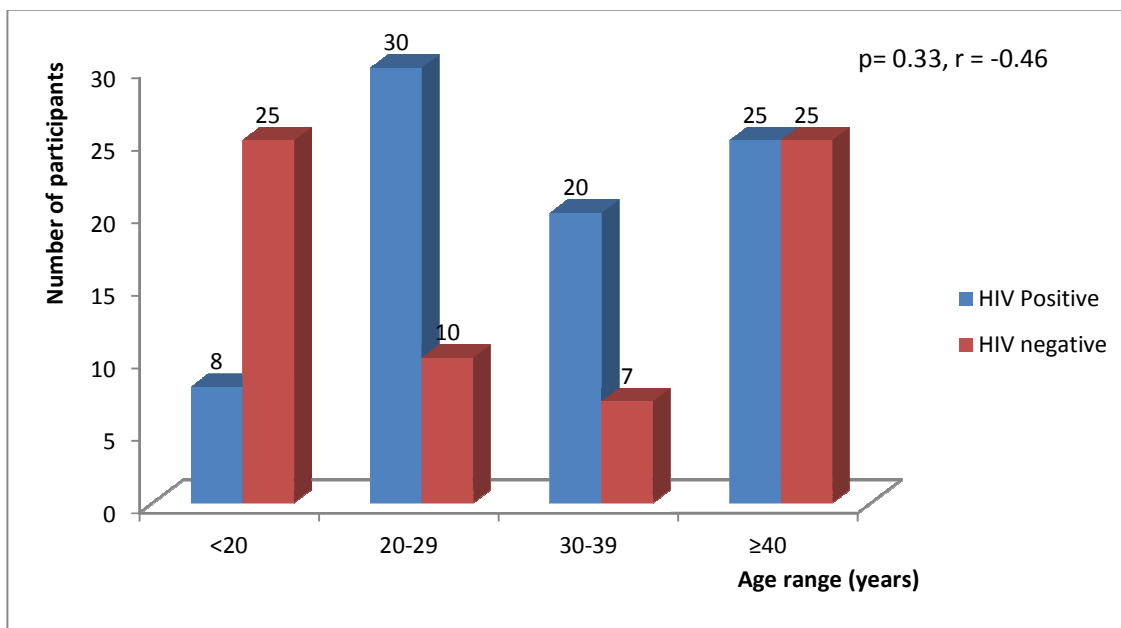


Fig. 2. Prevalence of HIV according to age range (positive n =83; negative n= 67)

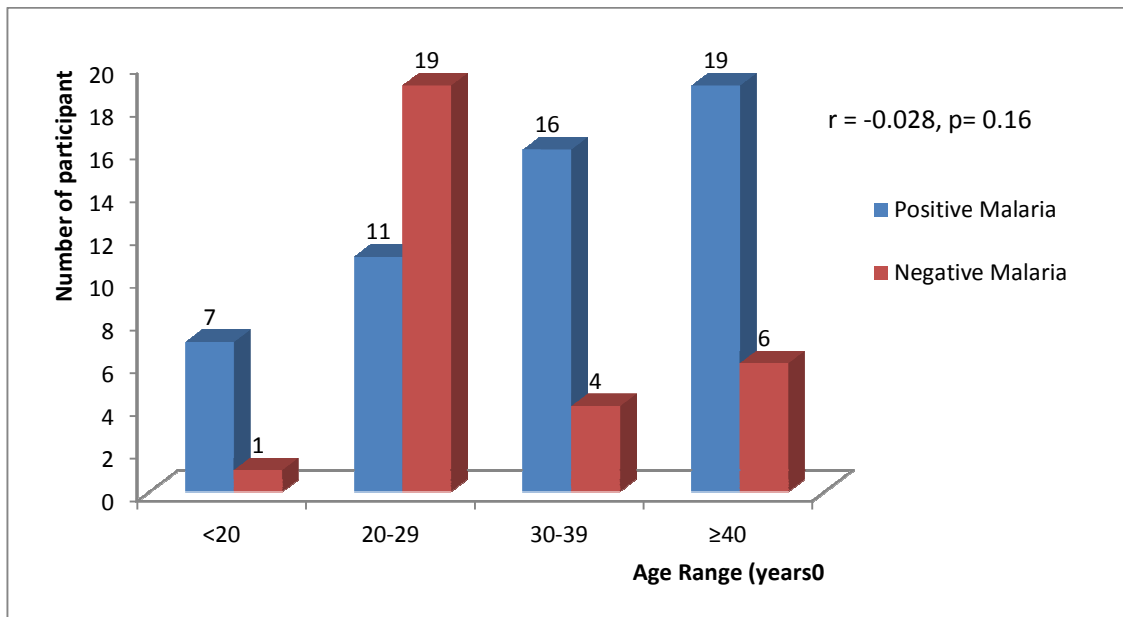


Fig. 3. Prevalence of malaria amongst HIV positive participants (n = 53 and 30 for positive and negative, respectively)

Table 2. Predisposing factors to malaria and HIV

Predisposing factors	Yes	No
Use of netted doors and windows	115(76.67)	35(23.33)
Overgrown bushes around homes	71(47.33)	79(52.67)
Presence of stagnant water	77(51.33)	73(48.67)
Mosquito net use	98(65.33)	52(34.67)
Use of insecticide	98(65.33)	52(34.67)
Antimicrobial therapies	85(56.67)	65(43.33)
Accurate knowledge of malaria	89(59.33)	61(40.67)
Accurate knowledge of HIV	65(43.33)	85(56.67)
Unprotected sex	87(58.00)	63(42.00)
Sharing of unsterilized sharp object	66(44.00)	84(56.00)
Transfused blood	16(10.67)	134(89.33)
Total	150	

5. CONCLUSION

The findings in this study indicate that the prevalence of HIV and malaria co-infection is very high although not significant. There is a need for the integration of control and prevention efforts for malaria and HIV.

ETHICAL APPROVAL

Ethical approval was sought for and obtained from the management of Bio-Karfred Medical Diagnostic Laboratory. Data protection act was

completely followed in handling the data obtained from the participants following their informed consent.

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We appreciate the entire management and staff of Bio-Karfred Medical Diagnostic Laboratory in Kaduna South Local Government Area for approving the study, creating a conducive environment and providing the necessary logistics during the study period.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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