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Serological evidence of HIV and Malaria co-infection among febrile HIV-Infected patients attending a tertiary Hospital in Port Harcourt, Nigeria

[1]Innocent-Adiele Hope Chioma, [1,2]Onyedibia Golden Chukwuma, [3]Emeruem Kingsley Emeka, [4]Ogbuji Cynthia Chizoba & [1]Okonko Iheanyi Omezuruike*

[1]Virus & Genomics Research Unit, Department of Microbiology, University of Port Harcourt, Port Harcourt, Nigeria.
[2]Biology Unit, Federal College of Education (Technical), Omoku, Rivers State, Nigeria
[3]Microbiology Technology Unit, School of Science Laboratory Technology (SSLT), University of Port Harcourt, Port Harcourt, Nigeria.
[4] Community Health Nursing Unit, Department of Nursing Sciences, Edo State University, Iyamo, Nigeria

ABSTRACT

An estimated 300 million malaria cases occur annually in the tropics, with 90% of these in the sub-Sahara, a region that already suffers the tremendous burden of HIV-1 infection. This study assessed the serological evidence of HIV/malaria co-infections among 100 HIV-infected patients attending the University of Port Harcourt Teaching Hospital (UPTH), Port Harcourt, Nigeria. The participants consisted of 66 females and 34 males; Blood samples were collected and screened for the presence of malaria *Plasmodium falciparum* antigen using an SD Boline malaria Antigen PF test strip and antibody against malaria *Plasmodium falciparum* using an ELISA kit. None of the participants was on antiretrovirals, had used any anti-malaria medication recently, and showed no definite symptoms of malaria or HIV. The overall seropositivity for HIV/Malaria co-infection was 4.0%, and 96.0% had HIV only. Of the 34 males screened, none (0.0%) were positive for malaria alone, and none (0.0%) had HIV/malaria co-infection. Among 66 females screened, 4 (6.1%) were positive for HIV/malaria co-infection, and none (0.0%) had malaria alone. HIV/malaria co-infection was higher (6.1%, n=4/66) in females than in males (0.0%, 0/34). HIV/malaria co-infection was higher in the age group 30 years and below (5.0%) compared to 31 - 40 years (4.0%) and 41 years and above (3.3%). This study has shown a relatively low HIV/malaria co-infection (4.0%) amongst HIV-infected patients in Port Harcourt, Nigeria. Females were found to be more prone to HIV-malaria co-infection, while their male counterparts demonstrated a more excellent disposition to HIV infection only. HIV status did not seem to influence the predisposition to malaria infection, as no increase in susceptibility was observed with HIV-infected patients. Further studies could be undertaken to investigate other relevant epidemiology parameters concerning HIV and malaria in the tropics.

1. INTRODUCTION

Malaria, a protozoan parasitic infection, is considered globally a leading cause of morbidity, particularly Plasmodium falciparum and is transmitted by Anopheles – mosquitoes. HIV and malaria are two of the world's most deadly diseases and are widespread. Their distribution overlaps

greatly in sub-Saharan Africa. Consequently, HIV-malaria co-infection (HMC) is expected in the region (Kwenti et al., 2017).

Plasmodium falciparum is the most virulent, with Nigeria having an endemic burden of 19%. The Nigerian government has instituted several interventions for malaria control, which include; Prevention of malaria transmission through vector control as part of an Integrated Vector Management (IVM) strategy, mainly through the promotion of insecticide-treated mosquito nets (ITNs) and indoor residual spraying; Prevention and treatment of malaria in pregnancy through intermittent preventive treatment (IPT), and Prompt diagnosis and adequate treatment of clinical cases (NMEP, 2020).

This geographical overlap of these infections has generated global interest regarding their potential evidence and interactions. Available research findings suggest that both human immunodeficiency virus (HIV) and malaria parasite infection act synergistically, resulting in worse health outcomes (Dibua et al., 2013), with a significant increase in disease progression, especially with the highly immunosuppressed population (Franke et al., 2010).

However, different reports show that malaria incidence is not common in HIV-infected individuals. In contrast, others have reported uncommon incidences of malaria in HIV-infected individuals in malaria-endemic areas (Bate et al., 2016). Malaria transmission is unstable throughout the year in these reports. Therefore, it may not be uncommon to observe co-morbidity with both pathogens (Inyama et al., 2016).

This study evaluated the occurrence of HIV and malaria co-infection among HIV-infected patients attending the University of Port Harcourt Teaching Hospital (UPTH) in Port Harcourt, Nigeria. This study will help to know if the pattern and burden of malaria amongst HIV-infected subjects are similar in all endemic areas irrespective of stable or unstable transmission throughout the year; of which. Thus, it may be essential to investigate the prevalence of malaria in HIV-infected subjects residing in a malaria-endemic area with stable transmission throughout the year.

2. MATERIALS AND METHODS

2.1. Study Area

The study was conducted at the health centre of the University of Port Harcourt Teaching Hospital (UPTH), East-West Road, Port Harcourt, Rivers State, Nigeria.

2.2. Study Population

A total of 200 HIV-infected patients were used in the study. The study involved both males and females. The study covers all age grades between 14-76 years.

2.3. Sample Collection

The patient hand was tied tight with a tourniquet and swabbed with 70% alcohol and cotton wool. A fist is made for the veins to be prominent. The needle is put in a prominent vein, blood is drawn out, and the patient releases his or her fist. Tourniquet was untied, and the blood was dispensed in

a collection tube (EDTA bottle). It is then centrifuged to get the plasma stored in the refrigerator at 40^0C until required.

2.4. Serological Analysis

Parallel tests were conducted for each plasma sample to detect malaria antigen in plasma using an SD Boline malaria Antigen PF test kit. The kit was used in a stepwise order to detect Malaria antigens in the blood. This method is immuno-chromatographic and qualitative and detects the presence of Malaria antigen in the blood. The method can be read *in-vitro*, having more than 99.9% sensitivity and 98.6% specificity. The test and interpretation of the results were made following the guidelines of the kit's manufacturers. The interpretation of test results was performed according to the manufacturer's specifications.

Plasma samples were also analyzed for the presence of Malaria *Plasmodium falciparum* using the ELISA kit manufactured by DIA.PRO Diagnostic Bioprobes Srl (Milano) – Italy, according to manufacturer's specifications. The absorbance of each well was read with an ELISA spectrophotometer at 450 nm with reference wavelength at 620 or 630 nm. Moreover, the results were recorded. ODneg was used to calculate the cut-off by multiplying this value by 4. The Ab (antibody) Index of each determination was calculated by dividing each sample's optical density (OD) value by the cut-off value. The value was used for the interpretation of the results. A positive reaction corresponded to an Ab Index above or equal to 1.0, and an adverse reaction to an Ab Index below or equal to 0.8.

2.5. Data Analysis

All the results obtained were analyzed statistically using the Chi-Square test.

3. RESULTS

3.1. Patients Characteristics

One hundred (100) HIV-infected patients (34 males and 66 females) were screened for HIV/Malaria co-infection. Most participants are 31-40 years (Table 1). None of the participants had used any anti-malaria medication recently, and none showed any definite symptoms of malaria or HIV.

3.2. Overall Seropositivity of HIV/Malaria co-infection

The overall seropositivity of HIV/Malaria co-infection was 4.0%, and 96.0% had HIV only (Table 1).

3.3. Sex-Related Seropositivity of HIV/Malaria co-infection

Of the 34 males screened, none (0.0%) was positive for malaria alone, and none (0.0%) had HIV and Malaria co-infection. Among females, a total of 66 people were screened; 4 (6.1%) were positive for HIV and Malaria co-infection, and none (0.0%) had malaria alone (Table 1). Seropositivity of HIV/malaria co-infection was higher (6.1%, n=4/66) in females than in males (0.0%, 0/34).

3.3. Age-Related Seropositivity of HIV/Malaria co-infection

Seropositivity of HIV/Malaria co-infection was higher in of age group 30 years and below (5.0%) compared to the age group 31-40 years (4.0%) and age group 41 years and above (3.3%), as shown in Table 1.

Table 1: Seropositivity of HIV/Malaria co-infection with age and sex of HIV-infected patients

Variable	Number Tested	No. Positive (%)	
		HIV Only	HIV/Malaria
Sex			
Male	34	34(100.0)	0 (0.0)
Female	66	62(93.9)	4 (6.1)
Age (years)			
30 and below	20	19(95.0)	1 (5.0)
31-40	50	48(96.0)	2 (4.0)
41 and above	30	29(96.7)	1 (3.3)
Total	**100**	**93(96.0)**	**4(4.0)**

4. DISCUSSION

Malaria and HIV co-infection are of public health concern, most especially in sub-Sahara Africa (Ombugadu et al., 2022). The overall seropositive screening for HIV-Malaria co-infection (HMC) was relatively low, with a prevalence rate of 4.0% among HIV-infected patients, while 96.0% had HIV only. The HMC observed in this study varies slightly from that seen in Ejike et al. (2020), who had a prevalence of 4.3% and 3.0% for old cross river state and Calabar, respectively. A similar study in Bamenda, Cameroon, also indicated a low co-infection rate of 2.24% (Njunda et al., 2012). HIV-Malaria co-infection indices in this study do not depict accordance with the observed co-infection rate of 56.8%, recorded among patients in Keffi (Yohanna et al., 2019), 24.0% among HIV patients in Jos (Iroezindu et al., 2012), 14.2% among HIV patients in Uyo (Amadi et al., 2018), 22.9% (Shafi'u et al., 2021) and 16.5% in Lafia, Nigeria (Ombugadu et al., 2022). This oblivious variance can be attributed to good malaria prevention strategies among HIV-positive patients.

The seropositive screening for HIV among the male population in this study shows a positive incidence rate of 34(100.0%) and an HIV-malaria co-infection rate of 0.0%. This observation is uncommon with the result of Ita et al. (2017), which recorded evidence of HIV-malaria co-infection among males.

The result of the sixty-six females involved in this study expressed 62(93.9%) seropositivity to HIV and HIV/Malaria (6.1%). Females exhibited oblivious susceptibility to HIV-malaria co-infection compared to their male study counterpart, who was identified as disposed to HIV infection only. The finding in this study consolidates with that observed in the reports of Dada et al. (2016), Sandie et al. (2016), Bello & Ishaleku (2018) and Ombugadu et al. (2022), which showed higher occurrence in females. The report of this study repels that of Ejike et al. (2020), which identified higher HIV-malaria co-infection among males (5.1%) than in females (3.9%) and expressed no significant difference between gender and HIV-malaria co-infection. In every region

of the world, gender remains a key determinant in health and disease burden because of the roles, relations and dynamics prevalent in the population (Carlucci et al., 2017).

HIV-malaria co-infection across age groups 30 and below, 31- 40 and 40 and above had an incidence rate of 5.0%, 4.0% and 3.3%, respectively. Co-infection indices between the age interval of 31-40 are in proportionate agreement with that identified in HIV-malaria co-infection among HIV-1 infected individuals, as indicated by Ejike et al. (2020), with 1.6% and 1.1% values within the age interval of 31-35 and 36-40 in a study carried out in two tertiary hospitals in old cross river state, Nigeria.

A prevalence rate of 5.0%, as observed among the study population between the age of 30 and below, is in close agreement with the result of a study carried out in a tertiary healthcare facility in central Nigeria (Yahaya et al., 2020), which indicated highest co-infection rate among the population within 20 years and below, which is attributed to the developing immune system state of populace. The lowest co-infection prevalence rate between ages 40 and above recorded in this study is in line with the findings of Kirinyet (2019), whose report indicated no significant relationship between age and malaria acquisition.

Malaria transmission is vector driven, and an unsupportive vector-thriving environment invariably halts the transmission of Plasmodium. Differences in sample size, study population, sensitivity and specificity of tests used, and weather and climate conditions may also account for these differences in the prevalence rates observed across studies. HIV status did not seem to influence the predisposition to malaria infection, as no increase in susceptibility was observed with HIV-infected patients. This result repels the findings of Kwenti (2018), whose study upvoted HIV as a factor proliferating malaria infection among HIV seropositive patients.

5. CONCLUSION

This study found a relatively low HIV- malaria co-infection rate (4.0%) among HIV-infected patients at the University of Port Harcourt Teaching Hospital. Females were more prone to HIV-malaria co-infection, while their male counterparts demonstrated a more excellent disposition to HIV infection only. HIV status did not seem to influence the predisposition to malaria infection, as no increase in susceptibility was observed with HIV-infected patients.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors have declared that no competing interests exist.

Statement of ethical approval

All authors declare that all experiments have been examined and approved by the University of Port Harcourt Research Ethics committee. Therefore, the study follows the ethical standards in the 1964 Declaration of Helsinki.

Statement of informed consent

"All authors declare that informed consent was obtained from all individual participants included in the study."

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