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RESEARCH ARTICLE

Evaluation of malaria parasite and covid-19 co-infection among jos resident and environs, plateau state, Nigeria.

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Abstract

Background and Objective: Countries in the equatorial and tropical zones that have a high burden–high incidence (HBHI) of malaria infection seem to have the lowest incidences of COVID-19. It is against this background that this study was conducted to ascertain prevalence of malaria and COVID 19 co-infection among Jos residents, Plateau State, Nigeria, immunological or protective effect of malaria parasite infection on COVID-19 infection and to determine which sex is more vulnerable in that locality.

Materials and Method: The study population composed of both inpa-tients and outpatients that came to three major hospitals in Jos Metropo-lis, Plateau State for medical attention with total population of seventy (70) subjects. Ethical clearance was obtained from Ministry of Health, Plateau State Ethical Committee and oral consent was obtained from the patients before their names were inputted into the data collection form. Using aseptic precaution, 5mls of blood was collected into K3EDTA bottle for thick blood film for malaria parasite and for COVID-19 IgG/IgM analysis using rapid chromatographic immunoassay for the qualitative detection of IgG and IgM antibodies to 2019nCov. The data obtained were analyzed by SPSS software version 21.

Results: In this study, the overall prevalence of COVID-19 and malaria co-infection was 71.4% while malaria and COVID-19 single infection were 14.3%, respectively. High percentage of co-infection observed in this study confirmed the immunological or protective effect of malaria on COVID-19 infection hence, low incidence of COVID-19 in malaria endemic area. It was also discovered in the study that men are more vulnerable than women.

Conclusion: It was discovered in this study that malaria and COVID-19 infection have common lymphocyte marker that bring about immunological protection on COVID-19 infection hence the low mortality rate among malaria endemic area. It was also discovered that men had higher susceptibility to COVID-19 infection than women as a result of testosterone inhibitory roles in immunological processes. Target to lymphocyte mark (CD147) receptor can be a target for COVID-19 treatment.

Keywords: COVID-19, malaria, co-infection, men, women.

1 | INTRODUCTION

Malaria parasite is transmitted by the bite of female *Anopheles* mosquitoes infected with plasmodium species in which the most grievous and common one is Plasmodium falciparum. The most common cause of morbidity and death in sub-Saharan Africa is malaria parasite. The evidence was captured in 2018 in which 228 million cases and 405,000 mortality were recorded worldwide[1]. From these statistics, 93% of cases were in sub-Saharan Africa across 38 African countries, 11 million pregnant women with malaria cases with the outcome of 900,000 children born with a low birth weight as a result of malaria in pregnancy[1].

The extremely poor, displaced and more nonurban populations in malaria endemic countries are at greater danger[2]. All ages are affected by malaria resulting to acute simplified sickness, obstructed growth in children and anemia commonly observed with *P. falciparum* infection[3]. Asymptomatic malaria-infected individuals are more frequent in high endemic locations working as stockpile of gametocytes for sustaining malaria transmission through *Anopheles* mosquitoes[4].

In early December 2019 in Wuhan, China, COVID-19 pandemic caused by a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was declared[5]. This pandemic has resulted to notable morbidity and deaths thereby adversely affecting healthcare systems and the economy of the world [6,7]. The result of this severe acute respiratory sickness is that it moves from a self-limiting acute upper respiratory tract infection to severe pneumonia, multi-organ failure and death[8].

Countries in subtropical and temperate zones have more numbers of COVID-19 infection while high burden–high incidence (HBHI) of malaria infection countries in the equatorial and tropical zones seem to have the lowest incidences of COVID-19 [9]. World Health Organization (WHO) report in 2018 on the prevalence of malaria in African region was 150.9 million with main infection caused by Plasmodium falciparum and have the lowest number of cases of confirmed COVID-19 (5,826,428 as of 8 July 2021) compared to other regions[9–11]

As at 8^{th} July 2021 by 8:59 GMT, global updates of COVID-19 were as follows: total confirmed cases: 185, 893, 922, total number deaths: 4,018,931 and total number of recovered cases: 170,131,616.

In African Region, which carries more than 90% of the global malaria burden, has the following update as of 8^{th} July, 2021: total confirmed cases 5,826,428, total number deaths, 149,122 and total number of recovered cases, 5,038,554. Then Nigeria has following update: total confirmed cases 168,110, total number deaths, 2,112 and total number of recovered cases, 164, 408 while Plateau State in particular, where this study was carried out has the following update: total confirmed cases 9,068, total number deaths, 57 and total number of recovered cases, 9,006 against non-endemic malaria region such as Italy with the following update as of 8^{th} July, 2021: total confirmed cases 4,265,714, total number of deaths, 127,718 and total number of recovered cases, 4,096,156, Germany: total confirmed cases 3,740,541, total number deaths, 91, 665 and total number of recovered cases, 3,631,500 and United Kingdom: total confirmed cases 4,990,916, total number deaths, 128,301 and total number of recovered cases, 4,345,499 [11].

Then the questions based on the above fact are: What is the prevalence of malaria-COVID-19 co-infection in Jos Plateau State? Does malaria infection have an immunological or protective effect on COVID-19 infection? Which sex is more susceptible to malaria COVID-19 co- infection?

It is against this background that this study was conducted to ascertain prevalence of malaria and COVID 19 co-infection among Jos residents, immunological or protective effect of malaria parasite infection on COVID-19 infection and to determine which sex is more vulnerable in that locality.

Supplementary information The online version of this article (10.15520/arjmcs.v7i11.383) contains supplementary material, which is available to authorized users.

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2 | MATERIALS AND METHODS

Study area

Methodology: The study population composed of both inpatients and outpatients that came to three major hospitals in Jos Metropolis, Plateau State, Nigeria for medical attention with the total population of seventy (70) subjects from March to September, 2020.

The study was carried out in Jos, Plateau State.

Ethical approval

Ethical clearance was obtained from Ministry of Health, Plateau State Ethical Committee and oral consent was obtained from the patients before their names were inputted into the data collection form.

Research protocol:

Using aseptic precaution, 5mls of blood was collected into K_3EDTA bottle for thick blood film for malaria parasite and for COVID-19 IgG/IgM analysis using rapid chromatographic immunoassay for the qualitative detection of IgG and IgM antibodies to 2019nCov.

Statistical analysis:

The data obtained were analyzed by SPSS software version 21.

3 | RESULTS

Table 1 shows 71.4% prevalence of malaria and COVID 19 co-infection among Jos resident which indicate common factors among them.

Table 1: Prevalence of malaria and COVID 19 co-infection among Jos resident n=70

Infection	Frequency (n)	Percentage (%)
COVID -19	10	14.3
Malaria	10	14.3
Co-infection	50	71.4

Table 2: Sex difference of malaria and COVID-19 co-infection among Jos resident with Mean age

Sex	frequency (n)	Percentage (%)	Mea ± SD
Male	51	72.9	43.8±18.6
Female	19	27.1	41.4±18.2

Table 2 shows that men (72.9% with mean age of 43.8±18.6) are more vulnerable to plasmodium faciparum and COVID 19 co-infection than women (27.1% with mean age of 41.4±18.2).

Figure 1: Graphical presentation of plasmodium faciparum and COVID 19 Co-infection among Jos resident showing men more vulnerable than women.

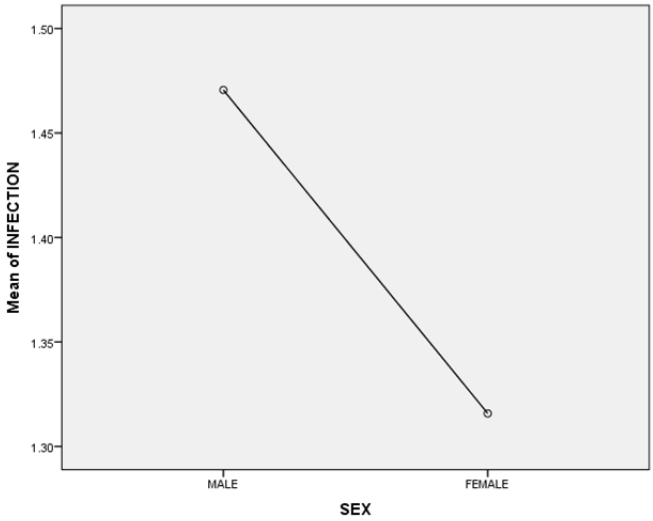

FIGURE 1: Graphical presentation of plasmodium faciparum and COVID 19 Co-infection among Jos resident showing men more vulnerable than women.

4 | DISCUSSION

This study reports the prevalence of COVID-19 and malaria co-infection and sex susceptibility determination to the infections. To our knowledge, this study is the first to characterize potential interactions between COVID-19 and malaria in Plateau State, Nigeria. In this study, the overall prevalence of COVID-19 and malaria co-infection was 71.4% while malaria

and COVID-19 single infections were 14.3%, respectively. The high percentage of COVID-19 and malaria co-infection may be due to RH5-CD147 that interacts with part of Plasmodium for invasion of erythrocytes which may eventually cause the death of the victim. Recent findings have indicated infection of the host cell by COVID-19 through spike protein–CD147 interaction, though the CD147 receptor is also expressed on the erythrocyte surface[12]. It was suggested the CD147 that receptor can be a target for COVID-19 treatment[13]. Homology modelling and molecular docking revealed that SARS-CoV-2 could attack haemoglobin and inhibit haeme metabolism as shown in previous study[14].

Furthermore, 71.4% of co-infection observed in this study confirmed the immunological or protective effect of malaria on COVID-19 infection with the following global update. On 8^{th} July, 2021 as stated earlier, we observed 1.3% deaths of confirmed positive cases in Nigeria, 0.63% death of confirmed positive cases in Plateau state against 3%, 2.5%, 2.6% deaths of confirmed positive cases in Italy, Germany and United Kingdom, respectively[11]. This may be due to malaria-induced immune modulation that has been shown to be protective against severe manifestations of some respiratory viruses[15] by diminishing the development of cytokines and reducing recruitment of cellular inflammatory components to the lungs, resulting to moderate clinical symptoms and inflammation[16].

In addition, current clinical information proposes that the same interferons that respond to cytokine storms that form in some COVID-19 patients also respond to malaria plasmodia infection[17]. It is a common fact that malaria initiates interferons with established effect against infection by certain viruses. Several research works discovered that lymphocytes release interferons in a regular immune response to infection by divers strains of malaria, and that these same interferons have both in vitro and in vivo effects against the coronaviruses responsible for SARS, MERS and COVID-19 [18,19]. Recurrent malarial infections also initiate the progression of persisting antibodies that neutralize a wide profile of merozoite antigens that have recently been marked to have effects against COVID-19 and other corona viruses [20,21].

Furthermore, it was also discovered in this study that men are more vulnerable than women. This is in agreement with study carried out in Wuhan, China, the origin of the virus (COVID-19) using 168 severe COVID-19 patients that men were significantly disposed to hospitalization and death with decrease in hospital discharge compared to women[22]. This may be as a result of some finding that suggested that testosterone may be involved in the advancement of COVID-19 through the stimulation of cytokine storm [23]. Therefore, a likely interpretation for men's higher susceptibility to infection may be testosterone inhibitory roles in immune processes [24].

Likewise, differences in men and women Angiotensin-converting enzyme-2 (ACE2) is an important feature for the access of COVID-19 to the cells [25,26]. Women have the likelihood to be heterozygous with respect to this enzyme while men are homozygous since ACE2 gene is located on X-chromosome [27].

5 | CONCLUSION

It was discovered in this study that malaria and COVID-19 infections have common lymphocyte marker that bring about immunological protection on COVID-19 co-infection hence the low mortality rate among malaria endemic area. It was also discovered that men have higher susceptibility to COVID-19 infection than women as a result of testosterone inhibitory roles in immunological processes.

Significant statement

Target to lymphocyte mark (CD147) receptor can be a target for COVID-19 treatment.

Recommendation

It is recommended that when COVID-19 is confirmed positive, malaria parasite should be investigated for effective management.

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