

# Co-circulation of Flavivirus and Malaria Antibodies in Nigeria

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## Abstract

A growing threat to public health are raboviruses and malaria, which affect not only the general population but also immune compromised individuals and pregnant women. Due to the co-circulation and transmission of ZIKV, malaria and FLAVI fever, individuals in vulnerable groups are more likely to experience severe complications. These mosquito-borne infections pose a diagnostic challenge for physicians in regions where they co-circulate because their clinical presentations overlap with those of other diseases in sub-Saharan countries like Nigeria. Maternal health and foetal outcomes can be devastatingly affected by vertical transmission, including an increased risk of foetal loss and premature birth. There is a lack of information regarding the prevalence of arboviruses, particularly ZIKV and other flaviviruses, in Nigeria despite the worldwide recognition of their burden.

**Keywords:** Raboviruses • Chikungunya • Flaviviruses

## Introduction

These diseases may have an impact on treatment outcomes and result in epidemiological synergy in urban settings, where they are endemic and share common biological, ecological and economic factors. As a result, it is absolutely necessary to carry out clinical and sero-epidemiological research in order to acquire a deeper comprehension of the disease burden as well as its hidden endemicity and, as a result, enable improved clinical management as well as prevention method. The immune blot serological assay was used to check for the presence of IgG antibody seropositivity against ZIKV and FLAVI in serum samples taken from outpatients in three Nigerian regions between December 2020 and November 2021. ZIKV, FLAVI and malaria co-circulation antibody seropositivity in the entire cohort was 24.0% (209/871). 19.2% of study participants had ZIKV-seropositive antibodies (167/871), 6.2% had FLAVI-seropositive antibodies (54/871) and 40% had malaria parasite antigens (348/871). Territorial investigation uncovered that members from the southern locale had the most noteworthy immune response seropositivity against ZIKV (21.7% (33/152)) and FLAVI (8.6% (13/152)), though those from the focal district had a higher intestinal sickness parasite antigen (68.5% (287/419)). The largest comparative cross-sectional descriptive sero-epidemiological study of ZIKV-FLAVI and malaria circulation in Nigeria is the subject of this study. The burden of ZIKV, FLAVI and malaria co-circulating in Nigeria, hidden endemicity and increased antibody seropositivity were all revealed by the findings of this study.

## Literature Review

Given their widespread distribution and the lack of broad-spectrum antivirals for prophylactic or therapeutic use, rabies pose a global public health challenge because they are one of the leading causes of death worldwide. Of specific concern are the Zika infection (ZIKV) and other flaviviruses (FLAVI), which are hyper endemic in various nations in the jungles and subtropics. In 1975, Nigeria received the first report of a ZIKV infection. Clinicians in Nigeria, where these mosquito-borne infections co-circulate pose a diagnostic challenge due to the fact that their clinical presentations overlap with those of dengue, West Nile virus

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and Japanese encephalitis. There is evidence of autochthonous mosquito-borne transmission of the Zika virus (ZIKV) and other flaviviruses in 89 countries and territories as of December 2021. In a number of African nations, there is evidence of the transmission of ZIKV and other flaviviruses; however, there is still a lack of information regarding the trends and current incidence of co-circulation of ZIKV, FLAVI and malaria transmission [1].

The bites of infected *Aedes aegypti*, *Aedes albopictus*, *Aedes africanus* and *Aedes hensilli* some of the species that have been implicated in the transmission of Zika—are the primary route by which the Zika virus (ZIKV) is spread. Sexual, perinatal and congenital transmission are additional methods of ZIKV and flavivirus transmission. Preterm birth and miscarriage are two complications of pregnancy that are linked to the Zika virus. Neurological complications, such as Guillain-Barré syndrome, neuropathy and myelitis, are more likely to occur in children and adults. Immunoglobulin levels in the CSF of new borns exposed to ZIKV infection during pregnancy are elevated, particularly in those who develop microcephaly. Intriguing but potentially alarming scenarios have emerged as a result of the Zika virus (ZIKV) and other flaviviruses appearing in regions where malaria is prevalent [2].

## Discussion

A Sri Lankan study has hypothesized that prior infection with one Zika or dengue virus influences the severity of subsequent infection with the other virus. Due to the high homology between these arboviruses, cross-reactivity of antibodies against flaviviruses like DENV, yellow fever virus (YFV), tick-borne encephalitis virus (TBEV) and Japanese encephalitis virus (JEV) can occur, which may make it harder to interpret serological results, circulation and severe foetal outcomes. This is a major health concern because of the high homology between these arboviruses. In Nigeria, the actual epidemic and interepidemic burden is largely unknown and underreported. Malaria, FLAVI and ZIKV are vector-borne diseases with similar endemic profiles and symptoms that can kill if left untreated. To improve diagnosis and develop therapeutic approaches, it is essential to comprehend these diseases prevalence and distribution. Due to recurrent outbreaks, these infections have recently become a global concern, particularly in tropical and subtropical regions like Nigeria.

Millions of new cases occur annually as a result of several of these diseases becoming endemic to malaria-endemic areas. Five distinct species of the protozoa parasite Plasmodium are responsible for the development and spread of malaria, which poses a significant threat to public health. These include the Anopheles mosquito-borne *P. falciparum*, *P. ovale*, *P. malariae*, *P. vivax* and *P. knowlesi* Intestinal sickness, ZIKV and FLAVI have a comparable scourge design that generally influences tropical districts around the world. A few investigations have demonstrated the way that every one of the three sicknesses can co-flow. The diseases have clinical manifestations that are comparable, with fever being the most common symptom. Due to frequent outbreaks in various parts of Nigeria, the burden of these infections has increased. Travel around the world

and rapid urbanization have spread disease endemicity by spreading vector populations to new environments. Malaria's co-circulation with FLAVI and ZIKV makes diagnosis and treatment more difficult [3].

There is a lack of reliable data and little information about the co-circulation of ZIKV, malaria and other flavivirus infections in Nigeria, despite this trend and the potential threat to public health. Participants who were serologically positive for ZIKV, malaria and other flaviviruses during the sampling period or time were the subject of our investigation into the seroprevalence of ZIKV malaria and FLAVI and their possible cocirculation in three regions of Nigeria. One of the few studies on arboviral and malaria seroprevalence, burden, hidden endemicity and geographic spread in sub-Saharan Africa is ours. With a seroprevalence of 24.0%, the findings indicated that Zika, flaviviruses and malaria cocirculation antibodies had spread throughout the three regions of Nigeria. 19.2% of the study population had antibodies that were positive for ZIKV, 6.2% had antibodies that were positive for FLAVI and 40% had antigens that were positive for malaria, according to the study.

In addition, 7.5% of people had antibodies that were positive for the ZIKV-FLAVI cocirculation, 4.3% had antibodies that were positive for the ZIKV-Malaria cocirculation and 2.2% had antibodies that were positive for the FLAVI-malaria cocirculation. It has been suggested in a number of studies that antibody seropositivity for ZIKV is significantly lower in southern Nigeria. In Kenya and Ethiopia, respectively, seroprevalence rates of 0.7% and 27.3% of arboviral infections have been documented. In Nigeria, no conclusive research on the cocirculation of malaria, ZIKV and FLAVI cocirculation antibodies has been conducted. The recent rise in the antibody seroprevalence of ZIKV, FLAVI and malaria in Nigeria is also explained by this study. Antibody cross-reactivity with other arboviruses, urbanization, arboviral vaccine (particularly yellow fever vaccine), unplanned settlements, poor drainage systems in major cities in the three regions, inadequate and unwholesome waste disposal, stagnant water bodies and water collected in waste metal containers and vehicle tires could be the causes of the increase in antibody seropositivity for ZIKV, FLAVI and malaria that the current study was unable to pinpoint. *Aedes* use these microhabitats as breeding grounds. Vectors of arboviral transmission include mosquitoes.

Numerous natural factors, including the survival, reproduction, development, activity, distribution and abundance of vectors and hosts, shape or affect the antibody seropositivity of these two arboviruses and malaria parasite cocirculations. Additionally, pathogen development, upkeep, replication and transmission are affected by these factors. These natural factors, in addition to human behavior, which can also have an impact on the frequency, onset and distribution of disease outbreaks, also affect the range of pathogens, hosts and vectors. Distribution within an endemic area can frequently be uneven, despite the fact that the route of transmission is typically identifiable. People who are malnourished and have weaker immune systems are more likely to get these kinds of diseases. Similar and divergent results are reported from other studies. The sampling period may also have had an impact on these outcomes [4].

There is a dearth of knowledge and data regarding malaria, ZIKV and FLAVI, particularly in Nigeria, despite the fact that the global burden of arboviruses (ZIKV and FLAVI) and malaria is well-established. It is also intriguing to speculate whether these vector-borne diseases are spread by a single mosquito bite or whether both infections can be acquired by a single mosquito during the feeding process [5,6].

## Conclusion

The largest comparative cross-sectional descriptive sero-epidemiological study of ZIKV-FLAVI and malaria cocirculation in Nigeria is the subject of this study. Increased antibody seropositivity, hidden endemicity and the prevalence of ZIKV, FLAVI and malaria co-circulating in Nigeria were all revealed by the findings of this study. Antibody cross-reactivity, previous exposure to the arboviral vaccine (possibly the yellow fever vaccine), long-term exposure immunity, different vector densities across the three regions due to different types of vegetation, human population indices or anthropogenic activities, climate change, vector adaptations, temperature and humidity variations and flooding may have influenced these results. As a result, patients with acute febrile syndrome should have a differential diagnosis made and screening blood donors for arboviral infections will help doctors and policymakers make interventions, get data and use effective control measures.

## Acknowledgement

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## Conflict of Interest

None.

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