

FIRST SEROLOGICAL PREVALENCE OF DENGUE VIRUS IgG ANTIBODY AMONG PREGNANT WOMEN IN PORT HARCOURT, NIGERIA

*¹Okonko, I. O., Innocent-Adiele, H. C., ¹Njoku, O. V., & ²Eugene, E. A.

¹Virus & Genomics Research Unit, Department of Microbiology, University of Port Harcourt, Port Harcourt, Nigeria

²Department of Biomedical Technology, School of Science Laboratory Technology, University of Port Harcourt, Port Harcourt, Nigeria

*Corresponding author's e-mail address: iheanyi.okonko@uniport.edu.ng;

Tel: +2347069697309, ORCID iD: [0000-0002-3053-253X](https://orcid.org/0000-0002-3053-253X)

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ABSTRACT

Dengue is a viral disease transmitted by Aedes mosquitoes and is considered a public health problem worldwide. Pregnant women and infants are at risk of developing severe dengue, which has been linked to poor outcomes. This study sought to determine the prevalence of Dengue Virus IgG antibodies among pregnant women attending antenatal care at the University of Port Harcourt Teaching Hospital, Rivers State, Nigeria. In this cross-sectional study, a total of 94 pregnant women were enlisted, and after gaining consent, approximately 5 ml of whole blood was taken. Enzyme-Linked Immunosorbent Assay (ELISA) was used to detect the presence of IgG antibodies to the dengue fever virus. IgG antibodies prevalence to the dengue fever virus was found to be 2.1%. Women who were within 16 to 20 years (6.7%), single (2.6%), employed (3.8%), had primary education (5.3%) and resided in urban areas (4.8%) all had higher incidence rates. Although this study reported a low prevalence of dengue virus among pregnant women, intensive enlightenment on the preventive measures which include the use of insect repellent and wearing of long-sleeved shirts, among others, should be sustained.

Keywords: ELISA, Dengue IgG, Mosquitoes, Seroprevalence

INTRODUCTION

Dengue virus (DENV) is one of the most common arboviruses. The virus is mainly transmitted by two epidemic vectors: *Aedes aegypti* and *Aedes albopictus*. These vectors have become widespread throughout tropical and subtropical regions and also spread worldwide as a result of global issues such as urbanization, increased population growth, limited water supply, poor waste management system and overseas travel (Simo et al., 2019).

It has been estimated by the World Health Organization that about 3.9 billion people in 128 countries are at risk of dengue infection and about 390 million infections occur globally yearly, among which the disease is clinically manifested by 96 million people, making up 25% of those infected (WHO, 2017).

There are four serotypes of dengue virus (DENV-1 to DENV-4) and the clinical range of infection manifested by any of the serotypes

is varied because it may appear as an asymptomatic, symptomatic or even a lethal infection (Horstick et al., 2015). The burden of dengue during pregnancy is not well understood (Paixao et al., 2018).

In addition, the thrombocytopenia, leucopenia, or haemoconcentration linked to dengue might be concealed by physiological changes that take place during pregnancy (such as haemodilution), and common obstetric complications can result in haematological and hepatic conditions concealing the disease.

Therefore, it might be a challenge to distinguish dengue haemorrhagic fever and frequent obstetric disorders, which could result in incorrect diagnosis (Basurko et al., 2006; Malhotra et al., 2006).

Nonetheless, dengue during pregnancy has been linked to poor outcomes for both the mother and the foetus. For example, studies have shown that pregnant women are more likely than non-pregnant women to experience severe dengue and require hospitalization as a result of the disease (Machado et al., 2013).

Furthermore, other studies have linked dengue infection to maternal mortality and other complications such as haemorrhage and an increase in caesarean section rates (Adam et al., 2010; Friedman et al., 2014; Feitoza et al., 2017; Paixao et al., 2018).

Dengue is a significant arthropod-borne viral illness of humans, and its control remains a top issue for public health in many endemic nations. Contrary to the situation in the Asia-Pacific and Latin American areas, where the burden and epidemiology of dengue virus infection are well documented, the situation in Africa, especially Nigeria, is unclear, even though cases have been reported (Tizhe et al., 2022).

In Nigeria, where malaria is common, it has been reported that more than 70% of febrile patients are presumed to have malaria and are commonly treated as such without a laboratory examination to rule out other possible causes of fever (Onyedibe et al., 2018).

As a result, many individuals with fever are classified as having malaria or having a fever of unknown origin and do not receive a test diagnosis, even when given antimalarial drugs.

This issue is mostly the result of a lack of accessible diagnostic equipment and implies that dengue virus infections frequently go undetected or are even misdiagnosed (Okonko et al., 2023).

Previous studies carried out in the Middle East and North Africa reported a median seroprevalence of dengue infection in the general population of 25% (with a range of 0 to 62%) and most of the reports were from Pakistan (Humphrey et al., 2016).

In Africa, a high prevalence of DENV has also been reported. For example, prevalence rates of 15.6%, 3.5%, and 0.0% respectively for immunoglobulins (Ig) G, IgM, and ribonucleic acid (RNA) were reported in apparently healthy populations (Simo et al., 2019). Also, prevalence rates of 24.8%, 10.8% and 8.4% for IgG, IgM, and RNA, respectively were reported for populations presenting with fever.

In addition, various studies conducted in Nigeria have reported high prevalence rates for IgM including 19.4% (Tizhe et al., 2022), 25.7% (Adeshina and Adeniyi, 2016), and 35.1% (Okonko et al., 2023) among febrile patients, and 17.2% among healthy individuals (Oladipo et al., 2014).

High prevalence rates for IgG have also been reported including 54.1% (Ekong et al., 2022) and 44.7% (Asaga-Mac et al., 2023). Among pregnant women, a high seroprevalence of

dengue IgG antibodies of 32.4% has been reported in Malaysia (Mohamed-Ismail et al., 2014).

On the other hand, low seroprevalence rates of 6.9% and 2.22% have been reported in India (Nujum et al., 2014) and China (Wang et al., 2021), respectively.

There is currently no treatment for dengue infection. The active monitoring and surveillance of vectors remain the primary method of preventing the spread of DENV (Guo et al., 2017). There is a paucity of data on the epidemiology of DENV infection among pregnant women in Nigeria, especially in Rivers State. It is therefore important to determine the prevalence of DENV as this may help in formulating effective interventions to curb the burden of dengue fever in the state.

MATERIALS AND METHODS

Study Area

The study was conducted at the antenatal clinic of the University of Port Harcourt Teaching Hospital (UPTH), Rivers State, Nigeria. UPTH is a tertiary healthcare institution located in Port Harcourt, that caters for patients from high-, middle- and low-income backgrounds, both within and outside Port Harcourt. The city of Port Harcourt is the centre of oil and gas activities and one of the busiest cities in Nigeria. Port Harcourt witnesses a tropical monsoon climate with long and heavy rainy seasons and very short dry seasons. According to the 2006 Nigerian census, Port Harcourt had a population of 1,382,592 (NPC, 2006).

Study Design

This was a hospital-based cross-sectional survey design that sought to evaluate the seropositivity of Dengue virus antibodies among pregnant women in Port Harcourt, Nigeria.

Sample Size Determination

The sample size for this study was determined using the standard formula (Charan & Biswas, 2013).

Study Population

The target population included all pregnant women who attended the antenatal clinic at the University of Port Harcourt Teaching Hospital (UPTH) for routine check-ups from February 2022 to October 2022. A total sample size of 94 pregnant women were randomly selected and enrolled in the study. The sociodemographic details of the women relevant to the study were obtained from their clinic records. Women excluded from the study included those who were not pregnant as well as those on any form of antibiotics/antiviral drugs.

Sample collection, preparation, and storage

A specimen of 5mL venous blood was drawn aseptically from the enrolled subjects into sterile ethylenediamine tetraacetic acid (EDTA) tubes. The blood was allowed to separate, and the plasma was aspirated into sterile Eppendorf tubes. Plasma was stored at +2°- 8°C for up to five days after collection.

Serological Analysis

Plasma was analyzed for DENV IgG antibodies using a human enzyme-linked immunosorbent assay (ELISA) kit (Diagnostic Bioprobes, Milano, Italy). ELISA tests were conducted according to the manufacturer's instructions and results were interpreted in line with the manufacturer's instructions. Samples with a concentration lower than 5 arbU/mL were considered negative for anti-DENV IgG antibodies. On the other hand, samples with a concentration higher than 5 arbU/mL were considered positive for anti-DENV IgG antibodies.

Method of Data Analysis

The data were recorded and analyzed using a Microsoft Excel spreadsheet.

RESULTS**General Characteristics of Participants**

A total of ninety-four (94) pregnant women were tested for dengue virus IgG antibodies. Of these, the majority were within the age group of 21 to 30 years (47.9%), married (47.9%), employed (56.4%), had secondary level education (42.6%), and resided in urban areas (77.7 %) (Table 1).

Prevalence of Dengue Virus IgG antibodies

Out of the 94 pregnant women tested for dengue fever virus IgG antibodies using ELISA, only 2.1% (2/94) were seropositive, while 97.9% (92/94) were seronegative, therefore giving an overall prevalence of 2.1% (Table 1).

Prevalence of Dengue Fever Virus IgG Antibodies as it Relates to Sociodemographic Factors

Analysis of the result based on sociodemographic parameters shows that out of the two pregnant women who tested positive for Dengue virus IgG antibodies, one was within the age group of 16 – 20 years (6.7%), while the other was within 31 – 40 years (3.7%).

In addition, one of the women was single (2.4%), while the other was married (2%). Although both of the women were employed (3.8%), one had primary education (5.3%) while the other had secondary education (2.5%), as their highest academic qualification. Also, one of the women dwelt in an urban area (4.8%) and the other in a rural area (1.4%).

Table 1: Serological Evidence of Dengue Virus IgG Antibodies with Sociodemographic Characteristics of the Participants

| Variables | Population Tested (%) | Number Positive (%) |
|-----------------------|------------------------------|----------------------------|
| Age (years) | | |
| 16 – 20 | 15 (16) | 1 (6.7) |
| 21 – 30 | 45 (47.9) | 0 (0.0) |
| 31 – 40 | 27 (28.7) | 1 (3.7) |
| >41 | 7 (7.4) | 0 (0.0) |
| Marital Status | | |
| Single | 34 (41.5) | 1 (2.4) |
| Married | 50 (53.2) | 1 (2.0) |
| Widowed | 10 (10.6) | 0 (0.0) |
| Occupation | | |
| Employed | 53 (56.4) | 2 (3.8) |
| Unemployed | 41 (43.6) | 0 (0.0) |
| Education | | |
| Primary | 19 (20.2) | 1 (5.3) |
| Secondary | 40 (42.6) | 1 (2.5) |
| Tertiary | 35 (37.2) | 0 (0.0) |
| Residence | | |
| Urban | 21 (22.3) | 1 (4.8) |
| Rural | 73 (77.7) | 1 (1.4) |
| Total | 94 (100) | 2 (2.1) |

DISCUSSION

The results of this study showed that the prevalence of dengue IgG antibodies among pregnant women in a tertiary hospital in Port Harcourt is 2.1%. This is much lower than the prevalence that was reported among pregnant women in some countries such as Malaysia (32.4%) (Mohamed Ismail et al., 2014) and India (6.9%) (Nujum et al., 2014), but very similar to the 2.22% reported in the Guangzhou province of China (Wang et al., 2021).

The observed prevalence in this study is also lower than the dengue IgG antibody prevalence of 12.3% reported in a Nigerian study, although the study population included both pregnant women and blood donors (Mahmod et al., 2018). It is quite interesting that a very low prevalence rate was recorded among pregnant women in this study even though a previous study had reported that dengue virus is endemic in the city of Port Harcourt with a prevalence of 35.1% for IgM among febrile patients (Okonko et al., 2023).

The prevalence of dengue IgG antibody in a study population in China is 2.22 % (Wang et al., 2021). This result is in agreement with the report from this study. The low prevalence observed in this study may be attributed to the adoption of preventive measures by pregnant women, including the use of insect repellent as well as wearing of long-sleeved shirts and long pants, among others (CDC, 2023)

Previous studies have suggested that several maternal demographic factors such as age, occupation, education, and income level, may be associated with the risk of dengue infection.

In this study, a higher proportion of women who were positive for dengue were within the age group of 16 to 20 years. This report is not in agreement with earlier findings by Perret et al. (2015) and Wang et al. (2021) which stated

that older pregnant women were more exposed to dengue virus than the younger ones.

Also, this study showed that a slightly higher proportion of women positive for dengue were single which is consistent with previous studies which found that seropositive Dengue fever virus antibodies were more common in single persons compared to married people and widowed or divorced people (Adesina & Adeniji, 2016; Okonko et al., 2023). However, this is in contrast to the finding of Kolawole et al. (2017) that seropositivity rates for Dengue fever virus IgM antibodies were higher among married people.

The women who were positive for the dengue virus in this study were employed. This is in contrast to the result of a study conducted in Malaysia, which reported that a higher proportion of dengue-positive pregnant women were housewives (Mohamed-Ismael et al., 2021). However, another study reported an increased risk of dengue infection among manual labourers and this was attributed to the fact that they spend more time outdoors and produce a lot of sweat, which could increase the level of exposure to mosquitoes (Raji & DeGennaro, 2017; Wang et al., 2021).

Additionally, a higher proportion of women positive for dengue in this study had primary education. This is consistent with the result of the study by Wang et al. (2021) which showed that a higher proportion of pregnant women who tested positive for dengue infection had a lower level of education. In line with this, Harapan et al. (2018) reported that pregnant women with lower levels of education and income may live in worse conditions than others and lack knowledge regarding how to prevent and control dengue fever, increasing their risk of contracting the virus through Aedes mosquito bites.

Furthermore, a higher proportion of women who tested positive for dengue in this study resided in urban areas. Although this was unexpected, it is also worth noting that residing in an urban area may not necessarily translate to living in a hygienic and comfortable environment.

Consistent with this, previous studies reported a higher frequency of anti-dengue IgM antibodies among urban residents compared to rural residents. The result was attributed to poor city planning, which could provide an additional breeding environment for mosquitoes (Oladipo et al., 2014; Okonko et al., 2023).

CONCLUSION

This study has shown that there is a low dengue prevalence rate of dengue virus among pregnant women who attended the University of Port Harcourt Teaching Hospital, Rivers State, Nigeria, is low and suggests that dengue burden is low among pregnant women in Port Harcourt.

While this low prevalence rate is encouraging, it is important to continue to enlighten women on utilization of preventive measures including the use of insect repellent and wearing of long-sleeved shirts.

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Disclosure of conflict of interest

The authors have declared that no competing interests exist. Statement of ethical approval All authors hereby declare that all experiments

have been examined and approved by the University of Port Harcourt and University of Port Harcourt Teaching Hospital Research Ethics committees and have, therefore, been performed following the ethical standards laid down 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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