



Research Article

Serological Evidence of Dengue Virus among Pregnant Women Attending Selected Hospitals in Maiduguri, Borno State, Nigeria

¹Falmata Audu Gubio, ²Fatima Baba Ali, ²Fateema Umar Mustapha, ¹Mohammed Mustapha Mohammed, ³Aisha Muhammad Ali and ³Jamila Aliyu Jibrin

¹Department of Microbiology, Faculty of Science, University of Maiduguri, Borno State, Nigeria

²Department of Biological Sciences, Faculty of Science, Borno State University, Borno State, Nigeria

³Department of Obstetrics and Gynecology, State Specialist Hospital Maiduguri, Borno State, Nigeria

*Corresponding author's Email: fagubio2@gmail.com, doi.org/10.55639/607.272625

ARTICLE INFO:

ABSTRACT

Keywords:

Dengue fever,
Arboviral disease,
IgM,
IgG

Dengue hemorrhagic fever, a common arboviral disease, poses a significant global health concern with increasing incidence and prevalence. This study investigates the serological evidence of Dengue virus infection among pregnant women attending selected hospitals in Maiduguri, Borno State, Nigeria. We assessed 62 blood samples from pregnant women at four hospitals, finding a 6.67% overall prevalence of Dengue virus infection. The prevalence was consistent across hospitals, indicating widespread transmission in Maiduguri. The highest infection rate was observed among women aged 18-27 years (7.40%), aligning with previous findings on age-related susceptibility. This study emphasizes the need for enhanced surveillance, targeted control strategies, and the implementation of confirmatory testing methods to accurately assess Dengue virus transmission and its impact on vulnerable populations, particularly pregnant women. Further research is warranted to elucidate the mechanisms driving Dengue virus transmission and to inform effective public health interventions.

Corresponding author: Falmata Audu Gubio, **Email:** fagubio2@gmail.com

Department of Microbiology, Faculty of Science, University of Maiduguri, Borno State, Nigeria

INTRODUCTION

Dengue, a vector-borne arboviral disease, is caused by the Dengue virus, a member of the Flaviviridae family within the Flavivirus genus. It is primarily transmitted through mosquitoes and is characterized by its single positive-stranded RNA structure, comprising four serotypes: DEN V 1-4 (Mustafa *et al.*, 2015). The clinical spectrum of Dengue ranges from asymptomatic cases to severe manifestations such as Dengue Shock Syndrome (Mutheneni *et al.*, 2017).

In Nigeria, the prevalence of DEN V IgG antibodies varies significantly across different zones, with the Sahel savannah region of Maiduguri recording the highest prevalence at 81.7% (Baba *et al.*, 2009). However, Dengue fever is often underreported due to healthcare providers' lack of awareness regarding its pathogenesis and clinical forms, coupled with inadequate laboratory facilities for virus detection. Consequently, many cases are misdiagnosed as other endemic febrile illnesses like malaria or typhoid fever, or simply categorized as fever of unknown origin (Stoler *et al.*, 2014).

Of particular concern is the heightened risk Dengue poses to pregnant women and infants, potentially resulting in stillbirth, low birth weight, or premature birth. Infants infected with Dengue are also at higher risk of developing severe forms of the disease (Bello *et al.*, 2016).

Globally, Dengue fever is recognized as the most significant arthropod-borne viral disease, with its incidence dramatically increasing in recent decades (Ayukekbong *et al.*, 2014). Recent estimates from the World Health Organization suggest approximately 390 million infections per year, with 96 million manifesting clinically across 128 countries. While Dengue fever has been previously reported in Nigeria, recent isolated outbreaks indicate its emergence as an endemic threat (Botros *et al.*, 1989).

Pregnant women and infants are identified as a vulnerable group for developing severe Dengue clinical forms, according to international and national guidelines. However, there's no consensus in the literature regarding the adverse effects of Dengue on pregnancy and/or neonates

(Halstead, 2009). Maternal Dengue antibodies may play a dual role in the pathogenesis of the disease in neonates, offering protection initially but potentially enhancing the risk of severe manifestations due to suboptimal neutralizing antibodies.

Transmission of Dengue can occur perinatally, via blood transfusion, breast milk, or organ transplantation. The mean age of Dengue patients has increased post-2010 compared to previous decades, and the viral serotypes causing outbreaks have varied over time, as has the occurrence of severe Dengue fever.

MATERIAL AND METHODS

Study area

The study was conducted at the University of Maiduguri Teaching Hospital (UMTH), established in 1967 as part of the Health program plan of the defunct North-East Government. The hospital has undergone significant development, expanding its departments from 18 in 1985 to 31 by 1999, including specialized units such as the Public Health Care unit, Microbiology department, Immunology department, and Hematology department. Notable additions include the opening of the General Out-Patient Department (GOPD) in 1998 and the completion of the permanent structure for the Kidney center in the same year.

Study Population

Pregnant women attending the antenatal ward from April to September 2020 were included in the study

Eligibility Criteria

Pregnant women with febrile conditions, specifically those in their second trimesters, were eligible for participation.

Questionnaire

A structured questionnaire was utilized to collect demographic data, including age, occupation, and sex, which were considered potential risk factors for Dengue virus infection.

Collection of samples and Preparation

Venous blood samples were collected by venipuncture and centrifuged at 1500 rpm for 5 minutes to separate plasma and serum. The serum

was then dispensed into labeled plain EDTA containers. The Ma Duo Dengue IgG/IgG rapid test kit was utilized following the manufacturer's instructions. Briefly, the test device was placed on a clean, flat surface, and the serum was dispensed into the sample well (S-well). Sample diluent was added to the buffer well (B-well), and the test was timed for 20-25 minutes. Results were interpreted according to the manufacturer's guidelines, with any result outside this timeframe considered invalid.

Determination of IgM/IgG antibodies

The Aria Duo Dengue Ag-IgM/IgG rapid test, a lateral flow chromatography immunoassay, was employed to detect Dengue antibodies. The test strip contains two lines: the G line for IgG anti-dengue virus and the M line for IgM anti-dengue virus. Presence of burgundy lines at the G and/or M lines indicated positive results, suggestive of past or acute Dengue infection, respectively. Absence of these lines indicated a negative result. The presence of only the control line (C line) confirmed the validity of the test.

Statistical Analysis

Data analysis was performed using the Statistical Package for Social Sciences (SPSS version 21). Pearson chi-square test was utilized to assess the relationship between Dengue virus infection and age and sex. Statistical significance was set at $p < 0.05$

RESULT

The prevalence of Dengue virus infection among patients attending Maiduguri State Specialist Hospital was assessed, revealing that out of sixty-two blood samples tested, 4 (6.67%) were positive, with a higher prevalence among females compared to males. Table 1 summarizes the distribution of Dengue virus based on the hospital where samples were collected, including the University of Maiduguri Teaching Hospital (UMTH), University of Maiduguri Clinic (UNIMAID CLINIC), State Specialist Hospital (SSH), and Umaru Shehu Ultra-Modern Hospital (USUMH). The prevalence of infection across these hospitals was consistent, each showing approximately 6.67% positivity.

Table 1: Distribution of Dengue Virus based on hospitals

Name of hospital	Total samples	Positive samples	Positive samples (%)
UMTH	16	1	6.25
UNIMAID CLINIC	16	1	6.25
SSH	15	1	6.67
USUMH	15	1	6.67
Total	62	4	6.45

University of Maiduguri Teaching Hospital Maiduguri (UMTH), University of Maiduguri (UNIMAID CLINIC), State Specialist Hospital (SSH) and Umaru Shehu Ultra-Modern Hospital (USUMH).

Table 2 displays the distribution of Dengue virus based on age groups. Patients were categorized into three age groups: 18-27, 28-37, and 38-47 years. The prevalence of

infection varied across these age groups, with the highest prevalence observed in the 18-27 age groups at 7.40%.

Table 2: Distribution of Dengue Virus based on Age

Age	Total samples	Positive samples	Positive samples (%)
18 – 27	27	2	7.40
28 – 37	18	1	5.56
38 – 47	17	1	5.88
Total	62	4	6.45

Patients with positive IgM test results were classified as presumptive recent Dengue virus infections, while those with negative IgM results were considered unconfirmed cases and classified as negative for recent infection.

DISCUSSION

The findings of our study provide valuable insights into the prevalence and distribution of Dengue virus infection among patients attending healthcare facilities in Maiduguri, Nigeria. The overall prevalence of Dengue virus infection among the sampled patients was found to be 6.45%. This prevalence rate, although relatively low, is nonetheless significant in highlighting the presence of Dengue virus transmission within the study population.

One notable observation from our results is the higher prevalence of Dengue virus infection among females compared to males. While the exact reasons for this discrepancy require further investigation, it may be attributed to various factors such as differences in exposure to mosquito bites, behavioral patterns, or hormonal influences on immune responses (Achee *et al.*, 2015). However, additional studies are needed to elucidate the underlying mechanisms driving this gender disparity in Dengue virus infection rates.

The distribution of Dengue virus infection across different hospitals in Maiduguri also merits attention. Our findings indicate a uniform prevalence rate ranging from 6.25% to 6.67% across the four sampled hospitals. This suggests that Dengue virus transmission is not limited to specific healthcare facilities but rather occurs throughout the region, emphasizing the need for comprehensive surveillance and control measures

across all healthcare settings (Murray *et al.*, 2013).

Regarding age-based distribution, our results reveal varying prevalence rates of Dengue virus infection among different age groups. While patients aged 18–27 years exhibited the highest prevalence (7.40 %), those aged 28–37 years and 38–47 years showed slightly lower rates (5.56 % and 5.88 % respectively). These findings align with previous studies indicating a higher susceptibility to Dengue virus infection among younger age groups, possibly due to increased outdoor activities and exposure to mosquito vectors (Halstead, 2008).

It is noteworthy that patients with positive IgM test results were classified as presumptive recent Dengue virus infections, while those with negative IgM results were considered unconfirmed cases. This distinction is crucial for accurately assessing the recent transmission dynamics of Dengue virus within the study population. However, it is essential to acknowledge the limitations of IgM testing, including the potential for false-positive results due to cross-reactivity with other flaviviruses (Vasconcelos *et al.*, 2016). Therefore, confirmatory testing using molecular techniques such as PCR is recommended to validate IgM results and confirm acute Dengue virus infections

CONCLUSION

Our study provides significant insights into the prevalence and distribution of Dengue virus infection among patients in Maiduguri, Nigeria, revealing an overall prevalence of 6.45 %. The consistent prevalence rate across various hospitals indicates widespread transmission, emphasizing the need for comprehensive

surveillance and control measures. Additionally, younger individuals exhibited higher susceptibility, likely due to increased outdoor activities and exposure to mosquitoes. The limitations of IgM testing, including potential false positives, highlight the necessity of confirmatory molecular techniques like PCR. Our study underscores the importance of ongoing surveillance and targeted control strategies, advocating for further research to understand Dengue virus transmission and develop effective interventions in endemic areas

REFERENCES

- Achee, N. L., Gould, F., Perkins, T. A., Reiner Jr, R. C., Morrison, A. C., Ritchie, S. A., & Gubler, D. J. (2015). A critical assessment of vector control for Dengue prevention. *PLOS Neglected Tropical Diseases*, 9(5), e0003655.
- Ayukekbong, J. A. (2014). Dengue virus in Nigeria: current status and future perspective. *Hosts and Viruses*, 1(4), 106.
- Baba, M. M., Saron, M. F., Vorndam, A. V., Adeniji, J. A., Diop, O., & Olaleye, D. (2009). Dengue virus infections in patients suspected of malaria/typhoid in Nigeria. *J Am Sci*, 5(5), 129-34.
- Bello, O. A., Aminu, M., & Jatau, E. D. (2016). Seroprevalence of IgM antibodies to dengue fever virus among patients presenting with symptoms of fever in some hospitals in Kaduna State Nigeria. *infection*, 3(4).
- Botros, B. A., Watts, D. M., Soliman, A. K., Salib, A. W., Moussa, M. I., Mursal, H., ... & Farah, M. (1989). Serological evidence of dengue fever among refugees, Hargeysa, Somalia. *Journal of medical virology*, 29(2), 79-81.
- Halstead, S. B. (2008). Dengue virus-mosquito interactions. *Annual Review of Entomology*, 53, 273-291.
- Halstead, S. B. (2009). Antibodies determine virulence in dengue. *Annals of the New York Academy of Sciences*, 1171, E48-E56.
- Murray, N. E. A., Quam, M. B., & Wilder-Smith, A. (2013). Epidemiology of dengue: past, present and future prospects. *Clinical Epidemiology*, 5, 299-309
- Mustafa, M. S., Rasotgi, V., Jain, S., & Gupta, V. J. M. J. A. F. I. (2015). Discovery of fifth serotype of dengue virus (DENV-5): A new public health dilemma in dengue control. *Medical journal armed forces India*, 71(1), 67-70.
- Mutheni, S. R., Morse, A. P., Caminade, C., & Upadhyayula, S. M. (2017). Dengue burden in India: recent trends and importance of climatic parameters. *Emerging microbes & infections*, 6(1), 1-10.
- Stoler, J., Al Dashti, R., Anto, F., Fobil, J. N., & Awandare, G. A. (2014). Deconstructing "malaria": West Africa as the next front for dengue fever surveillance and control. *Acta tropica*, 134, 58-65.
- Vasconcelos, P. F., Lima, J. W., Raposo, M. L., Rodrigues, S. G., & Rosa, J. F. (2016). Dengue epidemic in Fortaleza, Ceará: randomized seroepidemiologic survey. *Revista de Saúde Pública*, 50, 10s