

Seroprevalence of Dengue among Febrile Outpatients in Three Primary Health Care Centers in Federal Capital Territory, Abuja, Nigeria

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ABSTRACT

Dengue virus has increased dramatically within the last 20 years, becoming one of the worst mosquito-borne human pathogens. This study aimed to determine the seroprevalence of Dengue virus among out patients with febrile illness in three primary health care centers in the Federal Capital Territory, Abuja, Nigeria. This study included One hundred and fifty patients both males and females within the age range 15 to 60 years. All participants of this study had symptoms of febrile disease at the outpatient clinic of Primary health care centres of Kuchingoro, Tunga Maje and Sheda, located in sub-urban areas of the Federal Capital Territory, Abuja. Dengue virus was determined in subject's serum by rapid fluorescence immunoassay (Wondfo Biotech, China). Overall prevalence of dengue virus was 15.3 %, males where more infected than females, but this was not statistically different. Age was a significant factor in the prevalence of dengue among study subjects ($P=0.012$). The sero-reactivity to dengue NS1 was higher 10.6%, while IgG and IgM sero-positivity was 9.3 and 7.3 % respectively. Most commonly reported symptoms amongst dengue virus positive subjects were Fever. Screening for dengue virus should be included in the comprehensive diagnostic pool for patients with febrile illness in the study area.

Keywords: Dengue, Fever, Outpatients, Primary Health care centre

INTRODUCTION

Dengue fever also known as break bone fever is more common in tropical and sub-tropical regions of the world (Normil, 2013). Dengue is a classical viral hemorrhagic fever spread by *Aedes aegypti* mosquito, common symptoms include but not limited to high fevers, body aches, nausea and rash (Dwivedi *et al.*, 2017). Dengue virus is a single positive-stranded RNA virus of the family *Flaviviridae* (Ghosh *et al.*, 2014). Recent findings suggest that as the virus infects human cells, host homeostatic processes such as autophagy and ER stress response, not to mention apoptosis, are triggered depending on the infected cell type (Ghosh *et al.*, 2014). The DENV genome is about 11000 bases of positive-sense, single stranded RNA (ssRNA) that codes for three structural proteins (capsid protein C, membrane protein M, envelope protein E) and seven nonstructural proteins (NS1, NS2a, NS2b, NS3, NS4a, NS4b, NS5) (Rodenhuis *et al.*, 2010). Dengue Fever is more common in tropical and subtropical climates. Most people who get dengue won't have symptoms. But for those that do, the most common symptoms are high fever, headache, body aches, nausea and rash. Most will also get better in 1–2 weeks. Some people develop severe dengue and need care in a hospital (Bhatt *et al.*, 2013).

The incidence of dengue has grown dramatically around the world in recent decades, with cases reported to WHO increased from 505 430 cases in 2000 to 5.2 million in 2018 (Roth *et al.*, 2018). Screening for dengue in most of the West African regions are not routine, as most fevers cases are settled or perceived to be malaria or typhoid. The aim of this study is to determine the seroprevalence of dengue virus among febrile patients attending outpatient's clinics of primary health care centers of Kuchingoro, Tungan Maje and Sheda, in the Federal Capital Territory, Abuja, Nigeria.

MATERIALS AND METHODS

Study area

Abuja is the capital and eighth most populous city of Nigeria. Abuja's geography is defined by Aso Rock, a 400-metre (1,300 ft) monolith left by water erosion. At the 2006 census, the city of Abuja had a population of 776,298 and 179,674 households making it one of the ten most populous cities in Nigeria (placing eighth as of 2006) (National population census, 2006), making it then the eighth most populous city in Nigeria. United Nations figures showed that Abuja grew by 139.7% between 2000 and 2010, making it the fastest growing city in the world. As of 2015, the city is experiencing an annual growth of at least 35%, retaining its position as the fastest-growing city on the

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African continent and one of the fastest-growing in the world (Euromonitor, 2015).

Study design

This cross-sectional descriptive study was carried out in the period August 2022 to March, 2023. Study site where three primary health care centers of Kuchingoro, Tugan Maje and Sheda. These primary health care centres are located in semi-Urban areas of the Federal Capital Territory, Abuja, Nigeria. A total of one hundred and fifty febrile patients (both male and female) within the age group of 15 to 60 years that had high temperature ($\geq 37.5^{\circ}\text{C}$) were included after providing verbal informed consent.

Ethical approval

Ethical approval for this study was obtained from the research ethics committee of the FCT Abuja primary healthcare development board with a reference No: FCT/PHC/ETC/21-08457.

Collection and analysis of blood samples

Five mls of whole blood was collected by venipuncture, separated and serum used for dengue virus antigen/antibody testing. The diagnosis of dengue fever was made by using Wondfo combined dengue NS1, IgG and IgM colloidal gold assay kit (Wondfo Biotech, China). Wondfo Combined Diagnostic Kit for Dengue NS1 Antigen and IgG/IgM Antibody is a rapid test for the detection of dengue NS1 antigen and IgG/IgM antibodies in human whole blood, serum or plasma as an aid in the diagnosis of dengue infection. The kits specificity for NS1 antigen is 100%, while it is 98.18% for dengue IgG and IgM. The Wondfo fluorescent immunoassay analyser system (FIA meter FS-113 plus) displays the result automatically on the screen based on the cut-off index <0.9 as Negative and ≥ 1.0 as positive.

Statistical Analysis

Data was expressed as percentage for the study participants. Chi Square test were used to determine association between variables. Odd ratio of association between demographic characteristics were also determined. The level of significance was set at $p < 0.05$. All data were analyzed using both SPSS Software version 20.

RESULTS

The prevalence of dengue virus was 23 (15.3 %). However, there is variation in the prevalence of infection with respect to other variables. Gender related prevalence showed that males have the highest prevalence of 13 (15.7%) than females with 10 (14.9%) (Table 1). Statistical analysis indicates a significant association ($P = 0.012$) between age and

dengue disease as its prevalence increase with decrease in age of the patients (Table 1).

With regard to sero-response positivity to dengue, NS1 was found to have the highest prevalence of 10.6% while IgG and IgM have 9.3 % and 7.3 % respectively (Table 2). Overall, dengue was most prevalent among study participants in Tugan Maje 10 (43.5%) with the least prevalence being among study participants from Sheda 5 (21.7%) (Table 3). Fever was found to be the most reported clinical symptoms at presentation at the primary health care centre among all dengue positive participants (Table 4).

DISCUSSION

In this study, the prevalence of Dengue virus sero-positivity was high among febrile patients studied. The prevalence report of 15.3 % of dengue in this study is close to 18 % reported in a multicenter study in Northern, Nigeria (Baba *et al.*, 2013) and 13.02 % in Southeastern, Nigeria (Osarumwense *et al.*, 2022). Higher dengue virus infections have been recorded in some other parts of Nigeria, Ilorin 30.8% (Ayukekbong, 2014) and 24.9% in Lagos (Ahmadu *et al.*, 2020). The differences in prevalence rates is highly related to differences in environmental conditions, climatic conditions and availability of mosquito preventive programs. The finding of this study, re-enact a need for providing programs to reduce mosquito presence and improve general environmental well-being.

Commonly reported clinical symptoms by dengue positive patients where Fever (100 %), this was followed by Malaise (69.6%) while the least was Abdominal cramps (8.7 %). Fever has been noted to be the most reported cause for hospital visitation in suspected patients with dengue virus infection (Otu *et al.*, 2019). As dengue could be missed, it is emphasized that routine screening for dengue virus among febrile patients should be instituted if resources are available. A more comprehensive and detailed diagnosis of febrile conditions is advocated. Clinical assumptions of febrile conditions as either malaria or typhoid without comprehensive screening should be avoided.

In conclusion, the prevalence of dengue was high; routine screening among febrile patients visiting outpatients should be screened for dengue virus

Limitation of Study: Molecular techniques where not used in this study to detect dengue virus infection

Conflict of Interest: None exists

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Authors Contribution: We both designed, participated in sample analysis, statistical analysis, manuscript drafting.

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Table 1: Prevalence of dengue virus amongst study participants

Parameters	Dengue positive	Percentage (%)	Odds Ratio	P value
Gender				
Males	13	56.5	1.0586	0.060
Females	10	43.4		
Age (Years)				
15-24	9	39.1		0.012*
25-34	5	21.7		
35-44	7	30.4		
≥ 45	2	8.8		
Total	23	15.3		

Table 2: Prevalence of NS1 antigen, Dengue IgG and IgM among study subjects

Antigen/Antibody	No. Positive	Percentage (%)
Ns1 antigen	16	10.60
Dengue IgG	14	9.30
Dengue IgM	11	7.30

Table 3: Seroprevalence of dengue among study participants in the three Primary health care centres.

Study area	Number Tested	No. Positive	Percentage (%)
Kuchingoro	41	8	34.8
Tugan Maje	54	10	43.5
Sheda	55	5	21.7
Total	150	23	

Table 4: Common clinical symptoms of dengue positive subjects.

Symptom	Total Positive	Percentage (%)	P value
Fever	23	100	<0.00001
Vomiting	5	10.2	
Abdominal cramps	2	4.1	
Headache	5	10.2	
Malaise	14	28.6	
Total	15		

REFERENCES

- Adesina, O.A. and Adeniji, J.A. (2016). Incidence of dengue virus infections in febrile episodes in ile-ife, Nigeria. *African Journal of Infectious Disease*. 10 (1): 21 – 24
- Ahmadu, S.M., Odekunle, B. O., Chinedu, I.N. Hussain, A.A., Biobelu, A., and Adekanye, U.A. (2020). Prevalence and Determinants of Dengue Virus Immunoglobulin among Febrile Patients Attending Naval Medical Centre Victoria Island, Lagos State. *Global Biosecurity*. 2020; 3(1): 32-38.
- Ayukekbong, J.A. (2014) Dengue Virus in Nigeria: Current Status and Future Perspective. *British Journal of Virology*. 1:106–111.
- Baba, M., Logue, C.H., Oderinde, B., Abdulmaleek, H., Williams, J., Lewis, J., Laws, T., Henson, R., Marcello, A. and D'Agaro, P. (2013). Evidence of Arbovirus Co-infection in Suspected Febrile Malaria and Typhoid Patients in Nigeria. *The Journal of Infection in Developing Countries*. 7: 51-59
- Bhatt, S., Gething, P.W., Brady, O.J., Messina, J.P., Farlow, A.W., Moyes, C.L. and Drake, J.M. (2013). The global distribution and burden of dengue. *Nature*. 496: 504-507
- Dwivedi, V. D., Tripathi, I. P., Tripathi, R. C., Bharadwaj, S. and Mishra, S. K. (2017). Genomics, proteomics and evolution of Dengue virus. *Briefings in functional genomics*. 16(4): 217–22
- Euromonitor. (2015): World's Fastest Growing Cities are in Asia and Africa. Archived from the original on 17 November 2015. Retrieved 26 October 2015
- Ghosh, R.S., Sadigh, B., Datan, E., Lockshin, R.A. and Zakeri, Z. (2014). Regulation of cell survival and death during Flavivirus infections. *World Journal of Biological Chemistry*. 5(2): 93–105.
- Mukherjee, D., Das, S., Begum, F., Mal, S. and Ray, U. (2019). The Mosquito Immune System and the Life of Dengue Virus: What We Know and Do Not Know. *Pathogens*. 13;8(2):77-80.
- National Population Commission (2006). National population census 2006; Abuja Fact sheet PP: 215-225.
- Normile, D. (2013). Tropical medicine. Surprising new dengue virus throws a spanner in disease control efforts. *Science*. 342(6157): 415-419.
- Osarumwense, O., Nkechukwu, I., Favour, E., Izuchukwu, I., George, C., Umale, A. and Okechukwu, E. (2022). The Prevalence of Dengue Virus and Malaria Co-Infection among HIV-Infected Patients within South Eastern Nigeria. *Advances in Infectious Diseases*. 12:106-117.
- Otu, A., Ebenso, B., Etokidem, A. and Chukwuekezie, O. (2019). Dengue fever - an update review and implications for Nigeria, and similar countries. *African Health Sciences*. 19(2):2000-2007.
- Rodenhuis, Z.I.A., Wilschut, J. and Smit, J.M. (2010). Dengue virus life cycle: viral and host factors modulating infectivity. *Cellular and Molecular Life Sciences*. 67 (16): 2773–2786