Prevalence of Dengue Virus Antibody among Residents of a Rural Community in Southwestern, Nigeria

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Abstract: Dengue is an endemic mosquito borne viral disease which is sparingly considered during routine screening for agents of febrile illnesses in Nigeria even though it has been reported across major cities in the country. We investigated the prevalence of dengue virus infection among dwellers of a rural community in Osun State, Southwestern Nigeria. Whole blood samples were collected from consenting participants in Hospitals and clinics within the community and tested for DENV IgM antibody using an ELISA (Wkea Medical Supplies, Guanzou China) technique. Out of a total number of 120 serum samples screened, 57.50% tested positive for dengue IgM while 42.50% were negative. Female samples recorded highest positivity of 37.5% compared to males having 20%. There was a statistically significant difference in the prevalence of dengue IgM antibody by gender (X^2= 8.89, *df*= 1, &*p*= 0.003). There exist a statistical association between dengue IgM antibody and length of stay in the community (p<0.001); occupation (p=0.0175); travel history (p=0.003) as well as use of mosquito nets and insecticides (p<0.001). Our findings show a relatively high prevalence of recent dengue viral infection within the rural community which needs to be studied further. Hence, there is the need to constantly screen for dengue during all cases of febrile conditions.
Key words: Dengue virus, ELISA, Rural Community, IgM Antibody.

INTRODUCTION

Dengue, a mosquito-borne viral infection caused by dengue virus (DENV) is a disease of huge public health importance globally with half of the world's population presently at risk. Dengue virus, possess a positive sense ssRNA genome and belongs to the Flavivirus genus of the Flaviviridae family (Amarasinghe *et. al*. 2011). It is chiefly transmitted by the female *Aedes aegypti* mosquito and less significantly by *Aedes albopictus* in tropical and sub-tropical regions of the world (Faneye *et. al.,* 2013). Four major serotypes of dengue (DEN1-4) which are antigenically divergent are responsible for disease in humans and recovery from infection by either of the serotypes normally provides a lifelong immunity, but with a temporal cross-immunity to other serotypes (Faria *et al.*, 2016; Hamel *et al*., 2016; WHO, 2018;). Most recent estimates of the global burden of dengue indicated 390 million cases annually out of which only 96 million manifest clinical symptoms (WHO, 2018). About 500,000 people with severe dengue require hospitalization yearly with 2.5% deaths (Bhatt *et al.,* 2013; WHO, 2018). Dengue virus is responsible for three major disease manifestations including; dengue fever, dengue hemorrhagic fever (DHF) and dengue shock syndrome (Bhatt *et al.,* 2013). Currently, there are no effective/commercially available vaccines or therapeutic drugs to prevent or treat dengue virus infections (Nedjadi *et al.,* 2015).

Arthropod-borne viruses are widespread in Nigeria due to a very favorable climate which promote the multiplication of mosquito vectors responsible for the trans-mission of viral diseases like dengue, yellow fever, Chikungunya (*Aedes* spp.) as well as malaria (*Plasmodium* spp) (Bhatt *et al.,* 2013). Dengue co-infection with other arbovirus infections is therefore not uncommon and has been described in the country (Baba *et al*., 2011). The first isolated case of dengue in Nigeria occurred in the 1960s, but dengue is not usually reported with most cases often undiagnosed, misdiagnosed as malaria or referred to as fever of unknown cause (Carey *et al.*, 1971, Amarasingvhe *et al*., 2011).

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However, the activities of dengue virus in Nigeria have been indicated by several reports of immune responses to the infection. For instance, Faneye *et al.* (2013) and Oladipo *et al.* (2014) in Ogbomoso reported Dengue virus IgM seroprevalences of 30.8% among febrile children and17.2% among healthy children respectively. Hamisu *et al.* (2017) reported dengue IgM prevalence of 37.4% in Borno State. Similarly, dengue IgG/malaria co-infection was recently reported in Abuja with a prevalence rate of 44.2% (Mustapha *et al.,* 2017), while Idoko *et al.* (2015) only reported a 1.3% prevalence rate for dengue IgM/malaria coinfection in Kaduna. These data are consistent with the fact that dengue is an endemic and an important cause of fever in Nigeria. However, the disease is neglected, under recognized and under reported due to lack of awareness by health care providers and lack of prioritization by the public health authorities. Majority of previous surveillance efforts for dengue were conducted in urban cities with paucity of information on the prevalence of dengue viral infection among rural dwellers. This study therefore seeks to determine the prevalence of dengue IgM antibody in the rural community in Osun State, Southwest Nigeria.

MATERIALS AND METHODS

Study Area

The study area is a rural community located in Osun State Nigeria which is directly opposite and adjacent the Federal forest reserve. The community play host to the University where this study was conducted and staffs and students of the University lives and interact with the community.

Inclusion criteria

Any individual who live in the community and have visited health care facilities in the community for symptoms of malaria or any form of fever were included in the study.

Ethical Clearance

Ethical clearance was obtained from the authorities of Joseph Ayo Babalola University, Ikeji-Arakeji.

Collection of Sample

A total of 120 blood samples were collected from hospitals and clinics in a rural community of South West, Nigeria. Using a sterile syringe and needle 4ml whole blood samples were collected by venipuncture from consenting individuals into plain bottles after which serum was recovered by centrifugation at 2500 rpm for 8minutes. The tubes were labeled appropriately with the participants identifiers and the serum samples were stored in cryovials at -20^0C until analysis.

Dengue IgM Antibody Detection

The dengue virus antibody was detected in the serum using a qualitative ELISA technique with a commercial ELISA kit (Dengue IgM Enzyme Immunoassay Kit; WKEA Medical Supplies, China) by following the manufacturer's instructions.

Interpretation of Results

Serum samples having the ratios of ≥1.1 in relation to the optical density of standard 2 of the kit were indicated as positive, whereas those with ratios <0.9 in relation to the optical density of standard 2 were taken to be negative.

Data Analysis

Data generated from the research were analyzed using SPSS version 20 from SPSS Inc., USA. Chi square analysis was used to determine significance in the occurrence of Dengue virus IgM in relation to different variables at 95% confidence level.

RESULTS AND DISCUSSION

Dengue virus is no doubt a major contributor to febrile illness in Nigeria, although is not usually screened for in many hospitals and clinics not until malaria test turns negative and fever remained high. Also, dengue is not usually reported with most cases often undiagnosed or better still misdiagnosed as malaria or referred to as fever of unknown cause (Amarasinghe *et al*., 2011). Several studies conducted across major cities in Nigeria have established the activities of dengue in Nigeria with DEN IgM/IgG antibody prevalence range of 1.8-44.4% (Idoko *et al.,* 2015; Mustapha *et al*., 2017).

In this study dengue virus IgM antibody indicative of recent infection was investigated with an overall prevalence of 57.50% (Figure. 1).

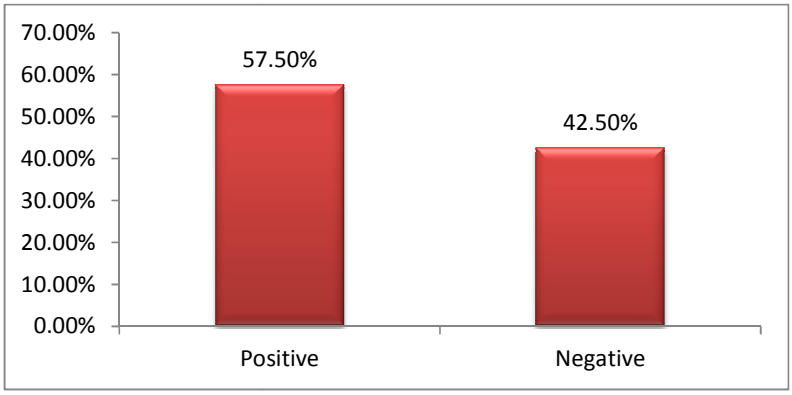

Figure 1: Prevalence of Dengue in a rural community in South West Nigeria

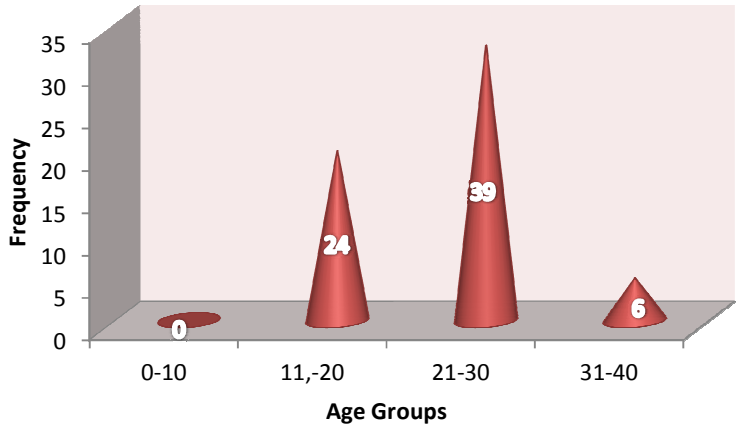

Figure 2: Frequency of Dengue virus infection among different age groups in a rural community in South West Nigeria.

Table 1: IgM antibody profile of individuals tested in a rural community in South West Nigeria against Dengue virus

Age (Years)	n	No of IgM positive cases	Percentage of IgM positive individual (%)
0 – 10	3	0	0
11 – 20	51	24	20
21 – 30	8	39	32.5
31 – 40	18	6	5
Total	120	69	57.5

Table 2: Sex distribution of Dengue virus IgM in a rural community in South West Nigeria

Sex	No Screened	No of +ve samples	%+ve	No of -ve samples	%-ve
Male	87	45	20	42	35
Female	33	24	37.5	9	7.5
Total	120	69	57.5	51	42.5

Table 3: Demographic and behavioral characteristics of subjects screened for dengue virus IgM antibody in a rural community in Nigeria

Characteristics	Number of subjects Tested	Number Positive (%)	*p-value*
Length of Stay (Days)			
Less than 30	31	10 (32.3)	<0.001*
30-60	32	15 (46.9)	
Over 60	57	44 (77.2)	
Occupation			
Farming	41	29 (70.7)	0.0175*
Trading	37	20 (54.1)	
Students	29	10 (34.5)	
University Staffs	13	10 (76.9)	
Travel History			
Often	66	30 (45.5)	0.003*
Less often	54	39 (72.2)	
Use of Mosquito nets and Insecticides			
Yes	57	20 (35.1)	<0.001*
No	63	49 (77.8)	
Total			

Note: *Significant for $p<0.05$.

Our findings (57.5%) showed a higher prevalence compared to 17.2% by Oladipo *et al.* (2014) in Ogbomoso, 37.4% by Hamisu*et al.* (2017) in Borno State, as well as 1.8% DEN IgM antibody reported by Idoko *et al*. (2015). The high prevalence obtained from our study may be attributed to the high population of the Dengue virus vectors in the study location since our study location is a rural area purely located in the forest region of Osun State in the South West of Nigeria. The Federal forest reserve forms part of the location of our study site Other contributing factors might include timing of sampling as epidemics of Dengue virus are consistent with the rainy season which provides favorable breeding sites for the insect vectors (Keating, 2001). However, our result is a bit similar to the findings of Oyinloye *et al.* (2016) who reported Dengue virus prevalence of 74.4% in the North-East Nigeria.

From our study, 37.5% females tested positive for DEN IgM antibody compared to 20% male's positivity (table 1). This agrees with the report of Hamisu *et al.* (2017) who reported 41.1% for IgM for females and 22.2% IgM for males. These findings could be due to dressing patterns of the study population where women tends to adorn short dresses thereby exposing their bodies to mosquito bites. Also females are more involved in most our door activities in this locality like going to market places which are usually located around the forest areas of the study location. Hence there is a statistically significant difference in the prevalence of dengue virus by gender in our study (p= 0.003).

Highest prevalence of DEN IgM antibody was discovered between the age group 21-30 (32.5%) in our study (figure 2). This corroborates to some extent the findings of Hamisu *et al.,* (2017) with 40% prevalence between age group 15-30 and Oyinloye *et al*., (2016) with 28.9% prevalence within the age group 19-23. Humoral immune response to viral infections is usually mediated with the production of antibodies which may be of distinct subsets. IgM antibody normally appears first in the serum in the first few weeks of infection following the manifestation of symptoms. The presence of IgM antibody is an indication of a recent or an on-going infection. It is usually replaced by IgG antibody which can persist for years in the serum as an evidence of a resolved infection.

The detection of dengue virus IgM antibody in this study shows a recent infection. Those that tested positive before reaching a window period could help amplify the disease transmission in the study location. This could happen when *Aedes egypti* mosquitoes feed on their infected blood and the go on to bite other individuals in the same environment.

In conclusion, there is need for routine screening for dengue virus at various hospitals and clinics in all cases of febrile illnesses in order to quickly ascertain the root cause of fever. Also, further molecular studies on the circulating serotype of gangue virus in Nigeria are needed.

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