American Journal of Biomedical Sciences
ISSN: 1937-9080
nwpii.com/ajbms

Dengue Virus Infection among Voluntary Blood Donors in Osogbo, Southwestern Nigeria

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Received: 28 April 2017; | Revised: 21 July 2017; | Accepted: 30 July 2017

Abstract

Dengue virus is one of the causative agents of viral haemorrhagic fever, which is transmitted primarily through Aedes mosquitoes. Transmission of the virus through non-vector sources had been proven, although, it is the most common arthropod-borne viral infection in human. This study was carried out to determine the prevalence of Dengue Virus amongst voluntary blood donors in Osogbo, southwest Nigeria. Ninety one voluntary non-remunerated donors that satisfied donor suitability criteria in Nigeria; having been considered fit based on physical assessment, responses provided to Blood Donors' questionnaire, and tested negative by both rapid diagnostic and ELISA techniques to HIV 1 & 2, HBV, HCV and syphilis were screened for anti-Dengue IgM antibody using Enzyme Linked Immuno-Sorbent Assay (ELISA). It was observed that most of the donors (56.04%) fall within age group 28-37 years, while none of the participant was older than 47. In terms of gender distribution, men (86.81%) were in the majority. Marital profile showed that most of the participants were unmarried (72.53%); while literates account for 58.24%. The seroprevalence of IgM antibodies showed that only two (2.2%) participants were positive for Dengue virus. Result showed that there is low prevalence of Dengue virus among voluntary blood donors in Osogbo. Monitoring the trends in prevalence of transmissible infectious agents in blood donors will provide a mechanism to evaluate the safety of the blood supply. It is hereby recommended that surveillance be sustained on all emerging and re-emerging infectious diseases that have potentials of being transmitted through blood transfusion, dengue virus inclusive.

Keywords: Dengue, transfusion transmissible infection, haemorrhagic fever, blood safety, ELISA.

1. Introduction

Dengue virus (DENV) is one of the causative agents of viral haemorrhagic fever [1]. The virus circulating in the blood of viraemic human is ingested by female mosquitoes (Aedes) during feeding. The virus then infects the mosquito mid-gut and subsequently spreads systemically over a period of 8 - 12 days. After this extrinsic incubation period, the virus can be transmitted to other humans during subsequent probing or feeding [2].

However, incidences have been reported when dengue viruses were transmitted without the involvement of the Aedes vector. Cases of percutaneous transmission via needle stick injuries, mucocutaneous transmission through a blood splash to the face, vertical transmission and transmission via bone marrow transplant were reported [3].

Transmission through mucocutaneous exposure was previously incriminated as the source of DENV infection in a health worker in the United State [4]. Recent report had shown that exposure during a laboratory-based mosquito infection and transmission experiments resulted in an acute DENV infection of the laboratory scientist [5]. In this instance, the experiments involved exposing colony-reared uninfected mosquitoes to an artificial blood meal containing DENV-2 via a membrane feeding apparatus. The high sequence homology and phylogenetic relatedness between the virus obtained from the patient and the virus used during the vector competence experiments confirms that they were identical strains and strongly suggests that the patient acquired the infection during the course of this procedure [5].

Infection with Dengue virus causes classic dengue fever (DF), dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS), but asymptomatic infection could also occur. After an incubation period of 4--10 days, infection by any of the virus serotypes can produce a wide spectrum of illness, while some infections manifest no symptom [6].

Although dengue has been documented to be in Africa continent for about 90 years ago in a retrospective serosurvey by Kokernot *et al* which suggested that dengue in Africa existed as far back as 1926–1927[7], Dengue Virus 1(DEN-1), Dengue Virus 2(DEN-2) and Dengue Virus 3(DEN-3) were isolated for the first time in 1960 in Nigeria [8]. Subsequently, dengue has been found to occur in Senegal and Burkina Faso (predominantly being transmitted in sylvatic cycles), and possibly in other tropical rainforests in western Africa [9, 10, 11]. The literature revealed that the prevalence of dengue virus varies from one population to another and constitute a source of concern in tropical countries, Nigeria inclusive [12].

The aim of this study was to determine prevalence of Dengue virus among asymptomatic adults who have been found fit as blood donors in Osogbo, Southwest Nigeria.

2. Materials and Methods

2.1 Study Area

A total of 91 voluntary non-remunerated donors that satisfied donor suitability criteria in Nigeria; having been considered fit based on physical assessment, responses provided to Blood Donors' questionnaire, and tested negative by both rapid diagnostic and ELISA techniques to HIV 1 & 2, HBV, HCV and syphilis were recruited for this study. Hence, every participant was a consenting individual with no symptom of any febrile illness or haemorrhagic disorder that approached the Blood Bank for voluntary blood donation between January and December, 2015. The participants' ages were between 18 and 65 years, with a minimum body weight of 50kg and PCV of ≥37% for male; and 45kg and PCV of ≥35% for female respectively.

2.2 Sample processing

Five milliliters of venous blood was drawn aseptically from each participant by venipuncture into vacuum EDTA tube. The specimens were centrifuged at 1200 revolution per minute (rpm) for

5 minutes to harvest plasma into a microtube for the generation Enzyme Immuno-Assay (ELISA) kit produced by DIA.PRO, Italy.

Diluted donor's plasma and neutralizing reagent were added to the microwells before one hour incubation at 37^0C. The controls were treated accordingly while A1 well was reserved for blanking. After washing with microplate washer, a volume of 100 µl of horseradish peroxidase conjugated polyclonal antibodies to human IgM (enzyme conjugate) was added to every well before 60 minutes incubation. Final 20 minutes incubation was preceded with addition of chromogen, and the reaction was stopped. During incubation, the specific immunocomplex formed in case of presence of anti-Dengue virus (IgM) in the sample, was captured on the solid phase which generates an optical signal that is proportional to the amount of anti-Dengue virus antibodies present in the sample.

The commercially prepared positive and negative controls were treated alongside the specimens. A cut-off value was determined and results were interpreted as positive and negative according to manufacturer's instructions [13, 14].

Dengue Virus IgM antibodies testing with third

3. Results

Out of the 91 voluntary blood donors recruited for Dengue virus IgM screening, 51 (56.04%) were in the active age group (28–37 years) accounting for the majority of the participants. None of the participant was older than 47. In terms of gender distribution, men (86.81%) were in the majority. Marital profile showed that most of the participants were unmarried (72.53%); while others were married. Most of the research participants were literate, with 53 (58.24%) among them having post secondary school qualifications (Table 1). The results of the seroprevalence of IgM antibodies showed that only two (2.2%) participants were tested positive. The two seropositive individuals were men within the age group of 28–37 years (Figure 1). When subjected to pearson's chi square analysis using statistical package for science students (SPSS) version 20, none of the demographical variables was established to have effect on positivity to anti-Dengue IgM antibodies (Table 2) as all p values > 0.05).

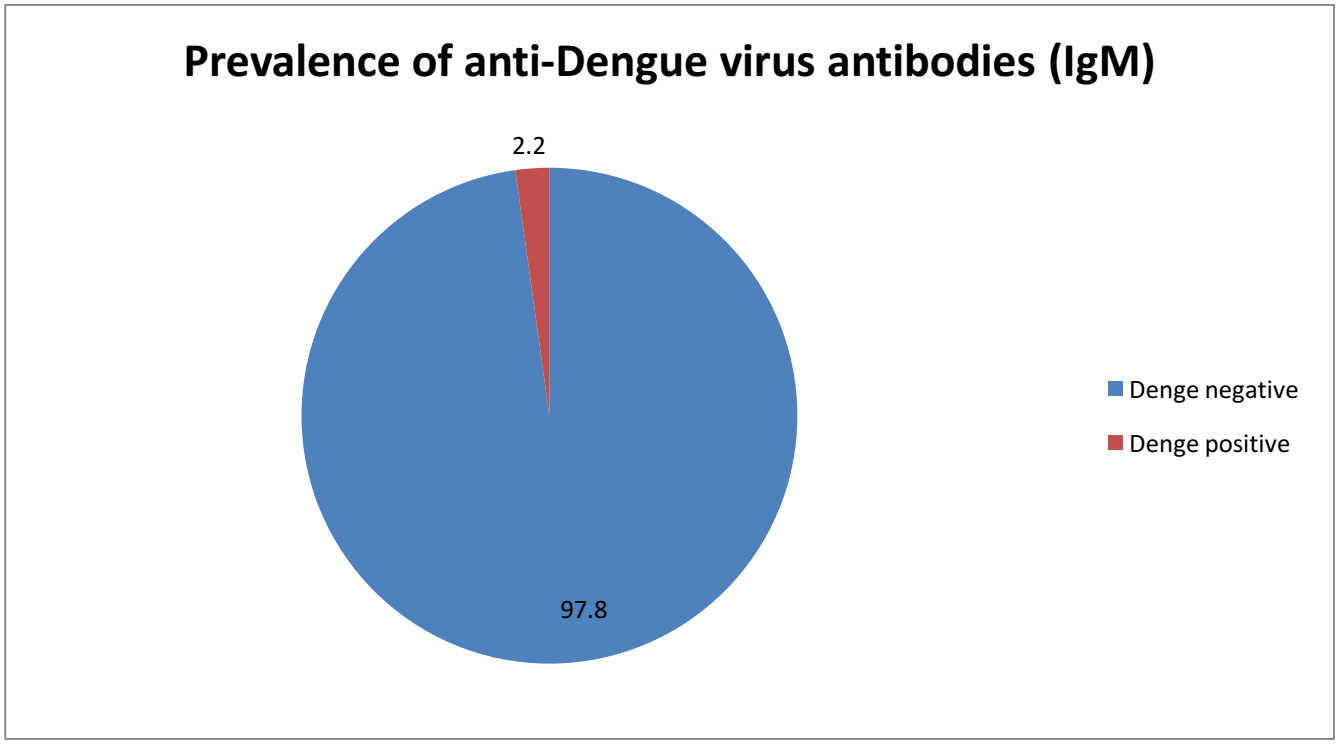

Figure 1: Prevalence of anti-Dengue virus antibodies (Ig M) among voluntary blood donor

Table 1. Socio-demographic characteristics of voluntary blood donors recruited

Characteristics	Frequency	%
Age (Year)		
18-27	35	38.46
28-37	51	56.04
38-47	05	5.50
Gender		
Male	79	86.81
Female	12	13.19
Marital status		
Married	25	27.47
Single	66	72.53
Educational level		
Illiterate	04	4.40
Primary school	12	13.19
Secondary schoo	15	16.48
Undergraduate/Graduate	53	58.24
Arabic education only	07	7.69
Occupation		
Unemployed	02	2.20
Traders	04	4.40
Professionals/Business men	31	34.06
Students	48	52.75
Civil Servants	06	6.59

Table 2. Effect of socio-demographic characteristics of voluntary blood donors on positivity to anti-Dengue virus antibodies (Ig M)

	p-value	Comment
Age	0.421	Not significant
Gender	0.448	Not significant
Marital status	0.319	Not significant
Education	0.265	Not significant
Occupation	0.306	Not significant

4. Discussion

Prevalence of Dengue virus infection among voluntary non remunerated donors in Osogbo is low (2.2%) and the figure may be considered negligible when the 2% possibility of false positive result is considered in a kit with 98% specificity [15, 16, 17]. This result agrees with the results of study conducted by Baba *et al* in 2009 where dengue virus prevalence for Nigeria and Ibadan (a

southwestern Nigeria city) were 0.67% and 0.9% respectively [18]. Incidentally, a positive IgM result on plasma sample suggests the infection occurs in the previous one to two months before sample collection [19]. Although, higher prevalence was recently reported in some studies in Nigeria[20, 21], the testing method used for these studies predisposes to cross-reactivity to other flavivirus infections or yellow fever vaccination, as IgG screening technique was adopted by most of these researchers who worked on symptomatic patients.

Transmission of dengue virus through blood transfusion becomes a blood safety issue because, possibility of contracting the virus through exposure to blood from non- vector sources was proven [4, 5]. More so, the Aedes vector usually transmits this infection through blood meal too [2]. However, it was postulated that family blood donation and remunerated blood donation, mostly found in developing countries is statistically associated with higher prevalence of infectious diseases [22, 23]. Hence, this low prevalence among voluntary blood donors confirms the concept that this group constitutes the low-risk group in terms of infection transmission.

5. Conclusion

Monitoring the trends in prevalence of transmissible infectious agents in blood donors will provide a mechanism to evaluate the safety of the blood supply. Increase in incidence and prevalence rate of an infectious disease agent is not uncommon because of interplay of factors like changes in population risks; the introduction of new screening technique, migration and occurrence of epidemics.

It is hereby recommended that surveillance be sustained on all emerging and re-emerging infectious diseases that have potentials of being transmitted through blood transfusion, dengue virus inclusive. Recruitment and patronage of voluntary blood donors remains the safest approach to blood transfusion practice, and stakeholders in Nigeria and other Africa countries should embrace the culture religiously.

The limitation of the study includes non-availability of support to fund procurement of reagents in quantity beyond 91 samples, having dedicated 5 wells to run controls in a 96 well ELISA plate. This is due to ongoing recession in Nigeria primarily, and non-availability of data to be used as template for sample size determination in terms of prevalence of dengue virus among blood donors in Nigeria.

Conflict of interest

The author declares that there is no conflict of interest.

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