

Serological Evidence of Recent Dengue Virus Infection Among Febrile Children in a Semi Arid Zone

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ABSTRACT

Presence of Dengue virus has been established in Nigeria; owing to the severity of this disease and its attendant complications we investigated the presence of this virus serologically in febrile Nigerian children under 5 years of age from Ilorin. Blood samples were tested from 130 children under the age of 5 years for the presence of IgM antibodies against all the Dengue virus serotypes using ELISA Kit by IVD research, Inc® California USA. A prevalence rate of 40(30.8%) was recorded, with male children having a higher rate of 30(44.1%) while female children recorded 10(16.1%). Age range distribution was highest in group 3>5 years with 10(62.5%) and lowest in age group <1 with 12(16.2%). Our findings in this study indicate potential endemicity of this virus infection in some parts of Nigeria. We therefore recommend further studies into circulating serotypes in human populations and urgent preventive and control measures of this emerging infectious disease.

Keywords: Children, Dengue Virus, IgM Antibodies, Ilorin

1. INTRODUCTION

Dengue virus is one of the most important vector-borne diseases of modern man, with about 50million infections per year (Domingo *et al.*, 2006). Dengue is an acute viral illness characterised by fever, muscular pain, rash, headache and sometime thrombocytopaenia. More severe forms of dengue infection include Dengue Hemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS) with both forms having a high mortality rate (Garg, 2011). Dengue virus belongs to the family Flaviviridea, which are spherical enveloped and about 40-50 nm in diameter. They consist of an inner core and covered by a lipid envelope covered with glycoprotein peplomers. They contain a linear single stranded RNA genome of about

11kb size, the genome is of positive polarity which is 5' capped but not 3' polyadenylated and it is infectious.

Dengue virus has 4 antigenically distinct serotypes, types 1 to 4, with each serotype capable of causing severe disease. The virus is maintained in a mosquito-monkey cycle with lower primates serving as forest reservoirs. However, only Dengue among the arboviruses have adapted to the human and domestic environment to the point that the forest cycle is no longer required for maintenance (Gubler, 2002; Baba *et al.*, 2009). The principal vector of this virus is *Aedes egypti* others include *Aedes albopictus*. Dengue occurs primarily in tropical countries of Asia, Oceania, America and Africa. More than 2.5 billion people live in areas at risk to Dengue infection.

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In Africa Dengue virus was first isolated in Ibadan, Nigeria around 1960 (Amarasinghe *et al.*, 2011), since then there have been several reports of isolated outbreaks of Dengue infection till date, although previous reports have indicated massive under-reporting of this infection possible due to unavailability of sufficient diagnostic tools in our health institutions (Baba and Talle, 2011). Previous report have also hypothesised that existence of cross reactive antibodies, possibly that of Yellow fever virus has prevented the emergence of Dengue fever as a predominantly severe infection in Africa (Amarasinghe *et al.*, 2011). There is also paucity of data regarding Dengue virus infection and its various manifestations in children from Nigeria. It is with this in mind we designed this study to investigate the prevalence of Dengue virus infection in young Children of 5 years and below in Ilorin, Central Nigeria.

2. MATERIALS AND METHODS

2.1. Study Area

The study was carried out at Ilorin capital City of Kwara State, North central, Nigeria. Our study site was the Specialist Hospital Ilorin the second largest referral Centre in the State, serving both the State and adjoining border towns of neighboring States of Niger and Kogi.

2.2. Study Population

Children under 5 years of age who were presenting with persistent fever were enrolled into the study. Parents of all participants consented to their wards being included in the study after full explanation of the study protocol to them.

Sample collection and Processing: About 2mls of blood was drawn aseptically into plain sample bottles, before serum was separated and spun down. Separated serum was then stored at -20°C until further use. Serum samples were then tested for the presence of group specific Dengue (types 1-4) IgM antibodies using ELISA test kits by IVD Research, Inc® Carlsbad, California USA. Controls were read first using an ELISA microplate reader, before the test samples. Results were interpreted following manufacturer's instructions.

2.3. Data Analysis

All generated data was analysed using Statistical package for social sciences SPSS version 15.0 for windows, tables were used to illustrate relationship of variables and comparisons made using the Chi-square test, a p-value of <0.05 was reported as significant.

Table 1. Dengue IgM positivity among under 5 children in Ilorin in relation to Gender

Gender	No tested (%)	No positive (%)
Male	68(52.3)	30(44.1)
Female	62(47.7)	10(16.1)
Total	130(100)	40(30.8)

Table 2. Dengue IgM positivity among under 5 children in Ilorin in relation to Age group

Age group	No tested (%)	No positive (%)
>1	74(57)	12(16.2)
1>3	40(30.7)	18(45)
3>5	16(12.3)	10(62.5)
Total	130(100)	40(30.8)

3. RESULTS

A total 130 children under 5 years presenting with various fevers were screened for the presence of Dengue specific IgM antibodies, consisting 68 male and 62 female children. An overall prevalence rate of 40(30.8%) was recorded among our study population.

Table 1 shows the Gender distribution of Dengue IgM positivity among the under 5 children in Ilorin metropolis. From the table male children recorded a higher prevalence rate with 30(44.1%) while female children recorded 10(16.1%).

Table 2 shows the Ade range distribution of seropositivity of Dengue IgM antibodies among the study population, from our results, age range 3 > 5 years recorded a seroprevalence rate of 10(62.5%), followed closely by age 1>3, with 18(45%) and lastly age group <1 with 12(16.2%).

4. DISCUSSION

From previous reports, Dengue virus has been shown to be actively circulating in various parts of Nigeria (Dawurung *et al.*, 2010; Baba and Talle, 2011). There is also evidence of high vector density in densely populated Nigerian cities (Adeleke *et al.*, 2010). This combined, justifies the high prevalence rate of 30.2% recorded in our current study. The prevalence rate observed in our current study is far higher than that recorded in a previous study done in various ecological zones in Nigeria, which recorded a rate of 38.1% IgG seropositivity and 0.6% IgM seropositivity in Grassland savannah (Baba *et al.*, 2009). This corresponds in terms of climatic condition with our study site Ilorin. Our report of 38.1% is indicative of potential endemicity of Dengue virus infection in Ilorin, this is a significant public health finding as this supports previous hypothesis

of low detection rate of Dengue in potentially endemic regions in Nigeria due to clinical oversight and lack of appropriate diagnostic facilities (Baba and Talle, 2011). The implication of this is a potential risk for Dengue Shock Syndrome (DSS) as multiple serotypes could be circulating among the human population in the study region putting them at risk of immune mediated DSS when previously infected persons become reinfected with a heterologous serotype (Gubler *et al.*, 2007). Surprisingly this has not been so in the past as only scanty report of serious life threatening infections of Dengue has been reported (Omilabu personal communication). Although it has been suggested that preexisting antibodies to yellow fever might be serving a protective role to the emergence of severe dengue infections in Africa (Amarasinghe *et al.*, 2011), this is still yet to be scientifically substantiated. Past research has however shown the success of previous Yellow fever mass vaccination campaigns in Nigeria (Adu *et al.*, 1996); continuous surveillance is still needed to reevaluate the level of herd immunity among young Nigerians before any categorical statements can be made. However this is a gap in knowledge for Nigerian researchers to look into. A significant limitation to our study was lack of clinical information to support our findings, this was due to unforeseen challenges in logistics and communication between the records department of our study institution and the investigators. However subjects were recruited into the study based on the presentation of a fever.

In our current study Dengue virus infection was significantly higher in males than in female children, $p < 0.05$ (X^2 test). This is however not in agreement with some past studies done on dengue such as that of Teixeira *et al.* (2012) who reported on sero-incidence of Dengue infection in pre-school children in Brazil and Baba *et al.* (2009). With regards to Age group, a higher prevalence was observed in age group 3>5, in respect to other age groups. This is expected because the mosquito vector for Dengue responsible for the transmission of the infection *Aedes aegypti*, is a predominantly day biting, outdoor vector, as a result younger children are at a lower risk of infection because they spend majority of their time indoors unlike the older children who are old enough to play and spend more time outdoors. In addition, rapid urbanisation in Africa has resulted in increase in vector density as a result of human practices that promote mosquito breeding (Monath, 1994). Our study thus highlights the importance of proper vector control and improved sanitation practices around households and school premises. Our inability to identify

the various serotypes among our study population is however regretted as this would have given insight into the predominant serotypes in the region; a recent study has however identified Dengue 2 as predominant serotype in some parts of Nigeria (Baba and Talle, 2011). This is however open for further study.

5. CONCLUSION

We have reported seroprevalence of acute Dengue virus infections in children, from North central, Nigeria for the first time. Our report has revealed that Dengue infection has reached an alarmingly high level among this population of children, which is indicative of potential endemicity of the infection in the general population of Northern Nigerians. This finding calls for urgent government attention into the prevailing factors responsible for this observed trend, as well as immediate control measures and public health preventive action against this disease in order to prevent emergence of the more severe forms Dengue, such as DHF and DSS among the general population in Nigeria.

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7. REFERENCES

- Adeleke, M.A., C.F. Mafiana, A.B. Idowu, S.O. Sam-Wobo and O.A. Idowu, 2010. Population dynamics of indoor sampled mosquitoes and their implication in disease transmission in Abeokuta, South-western, Nigeria. *J. Vector Borne Dis.*, 47: 33-38. PMID: 20231771
- Adu, F.D., O.O. Omotade, I.O. Oyedele, O. Ikushika and S.O. Odemuyiwa *et al.*, 1996. Field trials of combined yellow fever and measles vaccines among children in Nigeria. *East. Afric. Med. J.*, 73: 579-582. PMID: 8991237
- Amarasinghe, J.N. Kuritsky, G.W. Letson and H.S. Margolis, 2011. Dengue virus infection in Africa. *Emerg. Infect. Dis.*, 17: 1349-1354. PMID: 21801609
- Baba, M.M. and M. Talle, 2011. The effect of Climate on Dengue virus infections in Nigeria. *New York Sci. J.*, 4: 28-33.

- Baba, M.M., M.F. Saron, A.V. Vorndam, J.A. Adeniji and O. Diop *et al.*, 2009. Dengue virus infections in patients suspected of malaria/typhoid in Nigeria. *J. Am. Sci.*, 5: 129-134.
- Dawurung, J.S., M.M. Baba, G. Stephen, S.C. Jonas and D.N. Bukbuk *et al.*, 2010. Serological evidence of acute Dengue virus infection among febrile patients attending Plateau State Specialist hospital Jos, Nigeria. *Rep. Opin.*, 2: 71-76.
- Domingo, C., G. Palacios, O. Jabado, N. Reyes and M. Niedrig *et al.*, 2006. Use of a short fragment of the C-terminal E gene for the detection and characterization of two lineages of Dengue virus 1 in India. *J. Clin. Microbiol.*, 44: 1519-1529. DOI: 10.1128/JCM.44.4.1519-1529.2006.
- Garg, A., J. Garg, Y.K. Rao, G.C. Upadhyay and S. Sakhuja, 2011. Prevalence of dengue among clinically suspected febrile episodes at a teaching hospital in North India. *J. Infect. Dis. Immun.*, 3: 85-89.
- Gubler, D.J., 2002. Epidemic dengue/dengue hemorrhagic fever as a public health, social and economic problem in the 21st Century. *Trends Microbiol.*, 10: 100-103. PMID: 11827812
- Gubler, D.J., G. Kuno and L. Markof, 2007. Flaviviruses, In: *Fields Virology*, Fields, B.N., D.M. Knipe and P.M. Howley (Eds.), Lippincott Williams and Wilkins, New York, ISBN-10: 0781760607, pp: 1154-1161.
- Monath, T.P., 1994. Dengue: The risk to developed and developing countries. *Proc. Nat. Acad. Sci. USA.*, 91: 2395-400. DOI: 10.1073/pnas.91.7.2395
- Teixeira, M.G., V. Morato, F.R. Barreto, C.M.C. Mendes and M.L. Barreto *et al.*, 2012. Risk factors for the incidence of dengue virus infection in preschool children. *Tropical Med. Int. Health*, 17: 1391-1395. DOI: 10.1111/j.1365-3156.2012.03086.x