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SEROPREVALENCE OF DENGUE VIRUS AND MALARIA PARASITE CO-INFECTION IN OKENGWE, OKENE, KOGI STATE

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ABSTRACT

Dengue fever and malaria are febrile illnesses and common arthropod-borne diseases in humans. They represent major public health concerns. This study reports the seroprevalence of Dengue virus and Malaria parasite co-infection among febrile patients attending General hospital Okengwe, Kogi state. Blood specimens were collected from 50 subjects with febrile complaints in the hospital who gave their consent to participate in the research. Serological determination of dengue virus antibody was carried out using Dengue Virus Biopanda kit obtained from Biopanda Reagents Ltd., Unit 14 Carrowreagh Business Park, Carrowreagh Road, Belfast, UK. Malaria status was determined using the Biopanda Histidine RDT kit for malaria. Structured questionnaires were also administered to obtain data on risk factors and sociodemographic factors. The presence of Dengue virus and Malaria parasite in the study population was determined with a moderate prevalence of 42% and a high prevalence of 56% for Dengue virus and Malaria parasite infections respectively. A total of 21(75%) of the malaria positive cases were also infected with dengue virus. Demographic factors like gender and occupation as well as risk factors like use of mosquito nets and insecticides were observed to be significantly associated with the occurrence of Dengue virus and Malaria parasite co-infection. Therefore, as the clinical symptoms associated with dengue virus Infection are indistinguishable from many other febrile illnesses such as malaria, specific diagnostic tests assume critical importance in the identification of dengue virus infection. The use of mosquito nets and insecticides in the prevention of Dengue virus infection should also be enhanced.

Keywords: *Dengue virus, malaria parasite, dengue virus biopanda kit*

INTRODUCTION

Dengue caused by dengue virus is a neglected tropical disease that has emerged as an important cause of isolated outbreaks and epidemics in tropical urban and semi-urban areas nearly globally (Epelboin *et al*., 2012). Recently, the global burden of arboviruses has increased and that of dengue incidence remains higher (Amarasinghe *et al*., 2011). Although, a dengue vaccine has been licensed recently in some Latin American countries, it uses is limited for reasons such as safety concern, age of administration and seroprevalence requirements. No specific antiviral drug is currently available for the treatment of dengue and management of clinical cases is largely symptomatic. Dengue fever is classically a self-limiting, non-specific illness characterized by fever, headache, myalgia, and constitutional symptoms (Baba *et al*., 2009).

Annually, dengue hemorrhagic fever and dengue shock syndrome are responsible for exacting heavy morbidity and mortality and remain serious public health. Current seroepidemiological data on burden of DENV infection is lacking despite the tropical climate which favors spatial distribution of *Aedes aejypti* and *Aedes albopictus*, the principal vectors in the transmission of DENV and other arboviruses (Amarasinghe *et al*., 2011). Globally, dengue incidence has risen 30-fold in the past 50 years due to factors such as increased population growth, global warning, insufficient mosquito control, urbanization and inadequate facilities for laboratory detection of dengue virus (Epelboin *et al*., 2012).

Annually, between 50-100 million new cases of dengue infections are reported and more than 2.5 billion people reside in dengue endemic countries (Guzman *et al*., 2010).

Because of the vector which is increasing, acclimatizing and becoming competent to carry the virus, more countries are reporting their first outbreaks which has severely disrupted communities and drained economies (Guzman *et al*., 2010). In Nigeria, dengue fever has been

previously reported and reports of isolated cases of the outbreaks in recent times have re-emerged.

Among the causes of non-malaria febrile diseases around the world, DENV is frequently reported as one of the leading etiology of febrile illnesses (Epelboin *et al*., 2012). Because of lack of awareness by health care providers and inadequate laboratory facilities for diagnosis of dengue virus infection, most cases of dengue fever are misdiagnosed as malaria and typhoid fever or referred to as fever of unknown cause, this can lead to under reporting and off-target treatment.

Malaria is a disease caused by a parasite. The parasite is transmitted to humans through the bites of infected mosquitoes. People who have malaria usually feel very sick, with a high fever and shaking chills. Each year, approximately 210 million people are infected with malaria, and about 440,000 people die from the disease (World Malaria report, 2011). Most of the people who die from the disease are young children in Africa. While the disease is uncommon in temperate climates, malaria is still common in tropical and sub-tropical countries. World health officials are trying to reduce the incidence of malaria by distributing bed nets to help protect people from mosquito bites as they sleep. Scientists around the world are working to develop a vaccine to prevent malaria.

MATERIALS AND METHODS

Study Area

Okengwe is a village in Okene Local Government Area located at latitude 7º33' North and longitude 6º14' East (HASC 2006). Okene Local Government Area was created in 1976 from the then Ebira Division by the Administration of General Olusegun Obasanjo following the 1976 Local Government Reform. Ajaokuta and Ogori-Magongo LGAs were created from the old Okene LGA in 1991 and 1996 respectively. The people of Okengwe are a part of Ebira Tao people of the Central Senatorial District of Kogi state. A Hospital was selected in Okengwe and used for the study. The hospital was General hospital Okengwe, Okene, Kogi state. This hospital was selected because it receives large number of patients every day and the location will give representative samples from Okengwe.

Study population

Patients with febrile complaints sent to the laboratory of the selected hospital for malaria test at the time of the research were enrolled for the study. Such febrile complaints include symptoms of fever, headache, muscle and joint pains, cold, abdominal discomfort, diarrhoea, vomiting and rash.

Inclusion Criteria

Patients of all age, sex, residential area, attending the hospital during the period of the research who are referred to the hospital laboratory for malaria test and who gave their consent to partake in the research.

Exclusion Criteria

Non febrile patients and patients referred for malaria test who did not give their consent to participate in the study.

Sample Collection

A total of 50 serum samples were collected from febrile patients attending the hospital during the period of the research. About 5ml of blood was collected by venipuncture from febrile patients. The blood samples were placed in EDTA bottles and the serum was carefully collected after centrifugation at 2,000 rpm for 10 minutes and stored at – 4ºC for further analysis.

Detection of Dengue Virus Antibodies

An IgM Capture Immuno-assay technique as previously described by Vorndam and Kuno (1977) was used for the detection of IgM antibodies against DENs. The kit used for this test is Dengue Virus Biopanda kit obtained from Biopanda Reagents Ltd., Unit 14 Carrowreagh Business Park, Carrowreagh Road, Belfast, UK.

Determination of Risk Factors Associated with Dengue Virus Infection

A standard questionnaire was used to collect demographic data and clinical history of the patients. The questionnaire was divided into three sections. Section A required biodata such as age, gender, highest educational level attained, marital status and occupation from the patients. Section B required some clinical data such as symptoms of fever, headache, muscle and joint pains, cold, abdominal discomfort, diarrhoea, vomiting and rash. Section C attempted to uncover the exposure of the patients to risk factors such as use of mosquito nets, use of insecticides, presence of ditches or bushes close to residential area, sleeping in the afternoon, use of mosquito nets when sleeping in the afternoon, leaving of doors open in the early mornings and evenings, frequency of anti-malaria drug use and current use of anti-malarial drug predisposing to dengue

virus infection. The questionnaire was administered using the discussion method during which the researcher asked the patients questions contained in the questionnaire and thick as appropriate. The information gathered was recorded.

Determination of Malaria Parasites

This was carried out using the Biopanda Histidine RDT kit for malaria. This test was used to detect malaria parasite antigen.

Data Analysis

Data generated from the research were analyzed using SPSS version 21 from SPSS Inc., USA. Chi square analysis was used to check the level of significance in the occurrence of dengue virus antibody and malaria parasite in relation to different variables. These variables include risk factors such as use of mosquito bed nets, use of insecticides, presence of gutters and or bush close to or around residential area, sleeping in the afternoon and use of insecticide treated bed nets/insecticides when sleeping in the afternoon; demographic factors such as age, gender, highest educational level attained, marital status and occupation; symptoms such as fever, headache, muscle and joint pains, cold, abdominal discomfort, diarrhoea, vomiting and rash. Relationships with p-values less than 0.05 ($p<0.05$) were taken to be significant.

RESULTS

This study examined the seroprevalence of Dengue virus antibody among febrile patients within the study population. All analysis was carried out using SPSS version 21. The measure of accuracy was set at 95% confidence interval and a probability value of less than or equal to 0.05. A seroprevalence of 42% (n = 21[50]) was observed from the study.

Figure 1 shows the seroprevalence of Dengue virus and Malaria parasite and the co-infection of both. Table 1 presents the prevalence of Dengue virus antibody in the study population. Out of the 50 samples screened, 21 (42%) patients were seropositive for Dengue virus. The seroprevalence of Malaria parasite from this study was observed to be 56% (28) as shown in Table 2.

Seroprevalence of Malaria and Dengue co-infection in the study population

The prevalence of Malaria and Dengue virus co-infection obtained from this study was 42% (21) as represented in Table 3.

Seroprevalence of Dengue virus and Malaria co-infection in relation to some demographic factors

The seroprevalence of Dengue virus and Malaria co-infection in relation to some demographic factors was presented in figure 2 and Table 4. The demographic factors considered includes age, educational level, gender, marital status and occupation.

A higher prevalence of 24% was observed in males, as compared to females with a lower prevalence (18%). The seroprevalence of the test virus and Malaria parasite in relation to gender was statistically significant.

The prevalence was highest among secondary educated patients (16%), slightly followed by patients with no education at all (14%) and the tertiary educated patients (10%), and least in primary educated patients. There was no statistical significance in the seroprevalence of the test virus and Malaria parasite in relation to educational level.

The prevalence in relation to marital status was highest with single patients (20%) and least among widowed patients. There was no statistical significance in the seroprevalence of the test virus and Malaria parasite in relation to marital status.

With respect to occupation, the prevalence was highest among students (22%) and least among civil servants (4%). There was statistical significance in the seroprevalence of the test virus and Malaria parasite in relation to occupation.

Seroprevalence of Dengue virus and Malaria co-infection in relation to some associated risk factors

The seroprevalence of Dengue virus and Malaria co-infection in relation to some associated risk factors in the study population was presented in Table 5. The factors considered were use of insecticides, use of mosquito net, presence of ditch or bush around house, presence of stagnant water and sleeping in the afternoon.

The seroprevalence in those who did not have bushes around their houses was high (36%) and a low prevalence (6%) was observed in patients who had bushes around their houses. There was no statistical significance in the seroprevalence of the test virus and Malaria parasite in relation presence of bushes around houses.

A seroprevalence of 21% was observed in patients who did not sleep frequently in the afternoon, this was very high compared to the prevalence of 0% in those who sleep frequently in the

afternoon. There was no statistical significance in the seroprevalence of the test virus and Malaria parasite in relation to afternoon sleep.

The seroprevalence among those who use mosquito net was 26%, slightly higher than those who did not use mosquito nets (16%). There was statistical significance in the seroprevalence of the test virus and Malaria parasite in relation use of mosquito net.

The seroprevalence among patients who did not use insecticide was observed to be 28% and the prevalence among patients who use insecticide was 14%. The seroprevalence of the test virus and Malaria parasite in relation to use of insecticide was statistically significant.

A higher seroprevalence of 38% was observed in patients who did not have stagnant water around their houses, and a low prevalence of 4% was observed in patients who had stagnant water around their houses. There was no statistical significance in the seroprevalence of the test virus and Malaria parasite in relation presence of stagnant water around house.

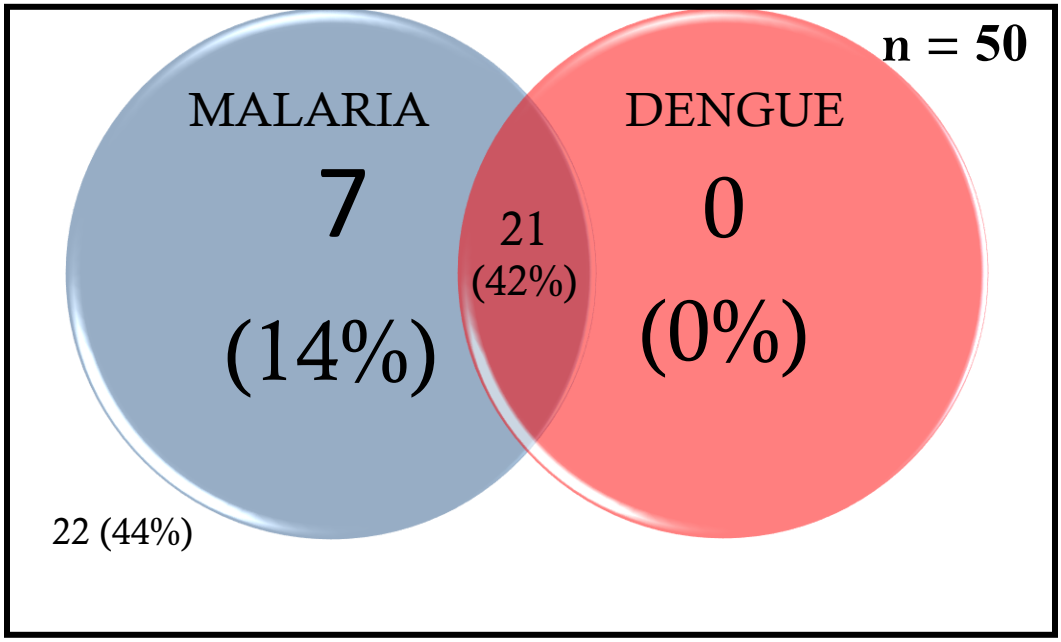


FIGURE 1: SEROPREVALENCE OF DENGUE VIRUS AND MALARIA PARASITE

TABLE 1: SEROPREVALENCE OF DENGUE ANTIBODIES AMONG FEBRILE PATIENTS

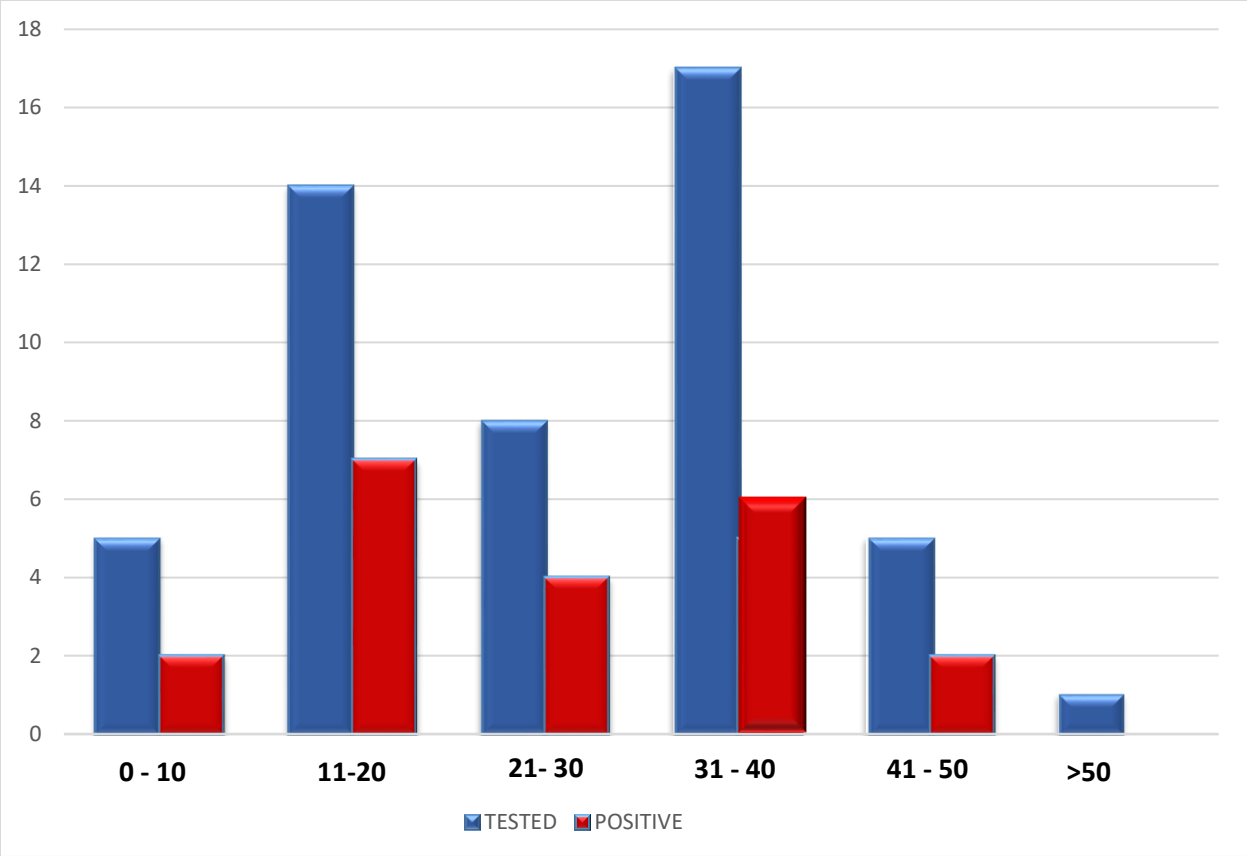
Dengue status	Frequency	Percentage
No of Positive Samples	21	42%
No of Negative Samples	29	58%
Total	50	100%

TABLE 2: SEROPREVALENCE OF MALARIA PARASITE AMONG FEBRILE PATIENTS

Malaria status	Frequency	Percentage
No of Positive Samples	28	56%
No of Negative Samples	22	44%
Total	50	100%

TABLE 3: SEROPREVALENCE OF MALARIA PARASITE AND DENGUE VIRUS CO-INFECTION AMONG FEBRILE PATIENTS

Co-infection status	Frequency	Percentage
No of Positive Samples	21	42%
No of Negative Samples	29	58%
Total	50	100%



P-value = 0.05, C.I = 95%

FIGURE 2: SEROPREVALENCE OF DENGUE AND MALARIA CO-INFECTION IN RELATION TO AGE

TABLE 4: SEROPREVALENCE OF MALARIA PARASITE AND DENGUE VIRUS CO-INFECTION IN RELATION SOME DEMOGRAPHIC FACTORS

Variable	Tested	Positive	X^2	P- value	C.I
Gender					
Male	28	12(24)	12.7`0.41	0.03	-0.39 - 17.3
Female	22	9(18)			
Education					
Tertiary	10	5(10)	30.84	0.09`	1.3 – 1.4
Secondary	20	8(16)			
Primary	8	1(2)			
None	12	7(14)			
Marital status					
Married	19	8(16)	71.34	0.14	-20.7 – 5-.05
Single	24	10(20)			
Widowed	2	1(2)			
Divorced	5	2(4)			
Occupation					
Farming	7	3(6)	14.5	0.05	-11.0 – 80.9
Civil service	6	2(4)			
Business	10	5(10)			
Student	27	11(22)			

KEY
χ^2 = Chi-Squared
P-value = Probability Value
C.I = Confidence Interval

TABLE 5: SEROPREVALENCE OF MALARIA PARASITE AND DENGUE VIRUS CO-INFECTION IN RELATION TO SOME RISK FACTORS

VARIABLE	TESTED	POSITIVE	X^2	P- VALUE
DITCHES/BUSH AROUND HOUSE				
YES	5	3(6)	20.4	0.26
NO	45	18(32)		
SLEEP IN THE AFTERNOON				
YES	2	0(0)	31.2	0.37
NO	48	21(42)		
USE OF MOSQUITO NET				
YES	32	13(26)	11,9	0.05
NO	18	8(16)		
USE OF INSECTICIDE				
YES	23	7(14)	32.04	0.03
NO	27	14(28)		
PRESENCE OF STAGNANT WATER				
YES	9	2(4)	9.27	0.06
NO	41	19(38)		

KEY
χ^2 = Chi-Squared
p-value = Probability Value
C.I = Confidence Interval

DISCUSSION

A seroprevalence of 42% for dengue virus antibody was obtained from the study. This prevalence has brought to light the occurrence of the virus within Okengwe metropolis, Kogi State. A positive case of dengue virus in a community is of epidemiologic importance as mosquitoes can transmit the virus from an infected person to a high proportion of susceptible individuals within the same environment. Out of the 28 positive malaria cases, 21 were seropositive for dengue virus antibody. This result is very important because Nigeria is one of the few African countries that limit investigation of febrile illnesses to malaria and perhaps typhoid with complete neglect to viral infections. Therefore, a co-infection of dengue and malaria as observed in this study was imperative.

The Prevalence of Malaria from this study strongly agrees with the report of Olasehinde *et al*., 2010 where he reported a high prevalence of 80.5% for Malaria parasite infection within southwestern Nigeria.

The seroprevalence of the Dengue virus and Malaria parasite in relation to gender from this study shows that the male population has a higher chance of acquiring the co-infection and this could be due to risk of exposure from occupation and recreational activities. Where as, the female population are mostly indoors and haves lower risk of exposure. This disagrees strongly with the findings of Dawurung *et al*., 2010 where he presented that Dengue infection is not peculiar to any age group or sex indicating that everyone is at risk of contracting the disease.

With respect to occupation, the study shows that populations who engage in business activities are more likely to be infected with Dengue virus. This may be due to the nature of markets which allows breeding of the vectors leading to a high risk of exposure.

In relation to use of mosquito nets, this studies shows that mosquito nets are effective in the prevention of Dengue virus and Malaria parasite co-infection as a lower prevalence was observed among the population that uses mosquito nets. This finding agrees with the report of WHO, 2010 where is was stated that the use of mosquito nets prevents arboviral infections.

This study also shows that the use of insecticide is effective in the control and prevention of Dengue virus infection. As mosquitoes are readily killed by most insecticides available, this finding agrees with the report of WHO, 2010 where it was stated that spraying of insecticides kills mosquitoes and prevents arboviral infections.

CONCLUSION

In this research, the presence of Dengue virus and Malaria parasite in the study population was determined with a moderate prevalence of 42% and a high prevalence of 56% for Dengue virus and Malaria parasite infections respectively. A total of 21(75%) of the malaria positive cases were also infected with dengue virus. Demographic factors like gender and occupation as well as risk factors like use of mosquito nets and insecticides were observed to be significantly associated with the occurrence of Dengue virus and Malaria parasite co-infection.

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