

# Seroprevalence of West Nile Virus among Blood Donors at Central Blood Bank, Khartoum State, Sudan

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## Introduction

West Nile virus (WNV) is a mosquito borne flavivirus in the Japanese encephalitis serocomplex of the family Flaviviridae [1]. WNV is transmitted primarily among Birds [2]. Birds are the natural reservoir (amplifying) hosts, and WNV is maintained in nature in a mosquito-bird-mosquito transmission cycle primarily involving *Culex* species mosquitoes. The virus is indigenous in Africa, Asia, Europe, and Australia and has recently caused large epidemics in Romania, Russia, and Israel. Humans serve as incidental hosts. Most of human infections in temperate and subtropical zones occur in summer or early autumn. In the tropics, the incidence is greatest during the rainy season when mosquitoes are most abundant. WNV was first isolated in 1937 from a human patient in Uganda [2]. During 1999- 2005, the virus spread throughout the USA and into Canada, Mexico, and the Caribbean Basin. With global warming under the influence of increasing temperatures and rainfall through warming of the oceans, and alteration of the natural cycles that stabilize climate, West Nile virus will continue to emerge in new regions [3]. A WNV infection in humans is typically characterized by a mild, self-resolving, dengue like illness with the onset of fever and myalgia [4,2].

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## ABSTRACT

**Objective:** West Nile virus is one of the transfusion transmitted viral infections with worldwide distribution; it can cause severe disorders of the Central Nervous System. This research aimed to provide information about the seroprevalence of West Nile Virus among blood donors at Central Blood Bank, Khartoum State-Sudan.

**Methods:** Ninety sera specimen were randomly collected from blood donors at Central Blood Bank. All collected sera specimen were tested for the presence anti-West Nile virus (IgM & IgG) antibodies by using semi-quantitative indirect ELISA.

**Results:** Out of Ninety blood donor sera, 40 (44.4 %) were reactive for anti-WNV IgG antibody, whereas 2 (2.2%) were reactive for anti-WNV IgM antibody.

**Conclusion:** In spite of higher percentage of Blood Donors at Central Blood Bank, Khartoum State-Sudan was exposed to West Nile virus, there were few recent cases. High care should be taken by health authorities for screening of blood donors, particularly when administered to immunocompromised patients.

**KEY WORDS:** Seroprevalence, West Nile Virus, Blood donors, Blood bank, Sudan

In a small percentage of patients, primarily the elderly and immunocompromised, disease progresses to a more severe form with central nervous system (CNS) involvement, including encephalitis and meningitis [5,6].

The death rate among patients with neuroinvasive disease in recent epidemics has averaged 10%. Among survivors, long-term neurologic sequelae may occur [7]. Although mosquito-borne transmission of WNV to human is by far the predominant mode, another 5 routes of WNV transmission to humans have been documented: blood transfusion, organ transplantation, transplacental transfer, breast-feeding, and laboratory-acquired infections via percutaneous inoculation or the airborne route. About 23 transfusion-transmitted WNV infections have been documented in 2002 [8]. Assuming that each donation was infectious and manufactured into 1.45 blood components, testing has therefore prevented close to 2200 recipient infections and potential clinical diseases [9]. At one extreme are some endemic areas of

Africa, where background immunity to WNV has been observed in approximately 50 percent of children and 90 percent of adults [10].

Serology continues to have a dominant role in the laboratory diagnosis of West Nile viral infections in humans. The detection of WNV-specific IgG in serum using Indirect antibody-capture enzyme immunoassay (EIA) indicates post exposure [2] while detection of IgM antibodies using IgM Antibody Capture Enzyme Immunoassay (MAC-EIA) is suitable for routine detection of immune responses resulting from an acute viral infection [11].

As part of this research, we focused on understanding seroprevalence of WNV in Khartoum Capital in particular the National Center blood donors. Mainly, we were interested in understanding whether there is a risk of exposure to WNV for blood recipients whom blood had no screening of WNV especially when considering that this area one of the WNV is epidemic. It thus provides evidence-based research to guide an effective strategy in reducing risks of transfusion-transmitted WNV infections in Khartoum Capital.

## Materials and methods

### Study design

This descriptive (Cross-sectional) study was conducted on Blood Donors at Central Blood Bank in Khartoum State-Sudan during period from April to May, 2016.

### Ethical considerations

Permission to carry out the study was taken from Blood Bank authority and verbal consent was taken from Blood Donors at Central Blood Bank.

### Sample collection

Ninety serum specimens were randomly collected from blood donors at Central Blood Bank. The samples were stored at -30 °C until ELISA test commenced. All collected sera specimens were tested for the presence of anti-West Nile virus antibodies (IgG and IgM) using the commercial semi-quantitative indirect ELISA kits (EUROIMMUN, Germany).

### Interpretation of results

Ratio calculation method used to calculate the results as to follow:

**Ratio = Extinction of controls or specimens/ Extinction of calibrators**

< 0.8 = Negative.

< 1.1 - => 0.8 = Borderline

> 1.1 = positive

### Quality control

The validity of ELISA kit was done by running the positive and negative controls, and then ratio was calculated for each control, which found within the range of O.D of quality control range of the kit.

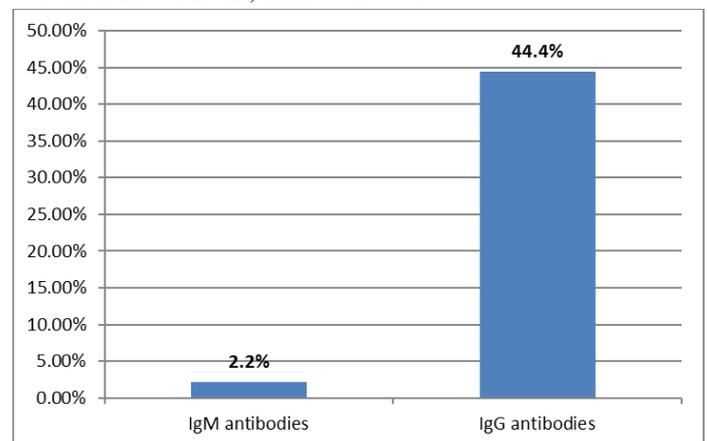
### Statistical Analysis

Statistical analysis was conducted using statistical package for social science program (SPSS).

## Results

A total of 90 sera were randomly collected from blood donors at Central Blood Bank for screening of IgM and IgG antibodies against West Nile virus. Out of Ninety blood donor sera, 40 (44.4 %) were reactive for WNV IgG antibodies, whereas 2(2.2%) were reactive for WNV IgM antibodies, Figure 1.

**Figure 1.** Sero-prevalence of WNV among blood donors at Central Blood Bank, Khartoum state.



### Discussion

West Nile virus is a known cause of flu-like illness and neuroinvasive diseases (such as meningitis, acute flaccid paralysis etc). Due to the outbreak of the virus in 1999 from cases of encephalitis in United States and established evidence of its transmission in blood transfusion, screening of blood donors for WNV was instituted in July, 2005 [12,13]. The present study was the first survey of WNV among blood donors in Khartoum state, Sudan. Which investigated that the sero prevalence of WNV among Blood Donors was

high; anti-WNV IgG antibodies was 44.4 %. Whereas anti-WNV IgM antibodies was 2.2% which indicated to recent WNV cases. Regarding the vector life cycle; it might have contribution on the relatively low percentage of recent cases of WNV, one of which is the seasonal changes that affect the vector survivability and maturation, and which cannot survive during summer season when our study had been performed. Our findings agreed with study was conducted by Watts *et al.*, 1994 on 185 febrile individuals from Northern Province of Sudan, which found that 59% and 5% were reactive for IgG and IgM, respectively [14]. Also, other study carried out among multi-blood recipient's patients by Al Hag *et al.*, 2015 which demonstrated a very high seroprevalence of WNV among that population, this result agrees with our hypothesis that blood donation is one of the major factors that lead to WNV distribution [15].

On the other hand, similar study was done in United Arab Emirates by Alfaresi & Elkoush, 2008, which exhibited the absence of WNV among blood donors. This finding disagreed with our results, which may be highly attributed to the absence of the vector in that area [16].

A series of sero-surveys on West Nile virus since 1939 in Central Africa, one of which is the study that was conducted in Sudan, 1953 in White Nile region, which was consistent with our findings, which found that up to 46.4% were reactive to anti-WNV IgG antibody.

In spite of higher percentage of Blood Donors at Central Blood Bank, Khartoum State-Sudan exposed to West Nile virus, there were few recent cases. The higher seroprevalence of WNV among Blood Donors reveals that blood transfusion may play a major role in WNV transmission.

Further studies are needed in order to obtain the knowledge about the actual prevalence of WNV in Sudan. Further studies using advanced and more accurate techniques like PCR is recommended. Routine screening of WNV among Blood Donors is highly recommended.

### Conflict of Interest

I declare that we have no conflict of interest.

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