Preliminary Study on the Prevalence of West Nile Virus Antibody among Horses, Donkeys and Camels in Borno State, Nigeria
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ABSTRACT

In spite of several serological evidences for the presence of West Nile (WN) virus in Nigeria, the host range of the virus is not fully understood. In this study, the prevalence of the WN virus antibody was determined among horse, donkey and camel populations in Borno state, Nigeria. Two hundred and fifty serum samples comprising of 96 sera from each of horses and camels and 58 from donkeys were tested for presence of WN virus neutralizing antibody. An overall prevalence of WN virus neutralizing antibody of 13.2% was noted in the population of animals tested. Significant difference (P<0.05) in prevalence was observed between the animals tested. Highest prevalence (17.7%) was noted in camels followed by horses (11.5%) and donkeys (8.6%). The results of this study confirmed the prevalence of WV virus antibody in camels in Nigeria and represented the first serosurvey for WN virus activities among horses and donkeys in this part of the country. There is considerable activity of the virus in the study area and provided evidence for the potential roles this group of animals could play in the epidemiology of WN virus infection in Nigeria.

ARTICLE HISTORY:  Submitted: 18/3/14;  Revised: 3/4/14;  Accepted: 17/4/14

KEYWORDS:  West Nile Virus, Neutralizing Antibody, Equines, Camels, Nigeria

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Introduction

West Nile (WN) virus is a zoonotic agent maintained in a transmission cycle involving birds and mosquitoes that could result in fatal encephalitis in humans and horses \[1\]. The virus is a member of the Japanese encephalitis complex (belonging to the family Flaviviridae). Members of the group are transmitted mainly by mosquitoes and are known to mainly infect birds, and cause illnesses among a wide range of hosts including birds, humans, horses, dogs, camels, cats, bats, chipmunks, skunks, rabbits, crocodiles and alligators \[2\]. WN virus infection in humans \[3,4\] and horses \[5\] varies from asymptomatic infection to mild febrile illness and to a neuroinvasive disease called WN meningitis or encephalitis. Since the first isolation of the virus in the West Nile district of Uganda in 1937, its geographical distribution has spread from Africa to West Asia and Middle East as well as Eastern Europe and the United States \[6\]. Outbreaks of WN virus infections in humans have been documented in Algeria, Romania, the Czech Republic, the Democratic Republic of the Congo and Russia. Epizootics involving horses have occurred in Morocco and Italy. The semi-arid zone of North-eastern Nigeria including Borno State harbours significant population of horses, donkeys and camels. In addition, high activity of the competent and potential mosquito vectors of the virus has been reported in this environment \[7\]. However, information on the activity of the virus among this group of animals in the study area is very scanty hence the need for this study.

Materials and Methods

1. Study area: This study was conducted in seven selected areas in Borno State, Nigeria including Maiduguri, Gwom, Maffa, Konduga, Baga, Damboa and Bama. Borno State has an estimated area of 70,898 km\(^2\) and a population of 2,596,589 \[8\]. The State is located in the extreme North-eastern corner of Nigeria between latitude 10° 14° N and longitude 10° 11.8° E, and shares international boundaries with countries of Cameroon, Chad and Niger, and national borders with Nigerian states Adamawa, Gombe and Yobe States. Majority of the inhabitants of Borno State are farmers, animal herders or fishermen. The state enjoys two distinct climatic conditions of a dry (November to May) and a rainy (June to October) seasons.

2. Serum samples: Blood samples for sera were randomly collected from every 5\(^{th}\) camel slaughtered at the Maiduguri Municipal Abattoir, Borno State, Nigeria, while blood samples were collected from horses in small stables owned by individuals and from donkeys owned by rural small livestock holders. The blood samples were transported to the laboratory immediately after collection, allowed to clot and later centrifuged at 1500 rpm for 10 minutes. The sera were aspirated after centrifugation and
stored in nunc tubes at -20°C until tested.

3. **West Nile virus:** The WNV virus strain (Uganda/M12284) from ATCC was used in this study. The virus strain and positive control serum were generously provided by CDC, USA.

4. **Serology:** The presence of WN virus neutralizing antibody in animal sera was determined using micro virus neutralization test as previously described by Niedrig *et al.* using the WN virus strain and positive control serum [9].

5. **Statistical analysis:** The student T-test was used for the analysis of the data obtained from the study by pair wise comparison of variables and where applicable, the analysis of variance (ANOVA) was used. The two statistical methods were evaluated at 5% level of significance.

### Results

Out of a total of 250 serum samples tested, 33 (13.2%) were positive for presence of WN virus neutralizing antibody (Table 1). Analysis of animal species distribution of prevalence of WN antibody revealed that donkeys had 5/58 (8.6%), horses had 11/96 (11.5%) and camels had 17/96 (17.7%) (Table 1). Significant difference (P<0.05) was observed in the prevalence of neutralizing antibody between donkeys and camels. However, no significant difference in prevalence was observed between horse and camel sera tested (Table 1). Gender analysis of the positive samples from donkeys and camels showed significantly (P<0.05) higher prevalence rates in females than the males; while the horse samples showed higher prevalence rate among males than females.

<table>
<thead>
<tr>
<th>Animal Species</th>
<th>Total No. tested</th>
<th>No.(%) positive</th>
<th>Male No. (%) positive</th>
<th>Female No. (%) positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donkey</td>
<td>58</td>
<td>5 (8.6)</td>
<td>2 (40.0)</td>
<td>3 (60.0)</td>
</tr>
<tr>
<td>Horse</td>
<td>96</td>
<td>11 (11.5)</td>
<td>11 (100.0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Camel</td>
<td>96</td>
<td>17 (17.7)</td>
<td>1 (5.9)</td>
<td>16 (94.1)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>250</strong></td>
<td><strong>33 (13.2)</strong></td>
<td><strong>14 (42.4)</strong></td>
<td><strong>19 (57.6)</strong></td>
</tr>
</tbody>
</table>

Table 1: Results of Micro Virus Neutralization test for West Nile virus antibody in the sera of horses, donkeys and camels in Borno State, Nigeria
However, no significant difference (P>0.05) was observed in the overall prevalence between the male and female sample tested (Table 1).

Geographical distribution of prevalence of WN virus neutralizing antibodies in horses and donkeys showed significantly (P<0.05) higher prevalence rates in Maffa when compared to Maiduguri (Table 2).

The prevalence rate among camels was significantly (P<0.05) higher in the samples originating from Borno state, Nigeria than those from Chad (Table 3). Also among the different locations in Borno state, Konduga showed highest prevalence rate followed by Dambo, Bama and Baga (Table 3).

Table 2: Distribution of West Nile virus neutralizing antibody in horses and donkeys from two local government areas of Borno state Nigeria

<table>
<thead>
<tr>
<th>Location</th>
<th>Donkeys</th>
<th>Horses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total No. tested</td>
<td>Total No. (%) positive</td>
</tr>
<tr>
<td>Maffa</td>
<td>39</td>
<td>4(10.3)</td>
</tr>
<tr>
<td>Maiduguri</td>
<td>19</td>
<td>1(5.3)</td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
<td>5(8.6)</td>
</tr>
</tbody>
</table>

Table 3: Distribution of West Nile virus neutralizing antibody in camels from different areas in Borno state, Nigeria and Chad

<table>
<thead>
<tr>
<th>Location</th>
<th>Total No. tested</th>
<th>Total No. (%) positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dambo</td>
<td>49</td>
<td>11 (22.45)</td>
</tr>
<tr>
<td>Baga</td>
<td>3</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Konduga</td>
<td>3</td>
<td>2 (66.7)</td>
</tr>
<tr>
<td>Bama</td>
<td>6</td>
<td>1 (16.7)</td>
</tr>
<tr>
<td>Total (Nigeria)</td>
<td>61</td>
<td>14 (23.0)</td>
</tr>
<tr>
<td>Total (Chad)</td>
<td>35</td>
<td>3 (8.6)</td>
</tr>
</tbody>
</table>
Discussion

The results of this study indicated that WN virus infection is prevalent among horses, donkeys and camels in the study area. This confirms the earlier reports that indicated WN virus to be prevalent among some domestic animals [10, 11] as well as humans and mosquitoes [7] in Nigeria. The overall prevalence of WN virus neutralizing antibody (13.2%) observed in this study is lower than the 33% prevalence of WN virus complement fixing (CF) antibody reported by Omilabu et al. among domestic animals in the same localities [11].

The disparity in the results may be due to differences in the specificity of the serological tests used in the two studies, the species of animal studied and the period when the studies were carried out. Neutralization test is more specific but less sensitive than the complement fixation test (CFT) and the latter could readily detect cross-reacting flaviviruses (e.g. Yellow fever, Dengue, Potiskum, Wesselsbron, Uganda S etc.) that are co-circulating in this environment with WN virus [12,13]. Besides, false positive reactions (due to the presence of non-specific reactors like contaminating microorganisms) in test sera are frequently encountered when working with CFT for detection of virus antibody. This also may explains the difference between the prevalence of antibody in camel (17.7%) observed in this study and prevalence of 62% reported previously by Omilabu et al. [11].

Apart from the effect of specificity of the test results, the period of the study could also affect the prevalence of WN virus infection. The camel population in the study area varies with season and there is a high influx of the animal from neighboring countries of Cameroon, Niger and Chad and countries farther afield like Central Africa Republic and Sudan into the study area during the dry season.

The prevalence of 11.2% observed in horses in the present study is higher than the 8.5% reported by Durand et al. among horses in France [14]. A seroprevalence of WN virus neutralizing antibodies (up to 97% in some countries in sub-Saharan Africa was reported previously by Cabre et al. [15]. Detection of WN virus infection among indigenous horses provides evidence for the possibility of high virus activity and possible endemicity of WN virus infection in Borno state, Nigeria. The antibodies detected could only have come as a result of natural infection as vaccination against WN virus is not done in Nigeria.

Although there was no significant difference in the overall prevalence between male and female animals tested, the gender difference in prevalence observed among horses and camels could be attributed to nature of sample collection from camels.
and the gender of horses kept by their owners. The camel sera were obtained from slaughtered animals and old unproductive female camels are usually taken for slaughter while young productive ones are retained for breeding. The horses kept by stable owners are mostly males which are used for racing, durbar and polo tournaments. Repeated exposure of male horses at stable and old camels to WN virus infection may explain the gender difference in prevalence observed among this group of animals.

The roles of horses, donkeys and camels in the epidemiology of WN virus infections need to be further investigated in a more detailed study in this environment. In addition, since the presence of other flaviviruses (Yellow fever, Dengue, Potiskum, Wesselsbron, Uganda S etc.) have been demonstrated in Nigeria, their roles in the epidemiology of WN virus infection require detailed investigation as previously recommended by Baba et al.[12,13]

Conclusion

This study has provided serological evidence for infection of Nigerian horses, donkeys and camels with WN virus in Borno State, Nigeria. Further studies are required to determine the epidemiological parameters of WN virus infection in Nigeria, including the incidence, prevalence, vectors and vectoral activities.

Acknowledgement

We acknowledge the technical assistance of Mr. Andrew Ali.

References


