INTRODUCTION

West Nile virus (WNV) is a mosquito-borne RNA virus belonging to the genus Flavivirus in Flaviviridae family. Though, WNV infection is generally asymptomatic in human (or causes a flu-like illness) life-threatening neurological complications (e.g. acute flaccid paralysis and meningoencephalitis) have been reported. WNV transmission is considerably influenced by environmental conditions; and abundance of avifauna and mosquitoes. There are very few reports on WNV exposure in individuals from Tripoli City in Libya. The main objective was to provide basic epidemiological information about the WNV seroprevalence in the human population of Tripoli.

Methods: A total of 400 serum samples were collected from persons (123 females, 277 males; age range: 15–78 yr) approaching the Tripoli Reference Laboratory for the purpose of obtaining health certificate; during the period from August to October 2013. The presence of WNV IgG antibodies was evaluated by a commercial kit based on WNV immunoglobulin G (IgG) enzyme-linked immunosorbent assay (ELISA).

Results: It was observed that 2.75% (11/400) samples were found reactive in the WNV ELISA assay. This result suggests that WNV has a low prevalence in the study area.

Interpretation & conclusion: Seropositivity rates of WNV in Tripoli region of Libya were low. However, continuous monitoring of population is important to keep track of the disease prevalence, risk factors, reservoir hosts and vectors for better understanding of the disease epidemiology and designing appropriate control strategies.

Key words  IgG antibodies; Libya; prevalence; Tripoli; West Nile virus
virus in the country. The objective of this study was to confirm the prevalence of West Nile virus IgG antibodies in the population of the capital city, Tripoli in Libya, and its relationship with several demographic variables. The study was primarily intended to provide direct estimate of the general seroprevalence of WNV in the human population.

MATERIAL & METHODS

Specimen collection

Blood specimens were collected randomly at Tripoli Reference Laboratory, Tripoli from 400 Libyan peoples, attending the laboratory, for the purpose of obtaining health certificate; during the period from August to October 2013, regardless of their health situation and whether they had WNF symptoms or not. Samples included 277 males and 123 females. Health certificates are usually compulsory for those applying to join army and police services and also for those working in the field of food industry, hospitals, restaurants, etc. Therefore, most of health certificate applicants were young and middle aged (working age). Blood samples were taken by venipuncture; sera were separated by centrifugation and stored at –20°C until tested.

Each patient gave his consent for the study and filled-out a questionnaire in which the following variables were registered—age, gender, occupation, area of residence, blood transfusion, the history of contact with domestic animals, and traveling history. No data regarding race were obtained. Samples were analyzed serologically in the Parasitology and Vector Borne Disease Research Laboratory at the National Centre for Disease Control, Tripoli, Libya.

Ethical approval: The study was approved by the Libyan National Committee of Biosecurity and Bioethics (Reference 52-13) and signed informed consents were obtained from all the participants.

Serological technique

Serum specimens were tested by immuno-enzymatic test (ELISA) to detect the presence of IgG antibodies against WNV using a commercial enzyme immunoassay kit, DRG® Flavivirus (West Nile) IgG ELISA (EIA-4400), DRG International, Inc., USA, according to the manufacturer’s instructions.

Statistical analysis

Prevalence of antibodies to WNV was calculated as the ratio between confirmed positive sera by ELISA and all tested sera. Chi square test was used to evaluate if the prevalence by demographic data was statistically significant ($p \leq 0.05$). All data were analyzed statistically with SPSS version 20.0 software.

RESULTS

The study population included 400 samples; 277(69.3%) males and 123(30.7%) females. Demographic characteristics of the blood samples collected is shown in Table 1. Out of the 400 serum samples, 11 (2.75%) were positive for WNV-IgG antibody; the positivity rate was higher among males (3.6%) than females (0.8%), the differences were not statistically significant ($\chi^2 = 2.492$, df = 1, $p = 0.115$).

The mean age of participants was 31.41±10 (range, 15–67 yr). All age groups showed positive test for WNV-IgG, except the participants older than 59 yr (Table 1). The differences between age groups were not significant ($p>0.36$). Participants outside Tripoli showed more positivity (10%) than the participants from Tripoli (2.16%), ($\chi^2 = 6.366$, df = 1, $p = 0.012$).

Positivity varied across the settlements, i.e. 7.9% of participants living in farms were positive for WNV-specific antibody, which decreased to 2.33% for the cases living in houses and 1.64% for those living in apartments; however, the differences were not significant ($p >0.06$). Almost half of the participants, who were positive for WNV-specific antibody, had contact with animals. It is worth mentioning that none of the positive tested participants had blood transfusion. Most of participants who were positive for WNV-IgG antibody (72.7 %) had traveled out of Libya.

Table 1. Demographic characteristics of participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>No. investigated</th>
<th>No. positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total participants</td>
<td>400</td>
<td>11 (2.75)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>277</td>
<td>10 (3.61)</td>
</tr>
<tr>
<td>Female</td>
<td>123</td>
<td>1 (0.81)</td>
</tr>
<tr>
<td>Age (yr)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;20</td>
<td>49</td>
<td>1 (2.04)</td>
</tr>
<tr>
<td>20–29</td>
<td>154</td>
<td>6 (3.90)</td>
</tr>
<tr>
<td>30–39</td>
<td>115</td>
<td>2 (1.74)</td>
</tr>
<tr>
<td>40–49</td>
<td>53</td>
<td>1 (1.89)</td>
</tr>
<tr>
<td>50–59</td>
<td>20</td>
<td>1 (5)</td>
</tr>
<tr>
<td>&gt;59</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Blood transfusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>No</td>
<td>386</td>
<td>11 (2.85)</td>
</tr>
<tr>
<td>Travelling history</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>278</td>
<td>8 (2.88)</td>
</tr>
<tr>
<td>No</td>
<td>122</td>
<td>3 (2.46)</td>
</tr>
</tbody>
</table>

Figures in parentheses indicate percentages.
DISCUSSION

West Nile virus is a re-emerging Flavivirus in countries like North Africa, Middle East and the Mediterranean Region. These countries have been dealing with recurrence of seasonal outbreaks of WNV in the last few years, especially countries neighbouring to Libya such as Tunisia and Algeria where number of cases have been reported during the year 2012–13. An increase of up to 86 human cases and one death was reported from Tunisia, while Algeria reported one case and Morocco reported 11 confirmed cases\(^\text{16}\). A considerable number of cases have been reported from the Middle East region. A study on seroprevalence of WNV from Jordan found that 8% of the study population have exposure to WNV infection\(^\text{17}\). Another study in Iran showed 3% seroprevalence for WNV among school children\(^\text{18}\). In Sudan, the prevalence of IgG antibodies against WNV among humans was 54.9%\(^\text{19}\). In the present study, only 2.8% of the samples were positive for IgG antibody.

The presence of IgG antibodies may infer a previous exposure to WNV or perhaps another Flavivirus, as the ELISA techniques lack specificity due to cross reaction with antibodies directed to other Flaviviruses, especially those of the Japanese encephalitis serogroup. The IgG positive results must be reconfirmed with other tests\(^\text{16, 20}\).

WNV could be transmitted by blood transfusions through receipt of blood products and transplantation\(^\text{21-27}\). The results obtained in this study suggest that WNV is circulating in the population of Tripoli. Since, none of the positive cases experienced/underwent blood transfusion, and only 2.88% of the cases having travelling history were positive for WNV, it can be said that transmission was less likely due to traveling or blood transfusion. Therefore, it can be assumed that the virus was transmitted by mosquito vectors. Several species of *Culex* and *Aedes* have been recorded in Libya; however, there are no data/studies reporting them as potential vectors for WNV transmission from Libya\(^\text{23-24}\). Hence, further entomological studies need to be conducted to answer this critical question.

It is widely acknowledged that climate has a significant impact on the distribution of infectious diseases\(^\text{25}\). Tripoli is characterized by semi-arid climate with hot and dry summers and relatively wet and mild winters, and a Mediterranean rainfall pattern, which differ from year to year; with some years receiving higher rainfall, causing increase in mosquitoes’ abundance, in contrary to drought years. The transmission and outbreaks of WNV depends on the abundance of mosquito species, feeding patterns of infected mosquitoes, factors influencing human exposure to mosquitoes, and the appropriate climatic conditions\(^\text{26-29}\). Tripoli as a city, is characterized by urban cycle of WNV (domestic birds, and mosquitoes feeding on both birds and humans); and the poor infrastructure offers suitable grounds for mosquito breeding and resting. On other hand, the cycle in rural areas depends on wetlands and irrigation systems.

To predict future outbreaks of infection due to emerging zoonotic pathogens, it would be useful to have a better understanding of avian migration patterns as Libya is situated on bird migration routes between Africa and Europe and can contribute to introduction of infectious diseases to the country.

Based on the results of the study, high seroprevalence rate among male participants could be attributed to their social economic activities (working outside and leisure) that increase the risk of mosquito bites. Moreover, men clothing style covers lesser body parts and exposes more skin, which is less protective against mosquito bites than traditional clothing worn by women in Libya. However, both male and female could be at risk if they visit places where there is high population/density of birds and mosquitoes.

Participants with WNV seropositivity had no knowledge of WNV disease, as WNF is generally asymptomatic which is due to different strains of WNV that vary in their behavioural and biological attributes, that may affect the degree of virulence\(^\text{7}\). Therefore, future research needs to focus on the identification of the WNV strain(s) circulating in Libya.

CONCLUSION

The study result suggests that WNV is circulating in the population of Tripoli, although its prevalence is low. However, continuous monitoring of population is important to keep track of the WNV prevalence, risk factors, reservoir hosts and vectors at different provinces, especially in the west of Libya to understand the epidemiology and for designing appropriate control strategies.

Conflict of interest

The authors declare that they have no conflict of interest.

ACKNOWLEDGEMENTS

The authors thank the team of Tripoli Reference Laboratory, Tripoli for their help during specimen’s collection.
REFERENCES


