

Seroprevalence of Dengue virus among pregnant mothers and their-newborn infants in the southwest of Saudi Arabia

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Summary

Dengue virus (DENV) is one of the most serious arthropod-borne viruses. This study was performed to investigate the prevalence of the virus in Najran, a city in the south west of Saudi Arabia. Four hundred and ten paired maternal and umbilical serum samples were obtained from mothers and their newborn infants. The samples were tested for the presence of IgG antibodies by ELISA. Anti-DENV IgG antibodies were detected in 31 maternal samples (7.6%), while all newborn samples were negative. All maternal seropositive samples were negative when tested by PCR. These results are further indication that DENV is endemic in Saudi Arabia and enhanced DENV surveillance is necessary.

Key words: Dengue; ELISA; PCR; Serum; Saudi Arabia; Pregnancy; Newborn infants.

Introduction

In recent decades, the incidence of dengue fever has increased dramatically in various parts of the world. Almost a fifth of the world's population is at risk of DENV infection. According to the World Health Organization, 50 million dengue infections occur every year worldwide [1-3]. Rapid movement of people, favorable climatic conditions and a lack of trained healthcare personnel have contributed to the global nature of dengue fever. The virus transmission occurs in about 128 countries and nearly 4 billion people are at risk [1-3]. DENV is a member of the family Flaviviridae, genus flavivirus. It causes a wide range of serious diseases, such as dengue fever (DF), dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) [1-3]. The main vector of the disease is the mosquito, genus *Aedes aegypti* [4]. Dengue is transmitted by mosquito bites, so it spreads significantly after the rainy season in the summer [4].

Multiple outbreaks of different DENV serotypes were reported in Saudi Arabia since 1994. Dengue disease has become an endemic disease in different regions of Saudi Arabia, particularly in the western region [5-11]. The presence of *Aedes aegypti*, year-round travelling to perform Hajj, Omrah or for tourism, and direct contact with people from endemic areas are all putting the country at risk for these diseases. Little is known about the prevalence of DENV in the Najran area, in the south west of Saudi Arabia. In order to provide timely information about the disease, we have tested pregnant mothers and their newborns at the time of delivery in the city of Najran for subclinical or past infections of DENV.

Material and Methods

Study design

The study was done in the pediatric, gynecology and obstetrics hospital in Najran, in the period between November 2016 and July 2017. Four hundreds and ten pregnant women presenting at the hospital in labor, and who agreed to participate in the study, were enrolled in this cross-sectional study. The study received ethical approval from the Research Committee of the College of Medicine, Najran University (approval number 15-01-18 EC).

Questionnaire

A questionnaire was administered to the patients covering information about place of residency, history of travel and any symptoms of illnesses.

Sampling

About five ml of clotted umbilical cord blood and maternal blood were collected from each participant. Blood samples were centrifuged at 3,000 rpm for five minutes and sera were separated and preserved at -60 °C until being analyzed.

ELISA

DENV IgG were detected by ELISA. The kits were purchased from MyBioSource Inc., San Diego, USA. The test was performed in accordance with the instructions provided by the manufacturer.

RNA extraction

Viral RNA was extracted from serum samples by TRIzol reagent (supplied by ThermoFisher scientific company, USA) according to the user manual. DENV positive and

Table 1. — *Demographic and clinical characteristics of the mothers.*

Variables		Total N (%)	DENV IgG positive N (%)
Residency	In Najran	342 (83.4)	29 (8.5)
	Out of Najran	68 (16.6)	2 (2.9)
History of travel	Yes	35 (8.5)	0 (0)
	No	375 (91.5)	31 (8.3)
Temperature	37	407 (99.3)	31 (7.6)
	> 38 °C	3 (0.7)	0 (0)

control extractions were performed and used alongside the experimental samples.

RT-PCR

The extracted RNA samples and positive and negative controls were mixed with Fast-track mastermix supplied by FTD dengue fast-track Diagnostics, Luxembourg. The samples were run on a LightCycler®480 (Roche) according to the instruction of the manufacturer.

Data analysis

The results of laboratory analyses of patient serum samples and the questionnaire data were analyzed by SPSS software version 23 (IBM). The differences among groups were identified using the chi-square test and the Pearson correlation coefficient.

Results

Demographic and clinical characteristics of the mothers

As shown in table 1, 35 of the mothers (8.5%) had travelled inside Saudi Arabia before delivery but none of them had been abroad. Three hundred and forty two women (83.4%) were from Najran city and sixty-eight (16.6%) were from the surrounding villages. All mothers were asymptomatic except for 3 (0.7%) who had a low-grade fever (> 38 °C). All of the newborn babies showed normal growth parameters as per gestational age norms and none of them had congenital malformations.

ELISA results

Of the 410 tested maternal serum samples, 31 were positive (7.6%) for DENV IgG. Of those, 29 samples were from residents of Najran city, while 2 samples were from residents of outside villages. A positive correlation between residency (Najran city) and maternal anti-DENV IgG was identified, with a non-significant p -value ($p = 0.09$). A significant negative correlation between a maternal history of travel and anti-DENV IgG was identified ($p = 0.02$). None of the febrile mothers had positive results (Table 1). All of the newborn samples tested negative for anti-DENV IgG.

RT-PCR results

The 31 maternal positive ELISA samples were subjected to RNA confirmation by RT-PCR. The PCR results showed that all samples were negative, indicating no active viral

infection.

Discussion

The presence of the DENV vector in Saudi Arabia represents a source of risk for DENV infection. The objectives of this study were to demonstrate the seroprevalence of DENV infection in the Najran region of Saudi Arabia and to identify the possible risk factors. Asymptomatic mothers and their newborn babies were screened for evidence of subclinical or past DENV infection. The major diagnostic methods for these virus outbreaks are serological tests, such as ELISA and viral RNA detection by RT-PCR [12-17]. Therefore, both methods were used in this study to identify and confirm the infection. Our results indicated the presence of DENV in 7.6% in the tested samples. Although the results of this study agreed with previous research in Saudi Arabia in terms of the presence of the virus, the rate of infection was much lower than the previous rates. The published DENV prevalence in Saudi Arabia ranges from 14% to 56% [7, 9, 10]. The disease transmission can greatly differ from one region to another due to different factors such as vector density, methodological differences, the choice of study population, sample size, and other factors such as virus strain [18-20]. In our study, the demographic, clinical, and environmental factors did not have a significant association with the prevalence of the disease except for a higher prevalence of antibodies among non-travelers. Our results were in contrast to previous work in SA who indicated significant risk factors such as age ≥ 20 years, lack of electricity and having water basins in the house [8].

Although there were no symptoms of active infection and viral RNA was not identified (confirming no active or asymptomatic infection), the presence of antibodies remains a significant concern. Transmission of DENV from asymptomatic or subclinical acutely infected blood donors to their recipients with subsequent disease development has been recorded [6, 21]. Moreover, transmission of anti-DENV antibodies from donors enhances the viral infectivity in recipients who are later exposed to a different DENV serotype [22, 23]. The findings in this study highlight the need for enhanced DENV surveillance, implementation of vector control strategies and determination of DENV serotype.

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Conflict of Interest

The authors declare no conflict of interest.

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