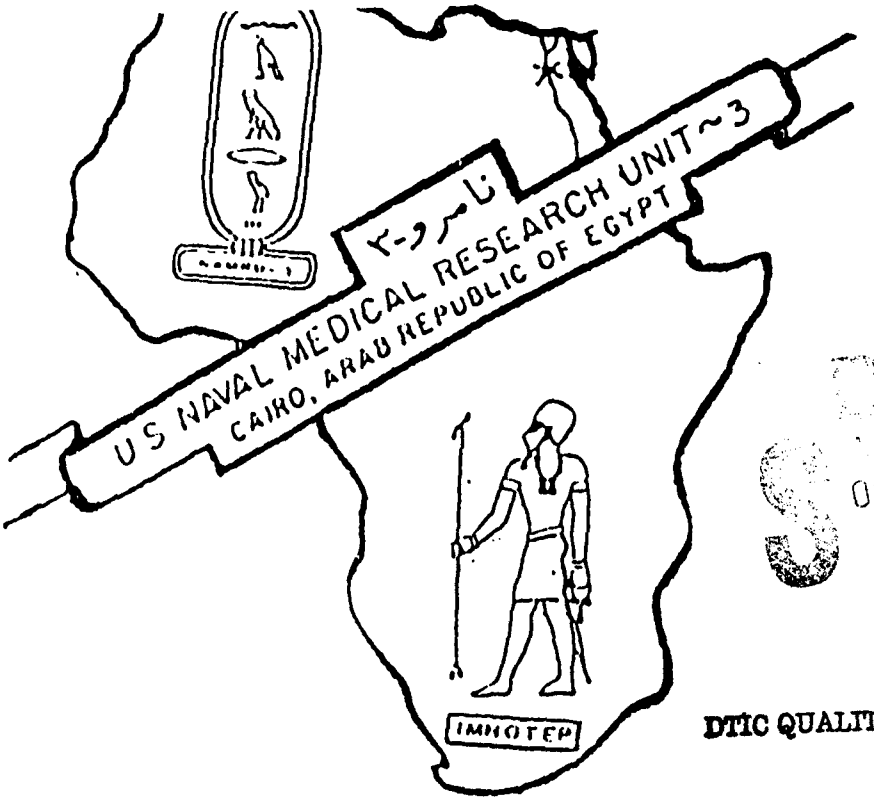




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ARTHROPOD-BORNE VIRAL INFECTIOUS ASSOCIATED WITH A FEVER OUTBREAK IN THE NORTHERN PROVINCE OF SUDAN

By

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An outbreak of acute febrile illness occurred during August and September 1989 in the Northern Province of Sudan coinciding with a high population density of phlebotomine sandflies. An investigation was conducted to determine whether arboviruses were associated with human illness during this outbreak. Sera were obtained from 185 febrile individuals and tested for IgG and IgM antibody to selected arboviruses by enzyme immunoassay (EIA). The prevalence of IgG antibody was 59% for West Nile (WN), 53% for Sandfly Fever Sicilian (SFS), 32% for Sandfly Fever Naples (SFN), 39% for Yellow Fever (YF), 24% for dengue-2 (DEN-2), 23% for Rift Valley (RVF), 12% for Chikungunya (CHIK) and 5% for Crimean-Congo haemorrhagic Fever (CCHF) viruses. Antibody prevalences tended to increase with age for WN and YF viruses. Antibody rates were about the same for males and females for most of the viruses tested. The prevalence of IgM antibody to SFN was 24% and reciprocal IgM titre exceeded 12 800 for some individuals suggesting that this virus was the cause of recent infection. The prevalence of IgM antibody for the other viruses did not exceed 5%. The study indicated that several arboviruses were endemic and some of them may have caused human disease in the Northern Province of Sudan.

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# Arthropod-borne viral infections associated with a fever outbreak in the Northern Province of Sudan

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## SUMMARY

An outbreak of acute febrile illness occurred during August and September 1989 in the Northern Province of Sudan coinciding with a high population density of phlebotomine sandflies. An investigation was conducted to determine whether arboviruses were associated with human illness during this outbreak. Sera were obtained from 185 febrile individuals and tested for IgG and IgM antibody to selected arboviruses by enzyme immunoassay (EIA). The prevalence of IgG antibody was 59% for West Nile (WN), 53% for Sandfly Fever Sicilian (SFS), 32% for Sandfly Fever Naples (SFN), 39% for Yellow Fever (YF), 24% for dengue-2 (DEN-2), 23% for Rift Valley Fever (RVF), 12% for Chikungunya (CHIK) and 5% for Crimean-Congo haemorrhagic Fever (CCHF) viruses. Antibody prevalences tended to increase with age for WN and YF viruses. Antibody rates were about the same for males and females for most of the viruses tested. The prevalence of IgM antibody to SFN was 24% and reciprocal IgM titre exceeded 12 800 for some individuals suggesting that this virus was the cause of recent infection. The prevalence of IgM antibody for the other viruses did not exceed 5%. The study indicated that several arboviruses were endemic and some of them may have caused human disease in the Northern Province of Sudan.

**Keywords:** arboviruses, fever, Sudan

## INTRODUCTION

Several arboviruses have been associated with human infections in the Sudan. Outbreaks of RVF were described during 1973, 1976 and 1981 in Central Sudan (Eisa *et al.* 1977; 1980; Saleh *et al.* 1981). Serological evidence of infection by YF, WN, RVF, CHIK, and Sindbis viruses was demonstrated among military recruits in Port Sudan (Scott *et al.* 1985). Also, dengue-1 and dengue-2 (DEN-2) viruses were associated with outbreaks of febrile illness in Port Sudan (Hyams *et al.* 1986). In Juba, Southern Sudan, serosurvey revealed evidence of human infection by certain arboviruses (Woodruff *et al.* 1988).

An outbreak of acute undifferentiated febrile illness occurred during August and September 1989 among humans in the towns of Merowie and Karima, Northern Province of Sudan. Phlebotomine sandflies

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**Table 1.** The distribution of arboviral IgG antibody in the Northern Province of Sudan

| Age (years) | No. of subjects | Antibody No. pos. (%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | DEN-2 | WN | YF | RVF | SFN | SFS | CCHF | CHIK |
| 11–20 | 28 | 7 (25) | 17 (61) | 8 (29) | 5 (18) | 15 (54) | 18 (64) | 2 (7) | 4 (14) |
| 21–30 | 58 | 13 (22) | 35 (60) | 25 (43) | 16 (28) | 18 (31) | 30 (52) | 3 (5) | 6 (10) |
| 31–40 | 48 | 10 (21) | 28 (58) | 11 (23) | 11 (23) | 9 (19) | 26 (54) | 2 (4) | 7 (15) |
| 41–50 | 33 | 9 (27) | 17 (52) | 17 (52) | 9 (27) | 11 (33) | 16 (48) | 1 (3) | 4 (12) |
| 51–60 | 13 | 3 (23) | 10 (77) | 8 (62) | 0 (0) | 5 (38) | 6 (46) | 2 (15) | 1 (8) |
| 61–70 | 5 | 2 (40) | 3 (60) | 3 (60) | 1 (20) | 2 (40) | 2 (40) | 0 (0) | 0 (0) |
| Total | 185 | 44 (24) | 110 (59) | 72 (39) | 42 (23) | 60 (32) | 98 (53) | 10 (5) | 22 (12) |

DEN-2 (dengue-2), WN (West Nile), YF (Yellow Fever), RVF (Rift Valley Fever), SFN (Sandfly Fever Naples), SFS (Sandfly Fever Sicilian).

were abundant and the feeding frequency upon humans was 150 bites per 12-hour period. All age groups were affected and patients recovered approximately one week after the onset of symptoms. Approximately 500 individuals were hospitalized. A malaria survey indicated that less than 3% of the human cases were attributed to *Plasmodium falciparum* infection.

Arboviruses have not been reported as a cause of human infection in Northern Sudan and the investigations reported here were conducted to determine whether arboviruses were associated with this outbreak.

## MATERIALS AND METHODS

A total of 185 febrile individuals, 81 males and 104 females, in the towns of Merowie (95) and Karima (90), Northern Province of Sudan were the subjects of this study. The mean age was 34 (range 11–70 years). Blood samples were collected by a field team from the Departments of Virology and Epidemiology and Endemic Diseases, Ministry of Health, Sudan. Sera were tested for arboviral antibody in the Virology Division of the US Naval Medical Research Unit No. 3 in Cairo, Egypt.

Sera from the study subjects were tested by enzyme immunoassays (EIAs) for IgM and IgG antibody to RVF, SFS, SFN, WN, YF, DEN-2, CHIK and CCHF viruses. Sera were tested for IgG antibody by an indirect sandwich assay (Meegan *et al.* 1981). A capture EIA was used to test sera for IgM antibody (Summers *et al.* 1984). Positive and negative control sera were included with each test run.

## RESULTS AND DISCUSSION

IgG antibody was demonstrated for WN, YF, DEN-2, RVF, SFS, SFN, CHIK, and CCHF among study subjects (Table 1). The prevalence of IgG antibody ranged from a low of 5% for CCHF to a high of 59% for WN. Prevalences of IgG antibody tended to increase with age for only WN and YF viruses (Table 1) suggesting that subjects were infected during infrequent epidemics rather than constant endemic transmission that would result in steadily increasing prevalence with age. The prevalence of IgG antibody was comparable for males and females for most of the viruses. The demonstration of IgG antibody presented evidence of previous infection with these viruses.

The prevalence of IgM antibody for SFN virus was 24%. A markedly lower prevalence was demonstrated for the other viruses ranging from 0.5% for RVF to 5% for YF viruses. No significant age or sex related differences were noted in SFN IgM antibody prevalences.

The IgM antibody titres were high for SFN virus and exceeded 12 800 for some individuals.

The high IgM antibody prevalence and titres to SFN virus among the study subjects suggested that this virus, or an antigenically related virus, was the cause of recent human infection. However, a conclusive indication of the possible association of this virus with the outbreak could have been obtained by either virus isolation or the demonstration of a significant increase in convalescent serum antibody titre. Unfortunately, facilities for proper transportation of samples for virus isolation (liquid nitrogen) and convalescent sera were not available.

These data demonstrated the first serological evidence of arboviral infections in the Northern Province of Sudan and suggested that SFN virus was the cause of recent human infection in the study towns. However, the identification of specific viruses must be interpreted with caution because of possible cross-reactivity among antigenically closely related arboviruses (Shope *et al.* 1980).

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