Preventive Veterinary Medicine 117 (2014) 121–128

Contents lists available at ScienceDirect

Preventive Veterinary Medicine

journal homepage: www.elsevier.com/locate/prevetmed

Occurrence of rift valley fever in cattle in Ijara district, Kenya

Nelson O. Owange[a,d,*], William O. Ogara[a], Hippolyte Affognon[d], Gathura B. Peter[a], Jacqueline Kasiiti[b], Sam Okuthe[c], W. Onyango-Ouma[e], Tobias Landmann[d], Rosemary Sang[d,f], Murithi Mbabu[b]

[a] University of Nairobi, Faculty of Veterinary Medicine, Department of Public Health Pharmacology and Toxicology, PO Box 29053-00625, Nairobi, Kenya
[b] Ministry of Agriculture, Livestock and Fisheries, State Department of Veterinary Services, Private Bag-00625, Nairobi, Kenya
[c] FAO, Emergency Centre for Transboundary Animal Diseases (ECTAD), Eastern Africa, FAO-UN, United Nations Avenue, Gigiri, Kenya
[d] International Centre for Insect Physiology and Ecology (ICIPE), PO Box 30772-00100, Nairobi, Kenya
[e] Institute of Anthropology, Gender & African Studies, University of Nairobi, PO Box 30197-00100, Nairobi, Kenya
[f] The Center for Virus Research, Kenya Medical Research Institute, PO Box 54628, Nairobi, Kenya

ARTICLE INFO

Article history:
Received 27 February 2014
Received in revised form 6 August 2014
Accepted 12 August 2014

Keywords:
Rift valley fever
Occurrence
Epidemiology
Sero-prevalence
In cattle
Maintenance

ABSTRACT

Ijara district in Kenya was one of the hotspots of rift valley fever (RVF) during the 2006/2007 outbreak which led to human and animal deaths causing huge economic and public health losses. The main constraint in the control and prevention of RVF is inadequate knowledge on its occurrence during the interepidemic period. This study was aimed at understanding the occurrence of RVF in cattle in Ijara to enable the development of improved community-based disease surveillance, prediction, control and prevention.

Six herds each 700–1000 cattle were identified with participatory involvement of locals and project technical team of the project. One animal per herd was tagged with global position system (GPS) collar to enable follow up. Sero-surveys were conducted periodically to understand the herd's movement through various ecological zones and risk of exposure to RVF virus. Sixty animals less than 3 years old from each herd were randomly selected each sampling time and sero-surveyed for RVF four times (September 2012, December 2012, February 2013 and May 2013) during the study period and along the nomadic movement route. The serum samples collected were subjected to RVF inhibition ELISA test to detect if there was exposure for RVF virus (RVFV). The RVF inhibition ELISA positive samples were subjected to IgM ELISA test to determine if the exposures were current or recent (within 14 days).

The result of the survey indicated that 13.1% (183/1396) of cattle sero-surveyed had RVFV antibodies by inhibition ELISA test while 1.4% (18/1396) was positive for IgM ELISA test. The highest RVFV circulation was detected after herds pass through bony forest between Lamu and Ijara and Halei forested areas. These forested areas also had the highest IgM detections. The findings indicate that even limited rainfall was able to initiate RVFV circulation in Ijara

* Corresponding author at: Nelson Ochieng Owange, PO Box 36001-00200, Nairobi, Kenya. Tel.: +254 0 725536153; fax: +254 0 736536153.
E-mail addresses: owanelson@yahoo.com, owangenelson@gmail.com, nowange@icipe.org (N.O. Owange), wogara@uonbi.ac.ke (W.O. Ogara), haffognon@icipe.org (H. Affognon), pgathura@uonbi.ac.ke (G.B. Peter), Kasiiti.orengo@gmail.com (J. Kasiiti), sam.okuthe@fao.org (S. Okuthe), onyaouma@yahoo.com (W. Onyango-Ouma), tlandmann@icipe.org (T. Landmann), Rosemary.sang@usamru-k.org (R. Sang), murithimbabu@yahoo.com (M. Mbabu).

http://dx.doi.org/10.1016/j.prevetmed.2014.08.008

region with highest circulation detected within forested areas with potential to become epidemic if rains persist with extensive flooding. There is need to carry out regular participatory disease surveillance in domestic animals and other host systems to identify risk locations in hotspot areas and carry out community awareness and focal vaccination campaigns against RVF for preparedness, prevention and control. Additionally, monitoring of environmental conditions in risky ecological zones to detect enhanced rainfall and flooding should be prioritized for preparedness.

1. Introduction

Rift valley fever (RFV) is a mosquito-borne viral zoonosis that periodically causes disease outbreaks in humans and livestock and has been endemic in sub-Saharan Africa since 1912 (Peters and Linthicum, 1994). The disease is caused by rift valley fever virus (RVFV), a member of the genus Phlebovirus, family Bunyaviridae transmitted to humans through bites from infected mosquitoes and direct contact with tissues and blood of infected animals. Before the 1977 outbreak in Egypt, RVF was considered a disease of livestock with little impact on humans (Meegan et al., 1979) but subsequently, periodic outbreaks associated with widespread human infection resulting in acute febrile illness with haemorrhagic syndrome have been reported in many African countries, Saudi Arabia, Yemen and Mauritania (Meegan et al., 1979; McIntosh et al., 1980; Meegan and Bailey, 1988; Ksiazek et al., 1989; Morvan et al., 1992; Abdo-Salem et al., 2006; CDC, 2007).

Outbreaks of RVF in North Eastern (NE) Kenya (Garissa County) have been associated with unusually heavy rainfall that causes extensive flooding of basins and low lying grassland depressions called dambos, triggering mass emergence of *Aedes* mosquitoes (Davies et al., 1985). In 1997/98 and 2006/07, massive outbreaks of RVF occurred in East Africa, both associated with El Nino events (CDC, 2007; Woods et al., 2002), with an estimated 27,500 human cases, and more than 600 deaths being reported in 1997/98 in Kenya alone. Historical outbreaks of RVF since the early 1950s have been associated with cyclical patterns of the El Nino/Southern Oscillation (ENSO) phenomenon, which results in elevated and widespread rainfall over the RVF endemic areas of Africa (Anyamba et al., 2010). In Garissa, RVFV was first detected in livestock in 1961 and although 21 national outbreaks have been documented since then, only six of these occurred in Garissa district. The two outbreaks, 1997/1998 and 2006/2007), were the most notable in terms of public health and socio-economic impact (Murithi et al., 2010).

About 90% of the human population Ijara is directly dependent on livestock for daily nourishment and as a source of income resource. During the last outbreak, a ban on livestock trade and imposition of quarantine resulted in severe economic losses greater than US$ 9.3 million (Murithi et al., 2010). In Ijara district, nomadic pastoralism is practiced where livestock (cattle) are driven over long distances towards Tana River Delta or into Boni forest passing through various ecosystems in search of pasture and water.

Garissa and Ijara districts were hotspots during the last RVF outbreaks in the arid/semi arid NE province of Kenya. The nomadic/semi-nomadic pastoralist communities in these districts maintain large livestock herds even in circumstances of limited pasture and water. RVF outbreaks have caused major disruptions to public health and economic mainstay for this population. The movement of these viruses among animals, vectors and occasional involvement of human populations, under the influence of environmental factors required further study to better understand the interplay between the changing ecosystems, climate and the emergence of infections.

This study used cattle tracking and sero-survey to establish the occurrence of RVF in Ijara along the livestock movement corridors. It was part of a bigger project whose overall objective was to bring about a better understanding of the environmental, biotic and socio-economic drivers of emergence of RVF and other arboviruses to identify viable control options against RVF in the arid/semi-arid NE province of Kenya, with focus on Ijara district, a major hotspot of the disease. The information from this study will become useful for awareness creation as well as formulating prevention and mitigation measures for RVF such as targeting specific ecological zones for monitoring and surveillance.

2. Materials and methods

2.1. Study area

The study was carried out in the arid and semi arid region of North Eastern Kenya between Garissa and Lamu counties which is traversed by nomadic pastoralists in search of pasture and water with Ijara district at the centre of the study. Due to cattle migratory movements, herds were also sampled while moving through Garissa, Fafi, and Tana River districts as shown in the map of the study area (Fig. 1)

More than 90% of the land in the study area is trust land and title deeds have not been issued. The study area falls in ecological Zone V-IV with a total forest cover of 2484 km^2. Boni forest, which is an indigenous open canopy forest forms part of the Northern Zanzibar–Inhamdare coastal Forest Mosaic, covers part of the study area. A section of the forest, the Boni National Reserve is under the management of the Kenya Wildlife Service as a protected conservation area. The soil types are black cotton and alluvial types, temperatures range between 15 and 38 °C, bimodal rainfall