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Impact of arthropods and arboviruses viruses on animals and human health and prevention strategies

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ABSTRACT

Arthropods like mosquitoes, ticks, sandflies, and biting midges are some of the major vectors of arboviruses -arthropod-borne viruses that pose a threat to the health of both animals and humans across the globe. Members of Flaviviridae, Togaviridae, and Bunyaviridae are these viruses that pose a challenge to get rid of due to their complex life cycle that includes arthropods and vertebrate hosts. The spread of diseases due to climate change, globalization, and animal and human movement has caused the number of diseases to rise, including dengue, Zika, Chikungunya, Rift Valley fever, and bluetongue. Arboviral infections lead to huge economic losses, due to lowered productivity, reproductive impairments, death, and trade limitations in animals, and to serious illness, long-term disability, and healthcare strains in humans. Integrated efforts such as the control of vectors, vaccination, better housing, personal protection, and effective surveillance systems are essential in effective prevention. A One Health strategy that brings together human, animal, and environmental health sectors is the most sustainable and coordinated approach to reducing the burden on arboviral epidemics, protecting human health, and achieving food security in the world.

Keywords: Arthropods, Arbovirus, Animal health, human health, prevention stratagies

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Introduction

Arthropods such as mosquitoes, ticks, sandflies, fleas and biting midges are of crucial importance in the transmission of infectious agents that pose threats to the health of animals and humans. These miniature creatures serve as reservoirs of many pathogens, most notably arboviruses (arthropod-borne viruses) which have such a widespread, high transmission rates, and can become a source of outbreaks in regions and species.

Arboviruses are self-sustaining in nature with their life cycle involving arthropods and vertebrate hosts, making it hard to eliminate and control once they have settled in an ecosystem. The arboviruses are a heterogeneous group of RNA viruses, primarily Flaviviridae (e.g. dengue virus, Zika virus, West Nile virus, Japanese encephalitis virus), Togaviridae (e.g. chikungunya virus, Venezuelan equine encephalitis virus), and Bunyaviridae (e.g. Rift Valley fever virus, Crimean Congo hemorrhagic fever virus) (1). They are described as having the capacity to reproduce both in the arthropod vectors and vertebrate hosts and this makes them survive and adapt to different environments. Transmission cycles typically include an efficient vector (mosquitoes, ticks, etc.), and an amplifying host (birds, cattle, and small mammals), and humans and some livestock typically act as incidental or dead-end hosts.

Arboviral diseases have significantly increased in the last few decades due to globalization, climate change, deforestation, urbanization and movement of animals and humans. Changing rain patterns and warmer conditions favor the survival and reproducing of vectors resulting in the introduction of viruses to new geographic regions. Animals and animal products trading at the global level also has resulted in the fast spreading of arboviruses to areas that were not affected before. In case of livestock, arboviral infections have very serious economic effects, such as decreased milk and meat production, losses in the reproductive system, death and trade blocks (2). Such diseases include bluetongue, African horse sickness, and Rift Valley fever capable of destroying herds, limiting international trade, and posing risk to the livelihood of farmers. Arboviruses, e.g. dengue, chikungunya, Zika, Japanese encephalitis, and Rift Valley fever are major causes of morbidity, neuro-adverse outcomes, congenital anomalies, hospitalization and even fatality in humans causing tremendous pressure on healthcare systems and augmenting the socioeconomic disbursements.

As arboviruses have zoonotic potential, they are a significant One Health threat, and human, animal, and environmental health are closely related with each other. The cross-species transferability of these viruses highlights the value of interagency work in surveillance, research, control and prevention. The biology of arboviruses, their ecology and influence on veterinary and human health is thus crucial in developing effective plans that would safeguard the health of the population, keep animal productivity up and food security sustainable (3).

Arboviruses of Veterinary and Human Importance

Arboviruses are a heterogenous category of viruses, which are carried by arthropods, including mosquitoes, ticks, biting midges, and sandflies. They are of great importance in veterinary and human medicine due to their capacity to induce high morbidity, mortality and extensive outbreaks. Arboviruses in animals cause direct economic losses, like in productivity, reproduction as well as trade blockage. The *flaviviruses* are now considered the most significant arboviruses in terms of human health, with up to 400 million people being infected annually. The family members that represent the greatest viruses are dengue virus (DENV), zika virus (ZIKV), yellow fever virus (YFV), West Nile virus (WNV), and Japanese encephalitis virus (JEV). Flaviviruses might have severe clinical effects, including hepatitis, vascular shock syndrome, encephalitis, acute flaccid paralysis, congenital abnormalities, and abortion. Another notable family of arboviruses that infect humans includes *Togaviridae*, one of them being the Chikungunya virus (CHIKV). Wild primates are natural hosts of CHIKV. Rift Valley Fever virus is a high epidemic threat to human beings and a member of *Phenuiviridae* family as well. RVFV is mostly transmitted by mosquitoes and infects primarily domestic animals (sheep, goats, and cattle), causing high infant mortality and abortion (4).

Bluetongue virus that is transmitted by Culicoides midges and afflicts sheep, cattle and goats with fever, swelling of the face and legs, as well as low milk production (5). In the same vein, the African horse sickness virus, which is also transmitted by biting midges causes fatal respiratory and cardiac disease in horses. The other emerging threat is that of lumpy skin disease virus, which is a mechanical transmission by the mosquitoes and the biting flies, and it severely affects cattle by causing nodular skin lesions, infertility and a loss in the level of milk production. The Venezuelan, Eastern and Western equine encephalitis viruses are also arboviruses known to severely cause neurological disease, and even high mortality of the equine (6). Arboviruses are also deadly in human beings, and it is more terrible in tropical and subtropical areas where vectors could thrive. One of the most common is Dengue virus, which is spread by the *Aedes aegypti* and *Aedes albopictus* mosquito, causing millions of cases each year, with dengue hemorrhagic fever being the most frequent as well as shock syndrome. Zika virus, which is also transmitted by *Aedes* mosquitoes is usually associated with mild fever and rash but has a long-standing reputation of causing congenital microcephaly and various neurological complications like the Guillain-Barre syndrome. The outcome of Chikungunya virus is high fever and prolonged joint pains which may last several months, quality of life. West Nile virus is a disease transmitted by Culex mosquitoes that infect human beings, horses, and birds and in severe cases leads to encephalitis and paralysis. Japanese encephalitis virus is another significant arbovirus, which is endemic in various countries of Asia and is a severe brain infection with a high mortality and lifelong disability. There are also risks of tick-borne viruses, such as Crimean Congo hemorrhagic fever virus, which is transmitted by Hyalomma ticks, causing

severe hemorrhagic disease in human beings with high mortality, and livestock are the asymptomatic carriers (7). The most worrying aspect of arboviruses is that they are zoonotic and most of them have made it across the species barrier infecting both humans and animals. Good examples are rift valley fever, West Nile virus, and Venezuelan equine encephalitis that result in terrible outbreaks in livestock along with spillage in human populations. When combined, these viruses pose a threat to the overall productivity of animals, trade as well as human health and food security. Their high distribution rate, possible rapid outbreak rates, and adaptability to changing climatic conditions make them a One Health crisis that needs a concerted effort in surveillance, vaccination, and control of vectors and enlightenment of the population to reduce their effects (8).

Impact on Public and Animal Health

Arboviral diseases affect animal health and economic systems of agriculture significantly. Some of the diseases that have very high losses in livestock include bluetongue, Rift Valley fever and African horse sickness which result in low milk and meat production, poor growth, reproductive failures and death (9). These infections not only raise the cost of veterinary care but also cause trade limitations and pose a threat to food security since they decrease the supply of animal protein and farm incomes to the farming communities. The consequences of outbreaks have a tendency to lead to quarantine zones and export bans, which cause long-term economic pressure and destabilize agrarian lives, which are largely dependent on livestock as a source of sustenance and income production.

Arboviral diseases like dengue, chikungunya, Zika and West Nile fever in humans impose huge burden on the health systems of the population particularly when there is a massive outbreak. The treatment, hospitalization, and the control of vectors, as well as the lost productivity due to illness and disability, have great impact on the economies and social well-being. Regular epidemic outbreaks add to mental stress, a decrease in the efficiency of the working force, and increasing healthcare loads in the already susceptible population. The integrated approach of combining the control of vectors, animal protection, and human health is effective to reduce the global effects of arboviruses on human beings and livestock (10).

Prevention and Control Strategies

Arthropod-borne viral disease eradication demands a combination of practices that integrate vectors and animal control, human and cross-sector cooperation. Environmental sanitation, clearing mosquito breeding habitats, and safe management of waste can be used to control the mosquito and tick population. Chemical control, with insecticides and acaricides will work in case of an outbreak but should be applied sparingly to prevent resistance and pollution (11).

Regular vaccination particularly against infections such as Rift Valley fever and bluetongue, as well as the use of repellents, insecticide-treated nets and better housing are some of the animal protection measures that will help reduce the exposure to vectors.

In the case of humans, preventative measures can include insecticide-treated bed nets, repulsives, protective clothing, and do exist where some vaccination like yellow fever and Japanese encephalitis. There should be effective surveillance and early warning mechanisms to enable detection of outbreaks early enough, the activity of the vectors and guide actions in time. The coordination of medical, veterinary and environmental sectors is guaranteed by adopting the One Health approach where human, animal and environmental health are connected. Such a combined approach is the best and the most sustainable method to mitigate the impact of arboviral diseases and preserve human and animal health.

Conclusion

Arboviruses endanger the health of people and animals, food security of the world, and world economies. Prevention and control are based on an integrated One Health approach which combines activities of medical, veterinary, and environmental sectors. By using targeted surveillance and control of vectors, vaccination and community education, it is possible to significantly lower the incidence of the diseases and guarantee the well-being of the population, as well as more robust ecosystems.

References

[1] Fatima Z, Qureshi MA, Muqadas ML, e Najaf D. Crimean Congo Haemorrhagic Fever. Biological Times. 2023.

[2] Ortiz DI, Piche-Ovares M, Romero-Vega LM, Wagman J, Troyo A. The impact of deforestation, urbanization, and changing land use patterns on the ecology of mosquito and tick-borne diseases in Central America. Insects. 2021;13(1):20.

[3] Shaheen MNF. The concept of one health applied to the problem of zoonotic diseases. Reviews in medical virology. 2022;32(4):e2326.

[4] Socha W, Kwasnik M, Larska M, Rola J, Rozek W. Vector-borne viral diseases as a current threat for human and animal health—One Health perspective. Journal of Clinical Medicine. 2022;11(11):3026.

[5] Subhadra S, Sreenivasulu D, Pattnaik R, Panda BK, Kumar S. Bluetongue virus: Past, present, and future scope. The Journal of Infection in Developing Countries. 2023;17(02):147-56.

[6] Luethy D. Eastern, Western, and Venezuelan equine encephalitis and West Nile viruses: clinical and public health considerations. Veterinary Clinics: Equine Practice. 2023;39(1):99-113.

[7] Celina SS, Italiya J, Tekkara AO, Černý J. Crimean-Congo haemorrhagic fever virus in ticks, domestic, and wild animals. Frontiers in Veterinary Science. 2025;11:1513123.

[8] Singh S, Sharma P, Pal N, Sarma DK, Tiwari R, Kumar M. Holistic one health surveillance framework: synergizing environmental, animal, and human determinants for enhanced infectious disease management. ACS Infectious Diseases. 2024;10(3):808-26.

[9] Muqadas AS, Qureshi A, Imdad N, Fatima Z, Khalid A, Ahmad B, Sindhu IA. Rift valley fever. One Health Triad, Unique Scientific Publishers, Faisalabad, Pakistan. 2023;3:151-6.

[10] Tajudeen YA, Oladunjoye IO, Mustapha MO, Mustapha ST, Ajide-Bamigboye NT. Tackling the global health threat of arboviruses: An appraisal of the three holistic approaches to health. Health promotion perspectives. 2021;11(4):371.

[11] George JE, Pound JM, Davey RB. Chemical control of ticks on cattle and the resistance of these parasites to acaricides. Parasitology. 2004;129(S1):S353-S66.