

Review on epidemiology and public health importance of Zika virus disease

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The review was made to document epidemiology and public health importance of Zika virus disease. The review was made by searching published paper online about Zika virus disease in different parts of the world. We detected that the disease is zoonotic and economically important diseases as emerging diseases in different parts of the world. The disease seen and diagnosed in different parts of the world after first

isolated from a rhesus monkey in the Zika forest of Uganda in 1947. In addition, serological evidence of infection was identified in a few animals in Indonesia, including horses, cows, goats and bats. The disease may appear anywhere where these animals/reservoirs found and environment is favourable for mosquitoes breeding that are the primary vector for virus in the world. Therefore, scientific communities, authorities and other concerned body need to give attention for the disease as it has public health and economic importance.

Key Words: *Control; Transmission; Prevention; Zika Virus; Zoonoses*

INTRODUCTION

Zika virus (ZIKV) disease is caused by an arthropod-borne virus of family *Flaviviridae* genus *Flavivirus* [1]. It is an Arbovirus which can cause diseases in humans through a mosquito vector that was daytime-active *A. aegypti* and *A. albopictus* mosquitoes. It was first isolated from rhesus monkey in the Zika forest in Uganda in 1947 [2].

The virus is most prevalent and emerging pathogen that has recently causing serious disease around the world. Cases of ZIKV disease were reported in Micronesia in 2007 and then in French Polynesia in 2013. In Brazil the virus was introduced and associated with cases of microcephaly [3].

The virus has the potential to spread anywhere the day time active mosquitoes capable of spreading this virus are found, but there is no case report about ZIKV disease in Ethiopia [4]. In non-human primates (NHP), antibodies against ZIKV have been reported both in wild and experimental animals in Borneo [5] and Uganda [6].

There is no case report of Zika virus disease in Ethiopia, Even though some studies and literatures review have been conducted on the ZIKV disease, the viral pathogen is re-emerging and spread into different countries of the World. Therefore the objects of this review is to review the epidemiology and public health importance of Zika virus disease

EPIDEMIOLOGY AND ZOONOTIC IMPORTANCE OF ZIKA VIRUS DISEASE

Etiology and morphology of the virus

ZIKV is a mosquito-borne disease caused by single strand, non-segmented, positive-sense RNA virus of family *Flaviviridae*, genus *Flavivirus* (Figure 1). The virus infects and cause disease in humans and non-human primates (NHP) [7].

The structure of the Zika virus is similar to other *Flavivirus*. The other complex structure of the genome is terminus which is essential for causing disease in human.

The protein composes the majority of the virion surface and is involved in the viral-host cell binding and membrane fusion during replication [9].

Geographical distributions and risk factor associated with diseases

The first virus isolation was case reported in human being in Uganda and Tanzania in 1954. Before 2007, there were reports of confirmed cases of Zika virus infection from the Africa and Southeast Asian continent (Table 1). Later on in 2007, major epidemic occurred in Yap Island (Micronesia) where it affected about 5000 person [6] and also case report in Gabon [10].

In late 2015, the virus was reported for the first time in a number of countries in Central and South America with symptoms of microcephaly in affected parts of Brazil and now includes many Caribbean nations. However, the epicentre of the virus was Brazil and the virus soon spread to El Salvador, Honduras, Colombia, Venezuela and Costa Rica.

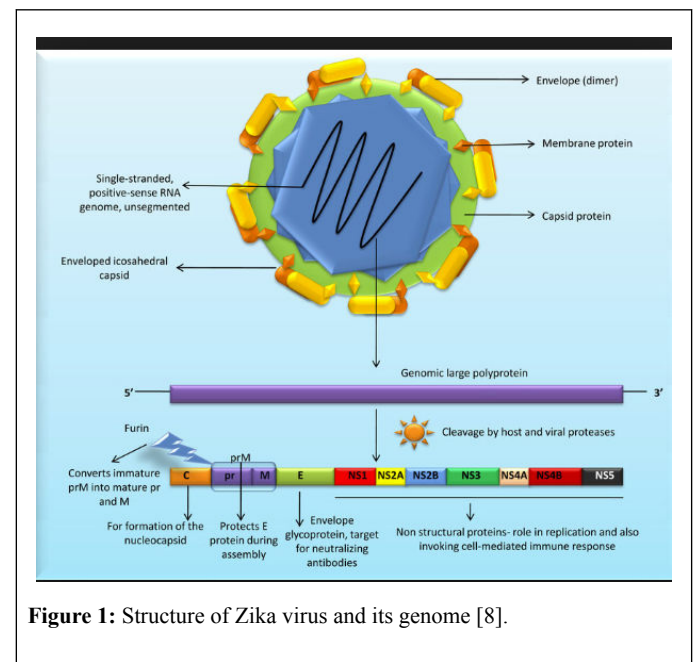


Figure 1: Structure of Zika virus and its genome [8].

The relationship of mosquito number with increased temperature is biological, that means it favours mosquitoes reproduction and increase

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their chance of contact with humans (for blood meal in case of female *A. aegypti*), which favour Zika transmission [21].

Table 1 Geographical distribution of Zika virus.

Location	Countries reported	References
Africa	Senegal, Uganda, Nigeria, Ivory Coast, Gabon, Tanzania, Egypt, Central African Republic, Sierra Leone, etc.	[4,10-14]
Asia	Cambodia, India, Indonesia, Malaysia, Pakistan, Philippines, Singapore, Thailand, Vietnam and Japan	[11,15-17]
Pacific	Micronesia/Yap, New Caledonia, south pacific, and Cook islands, French Polynesia	[4,18,]
Europe	Germany	[16]
America	Brazil, Barbados, Colombia, Ecuador, El Salvador, French Guiana, Guatemala, Guyana, Honduras, Martinique, Mexico, Panama, Paraguay, Puerto Saint Martin, Suriname, and Venezuela	[19,20]

Risk factors associated with a disease are Vector related, Host related and Environmental related risk factors. The virus reservoir host is not completely identified and isolated, some studies suggests that, the reservoir host of Zika virus was primates. The other authors indicate the presence of anti-Zika antibodies in various animals including big mammals such as Zebras, Elephants and rodents in Pakistan [22]. The main source of ZIKV is infection is mosquitoes, mainly *Aedes* and secondary source is infected humans (Figures 2A and 2B) [23].



Changes in climatic conditions, creates suitable conditions for mosquitoes by increasing its biting season and disease carrying mosquitoes will continue to bite as the climate warms. Weather conditions and global

warming are important in occurrences and incidences of ZIKV. For instance, El Niño is one of the factors that bring heavy rain which result in creating good opportunity for mosquito reproduction and multiplication site [24].

Transmission

The virus transmissions can be based on the numbers of primates and mosquitoes vectors [25]. The most common route of Zika virus diseases transmission is through the bite of mosquitoes of the family *Culicidae* and genus *Aedes* (hematophagous arthropods) during their blood meal [26]. Other modes of transmission are non-vector borne transmission through sexual intercourse, blood transfusion, organ transplantation and prenatal transmission has been reported. Sexual transmission of virus is a particular concern during pregnancy. Transmission of the virus from infected women to their sex partners has not been reported. However, transmission from infected men to women partner has been reported [27]. Transmission is possible through organ transplantation, mother-to-foetus during the period of pregnancy [28]. People travelled from areas with active ZIKV transmission to countries with free of Zika virus can transmit the disease to their sex partners. Transmission in laboratory form *A. aegypti* mosquitoes to mice and a monkey was reported [23,27].

Pathogenesis

Zika virus has affinity towards human immature dendritic cells, dermal fibroblasts and epidermal keratinocytes. The virus may replicate in the midgut. ZIKV enters the cells through receptors that are found on the surface of skin and nerve cells. After entrance the virus replicate and distributed to muscles, heart, central nervous system (CNS), and to foetus by crossing the placental barrier through blood vessels and lymphatic [29]. Viral replication in the host cells causes the release of type I interferon [30]. Inside the cells, they use host mechanism and finally cause apoptosis and autophagy of the cells. It causes damage to the eye of infants [31].

ZIKV use certain means to defeat the host defence of the trophoblast and by attacking neuronal tissues, it cause neuronal abnormalities in the foetus [32]. Some study show that, the virus have affinity towards brain cells which was demonstrated when intra-peritoneal injection of virus into mice the virus cross the blood brain barrier. Neurons and glial cells were infected by virus and producing intra-cytoplasmic inclusions called viral factories. One recent study revealed that, Zika virus and man have a

peptide in common which cause microcephaly and Guillain-Barré Syndrome (GBS) [33].

Clinical signs

The virus has an incubation period of 3-12 days. In confirmed case of ZIKV, clinical signs include acute fever, maculopapular skin rashes, non-purulent conjunctivitis, arthralgia, headache, myalgia and asthenia [34]. There are also less evident signs like anorexia, abdominal pain, vomiting, diarrhoea, burning sensation of sole and palm [35,36]. Symptoms are usually self-limiting and may last for 4-7 days [37].

Diagnosis

Diagnostic testing for *Flavivirus* is either direct detection of the virus RNA or detection of antibody responses to viral infection. In this manner virus can be detected from blood, other body fluids and tissues depending on stage of infection. For ZIKV, urine appears to have a higher viral detection than blood [38]. Reverse transcriptase–polymerase chain reaction (RT-PCR) methods used to detect both intact viral particles and replicating viral RNA inside cells. Serological tests for Zika virus on immunoglobulins (IgG and IgM) can be done in order to confirm the presence of neutralizing antibody infection [39].

Treatment

Zika virus disease is relatively mild and requires no specific treatment. People sick with this disease should get plenty of rest, drink enough fluids and treat pain and fever with common medicines like acetaminophen (paracetamol), and antihistamine for pruritic rash is necessary. Other non-steroidal anti-inflammatory drugs (NSAIDs) should be avoided until dengue can be ruled out to reduce the risk of haemorrhage [40]. It is also important to understand the link.

Prevention and control

Prevention and control relies on reducing mosquitoes through reduction of breeding sites and reducing contact between mosquitoes and people. Contact between mosquito and people can be prevented by using physical barriers such as window nets, closed doors and windows [6]. Integrated management of the *Aedes* mosquitoes through biological and chemical control is safe and cost effective. Integrated vector management systems are the most important prevention and control method [11].

In case of biological control, larvivorous fish are recommended for control of *Aedes aegypti* in large water bodies or large water containers. Endotoxin producing bacteria, *Bacillus thuringiensis* serotype H-14 has been an effective mosquito control agent [13].

Insecticide which can kill both adult and larvae are import control method in developing countries like Ethiopia. Larvicides include Temephos and Organophosphate compound. Adulticide recommend for the control of adult *Aedes* mosquito is Pyrethrum sprays [14].

CONCLUSION

In conclusion, ZIKV disease is not a life threatening, but it is serious disease because of the birth defect. It is important to understand the link between microcephaly and the disease because the link is used to develop vaccine. Therefore, People should aware about the transmission, prevention and control of diseases to avoid exposure of pregnant women to the vector and community water gathering around the house.

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