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One Health Concept with Emphasis on Zoonoses

M.G.Jayathangaraj[1]* and M.Raman[2]

Veterinary Clinical Complex, Centurion University of Technology and Management (CUTM), School of Veterinary and Animal Sciences, Paralakhemundi, Odisha State, India

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Abstract

There are many diseases that are communicable from animals to human beings esp. the wild fauna. When population of any one species increases due to multifaceted etiological factors, there may be an increase in the incidences of few zoonotic diseases, which cause more potential risks to the humans, in reality. Outbreaks of diseases have been documented in many incidences, esp. the diseases like Nipah viral infections. Japanese encephalitis, leptospirosis, Erysipeleas infections, Zerka viral infections etc. are the examples of such diseases related to the zoonotic pathogens affecting both man and animals. All such diseases need not be expected to reveal significant clinical symptoms apparently but the potentials related to the general health status, performance and reproduction related aspects may get frequently affected to a greater extent. Working together of both veterinary and medical communities was emphasized in order to maintain one health policy and close dependency between animal and human health is a vital factor to be taken into account when one health policy is to be achieved, successfully.

Key words : Zoonoses, encephalitis, leptospirosis, Erysipeleas infections

Human beings carry no natural immunity to many of the diseases, and thus are often placed at high risk of serious illnesses or death and regional as well as sectoral gaps exist as obstacles in maintenance of one health (Ahmed *et.al*., 2023). Zoonotic diseases, including the Nipah viral infections (Uwishema *et.al.* (2022), COVID-19 pandemic, are on the rise because of climate change, loss of habitat including deforestation, and wildlife trafficking. Asokan (2015) stated that the One Health approach could include law enforcement, policymakers, agriculture, communities, and even pet owners, but no one person, organization, or sector can address issues at the animal-human-environment interface alone.

One Health is the initiative of an inclusive collaboration linking human, animal, and environmental health. One Health is advocated through an inter-sectoral coordination to combat zoonoses and one Health is an approach that recognizes that the health of people is closely connected to the health of animals and our shared environment. One health is being emphasized recently because of the changed interactions between people, animals, plants, and the environment.

Many wildlife diseases in the recent periods gain momentum due to their direct or indirect affections in homosapiens and also due to the zoonoses related conflicts between wild fauna and homosapiens. Outbreaks due to spillover of zoonotic diseases from animal reservoirs often demand systematic studies, leading to pressure both on the veterinarians esp. those working in forest regions and the medical personnel. Due to this, considerable pressure is there on zoo veterinarians and the field veterinarians working in free ranging areas of forests like national parks, wildlife sanctuaries

**Corresponding author* : Email : mgjayathangaraj@gmail.com
[1]Professor, Veterinary Clinical Complex, Centurion University of Technology and Management (CUTM), School of Veterinary and Animal Sciences, Paralakhemundi, Odisha State, India.
[2]Research Professor, Center for Global Health Research, Saveetha Medical College and Hospitals, SIMATS, Chennai , Tamil Nadu State, India raman.tanuvas@gmail.com
ORCid ID 0000-0002-6747-3799

etc., in addition to the medical personnel who are directly involved in the upkeep of the health status in human beings.

Microbes like bacteria, viruses, parasites, or fungi can be spread to humans through direct physical contact, through intermediate hosts like wildlife or the insects, or through the air and most often, notable percent of wildlife are carriers of these diseases, meaning that they are able to transmit the illness without experiencing symptoms (Ahmed *et.al.*, 2023) and example of such diseases include the latent infections in free ranging pigeons, leptospirosis in carnivores, ornithosis caused by *Chlamydia psittaci* etc.

Though the diseases are in plenty, zoonotic diseases gain maximum significance due to the nature of mortality or severe morbidity. However, it is also equally true, that certain diseases may not reveal symptoms apparently but the performance related potentials, as happens in sub-clinical infections may get often reduced among both man and animals esp. livestock as well as wild fauna, thus this issue becomes one of the multiple causes, required for the maintenance of One Health Concept, throughout the globe.

Horefti (2023) stated about the linkage between the role of different experts and the immediate response and intervention in the case of a zoonosis epidemic, as well as the surveillance and mitigation of such public threats. Increased bat populations in China resulted in approximately more number of bat-borne corona viruses and the higher than usual temperatures in addition to the infrequent replenishment of home water supplies might have led to rise in Chikungunya virus infection, as in Zhejiang Province of China and similarly, there is five-fold increase in West Nile virus outbreaks in the European region for the period 2040-2060, as cited by Farooq *et.al.*(2023). During the awareness programme on One Health Concept, therefore, it becomes a need to place emphasis on the prevention of zoonotic diseases as a priority measure, due to the fact that many zoonotic diseases are being encountered in the recent years.

Li *et.al.* (2023) stated detected the novel human-associated circovirus 2 (HuCV2) in man and it raises the question about its origin, prevalence, and pathogenicity in humans and in addition, HuCV2 might circulate in animals, and detection in humans may have resulted from spillover through unknown routes.

Mpox or Monkey pox is also a viral illness caused by monkey pox virus belonging to the genus orthopoxvirus and has two clades, clade I and clade II. Singhal *et. al.* (2022) stated that this disease is transmitted from both animals to humans and humans to humans and the natural reservoirs are squirrels, dormice, rats, non-human primates etc. Vertical transmission of the disease was also reported. Person to person contact with skin lesions or infected animals transmit this viral infections (WHO, 2023), which cause enlargement of lymph nodes, painful rash and fever. Monkey pox virus infection was reported only in Africa till April, 2022 but was later noticed in more than 15 countries. Monkey pox also gets transmitted by sexual activity also in animals, in addition to face to face contact and is zoonotic in nature. Concurrent occurrences in both endemic and non-endemic countries in widely disparate geographical areas have been documented (Rio *et. al.,* 2022).

Strains of Capripoxvirus infect both sheep and goat with occurrence of papules or nodules with affections in the pulmonary regions, also and death may occur. Though the genus Capripoxvirus contains sheepoxvirus, goatpoxvirus and lumpy skin disease, zoonosis is mainly documented with lumpy skin disease. Suresh (2022) stated that infectious diseases like sheep and goat pox are among the major factors that limit the production and productivity of small ruminants and these diseases are associated with high mortality as well as morbidity, in addition to significant economic loss to the farmers rearing livestock. Hence, effective transboundary movement restrictions have to be exercised for the restriction or eradication of these diseases, and this will strengthen the One Health Concept, towards which almost all the countries focus their attention, currently. Emerging zoonotic pathogens like lumpy skin disease virus, influenza virus etc. demand increased awareness (Ryu, 2017), through one health based principles. Avian influenza is being

considered as one of several severe zoonotic diseases with pandemic potential in the presence of sustained human-to-human transmission.

Crimean-Congo hemorrhagic fever (CCHF) is a widespread disease caused by a tick-borne virus (Nairovirus) of the Bunyaviridae family and the CCHF virus causes severe viral hemorrhagic fever outbreaks and Hyalomma spp ticks and ticks of Ixodidae family are the major vectors associated with this zoonotic disease. Bites of the infected ticks with this virus spread this disease among different ruminant species as well as horses (Ghassem *et al*, 2023) and the integration of human and veterinary studies was emphasized for a better understanding and management of CCHF.

Sorvillo *et.al.* (2020) stated that for One Health approach to disease control, focus areas like species affected, nature of pathogensis etc. are to be investigated to mitigate the CCHFV spillover in any region and the mortality rate was 40 per cent in endemic regions and this warrants the effective study about the pathogen, in detail.

The most common wild reservoirs of rabies are raccoons, skunks, bats and foxes. In most cases the disease is transmitted via the bite of rabid animals which shed infectious virus with their saliva. The virus enters the body through transdermal inoculation (i.e. wounds) or direct contact of infectious material (i.e. saliva, cerebrospinal liquid, nerve tissue) to mucous membranes or skin lesions. The virus cannot penetrate intact skin. Jackson (2018) stated that rabies virus causes a progressive lower motor neuron weakness. Cardiopulmonary and multiple organ-failures are common in aggressively managed rabies patients in critical care units and aggressive nature is commonly encountered among various animal species. Radhakrishnan *et. al.* (2020) quoted on aggressive nature of rabies in elephant, hyaena etc. Consales and Bolzan (2007) quoted that wild animals such as any bat species, monkeys, foxes and skunks are considered potential transmitters of rabies and although rabies has been considered 100 per cent fatal, there are well-documented reports of animal survivals and six cases of human survival. Hence, steps like diversification of immunization routes, hygienic disposal of rabies affected dead animals, timely adaption of post-exposure vaccinations, periodical surveillance of rabies among domestic animals, monitoring the incidences of rabies, surveillance of rabies in wild animals etc. need to be emphasized towards maintenance of one health policy.

Ministry of Health and Family Welfare (2018) quoted about the large outbreak of 276 cases of Nipah viral infections in Malaysia and Singapore between 1998 and 1999. Nipah viral infection is a zoonotic disease caused by Nipah virus which is a member of the family Paramyxoviridae and genus Henipavirus. Similarly, in 2018, incidences of Nipah viral infections were documented in humans at Kozhikode district, as stated by Uwishema *et.al.* (2022) and in Malappuram district of Kerala state (WHO,2021) and infections were tested by ELISA based serological test, coupled with confirmation by real time PCR and suitable guidelines to prevent Nipah viral infections were framed accordingly. Core committees were established at village level and appropriate precautions like regular hand washing with soap and water, avoidance of contact with sick bats and pigs, hygienic disposal of dead bats or dead animals in the Nipah viral outbreak periods etc. were undertaken duly and the problem was contained to a great extent. It is worthwhile to quote the fact that nipah virus affects not only man but also affect various species of animals. Although Nipah virus has caused only a few known outbreaks in Asia, it infects a wide range of animals (WHO,2018) and in pet dogs (Mills *et.al*., 2019). Pigs are the primary animal species affected by Nipah virus. Dogs, goats, cats, horses and possibly sheep can also be infected and the virus is thought to be maintained in nature by "flying foxes" (type of fruit bat), which show no signs of infection (Iowa state University, 2018).

Regardless of precautions, it is to be understood that the disease causing pathogens like Nipah virus are inseparable between humans and wild fauna or the domestic animals, due to the factors like co-grazing in buffer zones of forest regions, interventions of wild pigs into villages, contacts with bats etc. Hence in the framing of one health policy, role of veterinar-

ians become inevitable, in general. Nipah virus is considered as the next pandemic agent, as stated by Dhadwal *et.al.* (2023) and with regard to one health concept, precautions like avoidance of contacts with dead or more critically ill fruit bats, pigs and particularly wild pigs, avoidance of contacts with the patients known to be affected with Nipah viral infections etc. are to be followed up, seriously. Still the viral diseases like Japanese encephalitis which is a *flavivirus related to dengue, yellow fever and West Nile viruses bear global importance because of zoonotic significance and is a* major disease burdon in the Asian region. In this regard, Beaman (2018) quoted about the community-acquired acute meningitis and encephalitis. Complex interplay of environment, host, climate and other miscellaneous factors are associated with encephalitis viral infections. Alam *et.al.*(2023) stated about the linkage between the neuropsychiatric symptom-causing autoimmune encephalitides with history of travel with particular emphasis on contact with animals, mosquitoes or other insects. Mosquitoes i.e. Culex species mosquitoes, particularly *Culex tritaeniorhynchus* get these viral pathogens during the bite of infected aquatic birds and migratory birds with Japanese encephalitis and thus, the Japanese encephalitis virus is transmitted to humans through the bite of infected mosquitoes and hence, the birds too have a role in the spread of encephalitis viral infections. In this regard, Impovinvil *et. al.* (2013) also quoted that the arthropod-borne zoonotic infections such as Japanese encephalitis presents some of the greatest challenges to animal and human health globally.

Leptospirosis is another globally significant zoonotic pathogen affecting animals as well as homosapiens and is common in canines, in which it mainly leads to pyrexia, jaundice, polyuria/polydipsia, cholestatic hepatic dysfunction, pancreatitis, various degrees of hemorrhage in pulmonary regions, corneal opacity, etc., as stated by Sykes *et.al.* (2022), who further stated that leptospirosis is a quintessential one health disease of humans and animals caused by pathogenic serovars which are more than 300 pathogenic serovars. Most of human infections are sub-clinical or self limited too. Being a neglected, widespread and reemerging infectious zoonotic disease, the prophylaxis and control of leptospirosis necessitates the systematic global surveillance of this disease among both the domestic and wild fauna of this country and it needs a better coordination among the various health care agencies regardless of different geographic and socio-economic circumstances, as stated by Pal *et.al.* (2021). Application of novel genomic approaches is required in order to understand thoroughly the epidemiology of this disease. A One Health approach to leptospirosis control is essential because human infection almost invariably results either from direct animal exposure or from exposure to environments contaminated by infected animals. One health approach for control of leptospirosis includes the maximizing of cooperation between all professions with an interest in leptospirosis, creating of the outcomes, proper communications with the governments, ensuring of the essential resources and comparison of results on leptospirosis evidences at global level.

Connell *et.al.* (1952) quoted that Erysipelas in pigs is considered to to the zoonotic disease, leading to public health problems. Sankar *et.al.* (2019) stated that *Erysipelothrix rhusiopathiae* is an established animal pathogen causing erysipelas in animals and leads to skin affections in humans, termed as erysipeloid. Dama *et.al.* (2015) also quoted that listeriosis in animals has public health significance and is an infectious as well as fatal disease causing mortality in many animal species like sheep, goat, cattle, birds and even the crustaceans, in addition to the homosapiens. *E. rhusiopathiae* also has zoonotic potential and can cause erysipeloid in humans with a clear occupational link to meat and fish industries. Hence, one health policy in this regard should comprise global surveillance of the disease in pigs, integrated documentations, avoidance of slaughter if skin related signs are visible, timely reporting to the global organizations etc.

Listeria monocytogenes has been isolated worldwide from humans, animals, poultry, environmental sources like soil, river, decaying plants, and food sources like milk, meat and their products, seafood and vegetables. Septicemia, encephalitis, meningitis, meningoencephalitis,

abortion etc. are characteristic of listeriosis in animals like sheep and goat. Connell *et.al.* (1952) quoted about the linkage of listeriosis causing organism with *Erysipelothrix rhusiopathiae* and the linkage is related to the absence of generic differences between the two, in addition to factors in the bacterial taxonomy. Factors such as diverse migratory bird populations, climate change, expanding human population and shrinking wildlife habitats play a significant role in both the emerging and reemerging zoonotic pathogens from wild animals like non-human primates, small ruminants, wild pigs etc. *Listeria monocytogenes* is considered a zoonotic agent and since the clinical listeriosis in humans occurs most often in pregnant women and immune-compromised patients; possible sources for human infections include exposure to contaminated soil and food or to human and animal carriers. Hence, one health concept in this regard comprises food safety, global surveillance of this disease with periodic monitoring and reporting at global levels, avoidance of contamination of food or soil by the identified animal that has been infected with listeriosis etc.

When reviewing diseases like Ebola virus, Zika virus, herpes viral infecions and aviary diseases like avian influenza, parasitic diseases like hydatidosis, infections with *Taenia solium, Taenia saginata,* toxoplasmosis, scabies, fungal infections etc. and the implementation of a One Health approach actually varies considerably between different geographical regions and remains a challenging uphill task.

International prominence is now linked with One Health Concept by coordination of efforts by multidisciplinary professionals, like veterinarians, human-health-care personnel, ecologists etc., as stated by Asokan (2015). No doubt that the challenges in front are huge; however, it is the duty of both veterinary and medical community move together to achieve a combined surveillance among their patients for evidences of different kinds of zoonotic infections, in addition to maintenance of environmental health and it needs additional focus mainly on the integration of human as well as veterinary studies and research. Ahmed *et.al.* (2023) stated that there is a need to widen the outreach for global One Health participations to overcome the highlighted regional and sectoral gaps in One Health research. Many zoonotic diseases like need timely as well as effective control measures for preserving the animal and human health and is to be borne in mind that there is a close dependency between human and animal health and the animals include wild fauna too, since all share a common environment, most of the times, regardless of the country.

The unknown pathogens of wild fauna, as well as the insect-fauna are still at large demanding immediate interventions in forest regions too, as a strategy to implement one health concepts in this globe and hence, the scientific community has to pay additional care and attention on research related to the concrete and successful strategic implementation measures for framing of One Health Concepts, to avoid the future sufferings by homosapiens, regardless of the region. Approaches for one health concept includes an integrated diagnostic approaches, surveillance measures, documentations in a periodical and systematical manner and creating awareness on zoonotic pathogens currently prevailing in both domestic and wild animals and both medical and veterinary personnel need to work collaboratively with interexchange of technical information on diseases esp. the zoonotic diseases.

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