Current Worldwide Status of Newcastle Disease

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Abstract

Newcastle disease is present worldwide. The WOAH demands rapid reporting to prevent its spread. It can cause 100% mortality among the birds. Various proteins are involved in its pathogenicity. No region of the world is safe from this disease. It is endemic in many regions around the globe such as Indonesia, Vietnam, Iran and Africa. It causes sporadic cases in Europe. Recent outbreaks have been reported in India and Russia. England has developed monoclonal antibodies against the virus while Australia has been declared a free zone from the virus. The migratory birds are considered to be a source of disease spread. Newcastle disease is present in both the wild and domestic birds. Furthermore, the lack of adequate information among the farmers is also a reason for its spread. Molecular identification of viral isolates suggests that its spread has geographical significance. Although a significant contribution has been made to detect its prevalence in different regions of the world, a huge contribution is required to check its prevalence in threatened areas.

Keywords: Newcastle, Disease, Virus, Birds, World

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Introduction

Newcastle disease virus infects more than 200 species of birds, and most of the cases have been reported in poultry (Zeng et al., 2024). It is considered one of the most deadly pathogens in the worldwide poultry industry (Chen et al., 2024). It affects the digestive, respiratory, and nervous systems of the bird (Taghizadeh et al., 2024). Its deadly effects can be estimated considering that the WOAH demands rapid reporting of any case of newcastle disease to prevent its spread to the surrounding environment (Shafaati et al., 2024). It is an economic disease of the poultry industry (Dai et al., 2024). The virulence of the viral strain and the species of the bird being affected decide the clinical signs that will appear (Zeb et al., 2024). The haemagglutinin-neuraminidase and fusion proteins play a role in the pathogenesis as well as immunogenicity of newcastle disease (Rajab et al., 2024). Strains of the newcastle disease virus are defined based on their pathogenicity namely lentogenic which is a non-virulent strain, mesogenic strain which is a moderately virulent strain, and velogenic which is a highly virulent strain (Al-Mubarak et al., 2024). The lentogenic strain causes sub-clinical infection and causes mild respiratory and enteric damage. The mesogenic strain causes respiratory distress with low mortality. The velogenic strain has been further classified into neurotropic velogenic strain and viscerotropic velogenic strain. The neurotropic velogenic strain is characterized by dyspnea, head twisting, depression, paralysis, and opisthotonus whereas the viscerotropic velogenic strain causes hemorrhages in the gastrointestinal tract, along with necrotic foci on the liver, spleen, and gut-associated lymphoid tissue (Zhang et al., 2023). The incubation period of the disease ranges from 2 to 15 days and can cause 100% mortality (Dzogbema et al., 2021).

Newcastle disease virus's genome encodes six structural and two non-structural proteins in total, including the phosphoprotein (P), fusion (F) protein, nucleocapsid (NP) protein, haemagglutinin-neuraminidase (HN) protein, large (L) polymerase protein, matrix (M) protein, and V and W proteins. The F, HN, and M proteins are connected with the viral envelope, whereas the NP, P, and L proteins, along with the viral RNA genome, make up the ribonucleoprotein (RNP) in virions. The F and HN glycoproteins predominantly mediate the entry and release of NDV virions respectively, while the M protein is principally involved in the assembly and budding of progeny viruses. Simultaneously, the NP protein encapsulates viral genome RNA to form helical nucleocapsids, while the P and L proteins connect to form the nucleocapsid, which functions as the viral RNA-dependent RNA polymerase. As a result, the nucleocapsid and vRdRp form the bare minimum of infectious units required for RNA genome transcription and replication (Duan et al., 2023). The Newcastle disease virus's

ongoing genetic drift and the appearance of new virulent genotypes suggest that multiple viral genotypes are concurrently evolving in various global regions. The likelihood of both vaccination and diagnostic failures rises as the virus's genetic diversity expands (Amoia et al., 2024). This chapter focuses on the current status of newcastle disease in different regions of the world namely Asia, Middle East, Africa, Europe, Russia, Australia, England, and America.

1. Current Worldwide Status of Newcastle Disease

1.1. Asia

In Pakistan, layer birds have the highest prevalence of newcastle disease followed by backyard poultry, broilers, pigeons, peafowls, ducks, turkeys, parrots, and quails (Aziz et al., 2023). The Newcastle disease virus has been now isolated from the pigeons in Pakistan (Wajid et al., 2024; Akhtar et al., 2023; Ather et al., 2023). Both Australian parrots and house sparrows are now susceptible to newcastle disease, although clinical signs do not develop in these birds (Khan et al., 2023). Complete genomic sequencing of newcastle disease virus isolated from India has now been carried out (Reddy et al., 2024). The recent outbreak of newcastle disease has been recorded in Gujarat state of India (Patel et al., 2024). Newcastle disease has now been observed in wild birds in China (Zeng et al., 2024). Eight pigeon strains of the virus have been discovered in various provinces of China (Wang et al., 2024). Research carried out in China explains the transmission of newcastle disease from domestic birds to wild birds (Liu et al., 2023). Molecular identification of new isolates currently has been performed in China (Wang et al., 2024). Newcastle disease is endemic in Indonesia causing outbreaks in both commercial and free-range farming (Dharmayanti et al., 2023). Malaysia has developed a recombinant newcastle disease virus that is non-replicating and thus can be used in the treatment of cancer as it is an oncolytic virus (Cheow et al., 2024). The viral subgenotypes identified in Malaysia are also identified in Africa (Amoia et al., 2024). Newcastle disease is endemic in Vietnam. Despite proper vaccination programs, various outbreaks have been reported. All the strains isolated in Vietnam are reported to be virulent strains (Tran et al., 2023).

1.2. Middle East

Sub-genotype VII.1.1 which is a newcastle disease virus challenge strain is the most common strain among the birds of Iran (Khabiri et al., 2023). Newcastle disease is also found in pet birds of Iran (Khalafi et al., 2023). Newcastle disease is endemic in Iran (Samakkhah et al., 2023). The commercial production of chicken in Saudi Arabia has been severely impacted by Newcastle disease. Due to outbreaks, lower egg output, and increased mortality rates, poultry breeders have suffered large financial losses. These consequences affect not only the financial sustainability of the poultry business but also food security and the availability of poultry products on the local market. Cobb 500 has the highest level of protection against the newcastle disease, while the Ross 308 and Avian 48 have low protection among the Egyptian birds (Khair et al., 2024). Since 2011, many outbreaks of the highly virulent Newcastle disease virus genotype VII have affected poultry in Egypt. According to phylogenetic analysis, all of the strains that were found in Egypt were highly virulent and belonged to class II under genotype VII.1.1. The geographically different but genetically similar virulent isolates in a wild bird and poultry may suggest that an outside factor is influencing the virus's spread throughout Egypt's poultry populations. The migratory behavior of wild birds may constitute one such contribution, although further research is needed to substantiate these conclusions (Eid et al., 2022). It has been determined that the severe genotype VII newcastle disease virus strains that are spreading among Egypt's vaccinated chicken farms have a high genetic relationship with the LaSota reference strain, which has led to considerable financial losses (Zain Eldeen et al., 2023). Newcastle disease has been found to occur in co-infection with adenovirus infection (Abdallah et al., 2023). Furthermore, newcastle disease virus has also been isolated from the ostrich in Egypt (Ghaly et al., 2023).

1.3. Africa

As of right now, Africa has reported half of the Newcastle disease class II genotypes. Even though the disease is widespread in the majority of African nations, there is still a dearth of information on circulating viral genotypes (Tsaxra et al., 2023). The disease is still endemic in Africa (Henriques et al., 2023). Two subgenotypes of newcastle disease virus are circulating among the birds in Tanzania, East Africa (Amoia et al., 2023). According to study findings, virulent genotype VII of the virus is found in birds in Tanzania's Morogoro and Iringa regions. These findings imply that existing vaccines are not effective in avoiding serious diseases because the tested hens had received vaccinations. A greater understanding of the disease status and classification of circulating strains will result from routine surveillance, which will also improve disease control (Amoia et al., 2024). For Kenyan farmers who produce local chicken in a free-range manner, this disease presents a significant barrier. Farmers' management of the disease is unknown due to inconsistent poultry-rearing procedures. The issue is worsened by low awareness and unfavorable opinions, which result in inadequate management and more illness outbreaks. There is also a lack of information regarding the level of disease awareness and perception among Kenyan farmers (Ipara et al., 2024). The distribution of genotype VII.2 and genotype 1 in wild waterfowl and poultry in live bird markets, respectively, in Zambia is now accessible for the first time. According to phylogenetic analysis, genotype VII.2 viruses are prevalent in chickens from Zambia. Furthermore, the genotype 1 isolates share a similar resemblance with viruses discovered in Europe and Asia, indicating that European migratory birds may have brought these viruses into Zambia (Kalonda et al., 2024). Four genotypes (I, II, VI, VII) of the virus are present in Ethiopia (Tibebu et al., 2024).

1.4. Europe

Newcastle disease is present in wild and domestic birds of Europe. Genotypes IV, V, VI, XIII, and XVI are circulating in the birds of Europe (Moustapha et al., 2023). Recently, panzootic outbreaks have affected the Eastern Europe (Criado et al., 2023). Vaccines have been now protecting against the disease in Europe (Vu et al., 2025). It also occurs sporadically in some countries in Europe (Dzogbema et al., 2021). Wild birds of Asia are found to be a source of newcastle disease outbreaks in Europe (Karamendin & Kydyrmanov, 2021). The synanthropic birds are responsible for the transmission of newcastle disease to the urban environment in Spain (Blanco-González et al., 2024). The migratory birds are playing a critical role in the transmission of disease in Ukraine (Goraichuk et al., 2023). Newcastle disease is endemic in free range bird population of Germany (Oberländer et al., 2020). Europe is now working to reduce the pathogenicity of the virus to use it as an oncolytic virus (Najmuddin et al., 2023).

1.5. Australia

Australia has reported excessive outbreaks of newcastle disease in the past (Bhattacharya et al., 2024). Australia has declared it a free zone from newcastle disease (Kolluri et al., 2024). The virus has not been isolated during the research activity (Kelly-Bosma et al., 2024). However, recently a case of a child infected with newcastle disease has been reported in Australia (Harvey & Foster, 2024), which describes the presence of a virulent strain of newcastle disease virus (Guseva et al., 2023).

Table 1: Current worldwide status of newcastle disease

Zone	Country	Status of newcastle disease	Reference
Asia	Pakistan	Layer birds have the highest prevalence followed by backyard poultry, broilers, pigeons, peafowls, ducks, turkeys, parrots and quails	Aziz et al., 2023
		Isolated in pigeons	Wajid et al., 2024; Akhtar et al., 2023; Ather et al., 2023
		Isolated in Australian parrots and house sparrows	Khan et al., 2023
	India	Outbreak in northeastern region	Rajkhowa et al., 2023
		Complete genomic sequencing of virus carried out	Reddy et al., 2024
		Outbreak in Gujarat	Patel et al., 2024
	China	Isolation in wild birds	Zeng et al., 2024
		Isolation of eight strains in pigeons	Wang et al., 2024
		Transmission from domestic to wild birds	Liu et al., 2023
		Molecular identification of new isolates	Wang et al., 2024
	Indonesia	Endemic	Dharmayanti et al., 2023
		Development of Kampung Unggul Balitbangtan (KUB) chicken resistant to infection	Hayati et al., 2024
	Malaysia	Development of non-virulent virus for cancer therapy	Cheow et al., 2024
		Viral sub-genotypes are identical to those of Africa	Amoia et al., 2024
	Vietnam	Endemic	Tran et al., 2023
Middle East	Iran	Presence of sub-genotype VII.1.1	Khabiri et al., 2023
		Discovered in pet birds	Khalafi et al., 2023
		Endemic	Samakkhah et al., 2023
	Saudi Arabia	Has integrated vaccination campaigns, quarantine guidelines, and biosecurity measures	Al-Rasheed, 2024
	Egypt	Cobb 500 has the highest protection, Ross 308 and Avian 48 have lower proetction	Khair et al., 2024
		Presence of genotype VII	Eid et al., 2022
		Co-infection with adenovirus infections	Abdallah et al., 2023
		Isolated from the ostrich	Ghaly et al., 2023
Africa		Endemic	Henriques et al., 2023
	Tanzania	Presence of two sub-genotypes	Amoia et al., 2023
		Presence of genotype VII	Amoia et al., 2024
	Kenya	Lack of information among the farmers	Ipara et al., 2024
	Zambia	Presence of genotype VII.2 and genotype 1	Kalonda et al., 2024
	Ethiopia	Presence of four genotypes (I, II, VI, VII)	Tibebu et al., 2024
Europe		Presence of genotypes IV, V, VI, XIII, and XVI	Moustapha et al., 2023
		Panzootic outbreaks	Criado et al., 2023
		Sporadic occurrence	Dzogbema et al., 2021
		Wild birds of Asia transmit disease	Karamendin & Kydyrmanov, 2021
	Spain	Synanthropic birds transmit disease	Blanco-González et al., 2024
	Ukraine	Migratory birds transmit disease	Goraichuk et al., 2023
	Germany	Presence in free-range birds	Oberländer et al., 2020
Australia		Free zone from disease	Kolluri et al., 2024
		Reporting of a zoonotic infection	Harvey & Foster, 2024
Russia		Massive outbreak in 2022	Rtishchev et al., 2023
		Virus isolated resembles to that of Iran	Treshchalina et al., 2023
		Prevalence in various regions	Murashkina et al., 2024; Guseva et al., 2023
England		Development of monoclonal antibodies	Dharmayanti et al., 2023
America		Presence of Lasota and B1 strains	Najmuddin et al., 2023
		Prevalence of viral genotype VII	Adam et al., 2023; Fernández-Díaz et al., 2023; Dharmayanti et al., 2023; Mase, 2022; Naguib et al., 2022

1.6. Russia

Mortality among chickens was noted in a home farm in the Moscow area of Russia, and within a few days of the onset of symptoms, all 45 of the farm's chickens either died or were killed. The sick birds were found to contain *Paramyxovirus*. As is common for the velogenic pathotype, the mean time of death for 10-day-old chicken embryos after infection with the lowest infectious dosage was 52 hours. This indicates that the virus can spread not just through the fecal–oral channel but also through the aerosol route. The virus killed 100% of six-week-old chickens during oral infection and 100% of all contact birds, including those in distant cages (Rtishchev et al., 2023). The virus isolated was closely associated with that isolated from Iran (Treshchalina et al., 2023). Newcastle disease is present in various regions of Russia (Murashkina et al., 2024; Guseva et al., 2023).

1.7. United Kingdom

The monoclonal antibodies against newcastle disease have been developed by the Central Veterinary Laboratoty, England (Dharmayanti et al., 2023).

1.8. America

The class I strain of newcastle disease virus is circulating among the wild and domestic birds of America. The Lasota and B1 strains are present among the birds of North and South America (Najmuddin et al., 2023). Newcastle disease is endemic in Central and South America. Viral genotype VII is present in South America (Adam et al., 2023; Dharmayanti et al., 2023; Fernández-Díaz et al., 2023; Mase, 2022; Naguib et al., 2022). Costa Rica has been declared as free zone from newcastle disease (León et al., 2023). Current worldwide status of Newcastle disease have been summarized in Table 1.

Conclusion

Newcastle disease is present in all parts of the world, becoming a threat to the poultry industry worldwide. It is endemic in different areas of the world, while in some regions there is sporadic occurrence. Some regions have been declared as free zones from the disease such as Australia. The development of monoclonal antibodies in England is a great step towards its control. Although the available data regarding the prevalence of Newcastle disease is not scarce, however, there is a need for further research to determine its exact prevalence.

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