

AN OVERVIEW OF OUTBREAKS OF LPAI AND HPAI H5N8 IN COMMERCIAL POULTRY IN CALIFORNIA AND HPAI H5N2 IN MIDWEST USA

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Avian Influenza (AI) viruses infect various species of birds and mammals including humans. AI viruses are divided into various subtypes based on two surface glycoproteins; Haemagglutinin (H) and Neuraminidase (N). There are 16 H (H1- H16) and 9N (N1- N9) subtypes with a potential for 144 combinations. They are further divided into Low Pathogenic AI (LPAI) and High Pathogenic AI (HPAI) strains depending on their pathogenicity and LPAI strains can change to HPAI on some occasions. AI viruses of subtypes H5 and H7 are considered to be pathogenic to poultry species or have the potential to become HPAI. Waterfowl such as ducks, geese and swans and shore birds such as gulls, terns, plovers, *etc.* can act as reservoirs for AI viruses. The following is a summary of AI H5N8 outbreaks in California in quail, turkeys, chickens and ducks during the years 2014 and 2015.

In April of 2014, LPAI H5N8 was diagnosed in 10 to 15-week-old Coturnix quail (*Coturnix C. Japonica*) from a flock of 25,000 birds located in the Stanislaus County, CA. Except for mild to moderate increased mortality in the flock there were no significant clinical signs reported. Necropsy of 20 birds revealed confluent pale foci of necrosis and hemorrhages in the pancreas in most of the birds and pale foci of necrosis in the liver of a few birds. Histopathology revealed acute multifocal to locally extensive severe to massive coagulative necrosis of acinar cells with little or no inflammation in the pancreas. Livers had mild to moderate coagulative necrosis of hepatocytes with mild infiltration of lymphocytes. Immunohistochemistry (IHC) for AI revealed nucleoprotein in the nucleus and cytoplasm of pancreatic acinar cells of most birds and in the hepatocytes, mononuclear cells of the spleen and cells in the interstitium of lungs in a few birds. Oropharyngeal and cloacal swabs taken from the quail tested positive for AI by RT-PCR. AI virus was isolated, sequenced, IVPI done by National Veterinary Services Laboratory, Ames, Iowa and was determined to be LPAI H5N8 of the North American Lineage. Birds in the affected premises were depopulated, the premises were cleaned and disinfected and surveillance of birds in the 10 to 20 km zone did not reveal any positive birds for AI.

In January of 2015, HPAI H5N8 was diagnosed in 14-week-old turkeys with a history of increased mortality of 8, 75 and 500 per day in the last three days from a flock of 10,000 turkeys in Stanislaus County, CA. There were a total of 150,000 turkeys on the ranch.

In February of 2015, HPAI H5N8 was diagnosed in 12-week-old brown chickens with a history of mortality of 72, 123, 110, 140 and 170 per day in the last five days from a flock of 26,500 chickens in Kings County, CA. There were a total of 100,000 chickens housed in four different houses on the ranch.

Necropsy of five turkeys and 11 chickens revealed similar lesions except for a few differences. These included enlarged and mottled pale spleens, pale patchy or red areas in the pancreas, hemorrhage in the cecal tonsils of turkeys and increased mucus in the trachea and small and pale spleen in the chickens. Histopathology in turkeys and chickens were similar and included encephalitis, pancreatitis, splenitis tracheitis, pneumonia, myocarditis and IHC revealed nucleoprotein in the cells of these organs.

The ranch which housed chickens also housed about 36,000 Pekin ducks ranging in age from 2 to 4-weeks in three different houses. One of the houses that housed 4-week-old ducks in a house of 16,000 experienced decreased feed consumption, increased mortality that ranged from normal 5 to 7 per day to 22, 24, 18, 28, 33 and 65 per day in the last six days. About 2 % of the ducks in the flock were experiencing ataxia, torticollis and opisthotonus. Necropsy of six live ducks revealed mild cloudy air sacs in three birds and pale foci of necrosis in the liver and pale patchy myocardium in one bird each.

Histopathology in ducks was similar to turkeys and chickens and included encephalitis, pancreatitis, splenitis, tracheitis, pneumonia, myocarditis and also hepatitis. IHC revealed nucleoprotein in the cells of these organs. Similar to the quail, the oropharyngeal and cloacal swabs from the ducks and oropharyngeal swabs from turkeys and chickens tested positive for AI by RT-PCR. AI virus was isolated, sequenced and determined to be HPAI H5N8 of the Eurasian Lineage. Birds in the two affected premises were humanely euthanized by foam and composted in-house, pressure cleaned and disinfected. Swabs taken periodically from the houses were negative for AI by RT-PCR. Surveillance of birds in the 10 to 20 km zone did not reveal any positive birds for AI.

In March 2015 HPAI H5N2 arrived in Minnesota in the Midwestern region of USA. AI was diagnosed in a commercial turkey breeder flock where the birds experienced a sudden increase in mortality. Hemorrhages in the pericardial and serosal fat and in the proventriculus were the prominent lesions. The disease spread rapidly within a few days to other turkey and layer flocks not only in Minnesota but also in the adjoining states of Iowa, Nebraska, Wisconsin, Missouri, Arkansas, *etc.* The states of Iowa and Minnesota were the worst affected, with 75 and 101 cases, respectively. This resulted in depopulation of more than 31 million birds in Iowa and nearly 9 million birds in Minnesota. The reasons for such a rapid spread of the disease included many factors; ideal weather conditions for spread of the virus, many aspects of poor biosecurity, failure to diagnose the disease quickly as well as, to depopulate and dispose the birds quickly, lack of proper communication between the various agencies and the poultry industry, *etc.* The last

outbreak of AI was in June of 2015. Genetic sequencing of the virus isolates revealed that migrating waterfowl were the source of HPAI H5N2 and the virus of Eurasian type.

In summary HPAI H5N8 and HPAI H5N2 outbreaks from December 2014 through June of 2015 in poultry was the worst animal health emergency in the history of the United States. The disease was detected in commercial poultry, backyard poultry, captive falcons and wild birds involving 21 states. A total of 232 premises, including 211 commercial and 21 backyard flocks were depopulated. Approximately 49.6 million birds; 7.5 million turkeys and 42.1 million chickens (layers and broiler breeders) were depopulated. Interestingly no commercial broiler chickens were involved during this outbreak. It is estimated that the total economic impact of the HPAI outbreaks in poultry and to the poultry industries in the US was more than 3 billion dollars.

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