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HIGHLY PATHOGENIC AVIAN INFLUENZA VIRUS DISEASE (*BIRD FLU*) – RECOMENDED CONTROL MEASURES

Maduike C. O. Ezeibe

Department of Veterinary Medicine, University of Nigeria, Nsukka, Enugu State, Nigeria

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ABSTRACT

Avian influenza (bird flu) is a disease of wild birds which sometimes spills over to domestic poultry. It also affects cats, pigs, donkeys and humans. The disease is caused by Influenza A viruses with the H5N1, H5N2 and H7N7 as the highly pathogenic (HPAIV) strains. The viruses are transmitted to susceptible hosts by inhalation and ingestion. Bird flu was first recognized as a disease of domestic poultry in 1878 and by 1918 the causative virus was confirmed as cause of the first human influenza pandemic. Thereafter, human influenza pandemics were recorded every forty years; a period postulated for the virus to mutate to strains that are pathogenic to man. This led to fear that the third human influenza pandemic could occur about 1998. Therefore, effort of the world was directed at preventing avian to human and avian to porcine transmission of the virus since the virus uses man and pig to mutate. It is also known that the Influenza viruses are enveloped viruses and that heat, disinfectants, soap or sunlight destroy their envelopes making them loose infectivity. Consequently, the consumption of well cooked pork, poultry meat and eggs, does not expose humans to bird flu. Therefore, strict hygiene, rather than abstinence from pork and poultry, is necessary to prevent avian influenza in humans.

Keywords: *Avian Influenza, Bird flu, Review, Control*

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INTRODUCTION

Highly pathogenic avian influenza (HPAI) disease (b*ird flu*) is a generalized disease of avian species. It also affects pigs, cats, donkeys and man. The disease affects mainly the digestive and respiratory systems but the cutaneous, nervous and reproductive systems may also be affected [1].

AETIOLOGY

Bird flu viruses belong to the family *Othomyxoviridae* and the genus *Influenza*. Influenza viruses are classified into three types (A, B and C) based on their nucleoprotein (N) and matrix (M) antigens. Avian i*nfluenza* virus belongs to type A which are further classified into sub types based on the kind of

***Correspondence: Email:** maduikeezeibe@yahoo.com; **Tel.:** +234850394526
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haemagglutinin (H) and neuraminidase (NA) antigens they possess. Sixteen different H antigens and 9 different NA antigens have been reported among the Influenza A viruses [2]. These H and NA antigens come in different combinations on envelopes of the Influenza A viruses. Influenza viruses with all possible combinations of H and NA antigens have been isolated in the avian species but only H_5N_1, H_5N_2 and H_7N_7 are known to be highly pathogenic. Others are low pathogenic avian influenza viruses (LPAIV). The LPAIV can mutate to HPAIV [3 ,4,5,6]. So, even the LPAIV deserve attention in efforts to control avian influenza.

SUSCEPTIBLE HOST SPECIES

Water fowls and sea birds are natural reservoirs of avian influenza viruses [7]. They serve as sources of infection to domestic birds [2]. These natural hosts of avian influenza viruses are found in most parts of the world [2]. Among the domestic birds, chickens and turkeys are highly susceptible, while ducks and geese show clinical signs only when infected with very highly pathogenic avian influenza viruses (HPAIV) [8] . Cats, pigs, donkeys and man are also susceptible to HPAIV [8,9,10,11]. Resortment of the H and NA antigens often takes place in pigs and in humans when AIV and other *Influenza* viruses infect same cells at the same time [8].

Most avian species are reported to be susceptible to avian influenza virus [12]. Infection of domestic birds, initially results to LPAI [13]. Mutation of the LPAIV in the domestic birds leads to evolution of the HPAIV which then leads to bird flu epizootics, hence the need to control even the LPAI in domestic flocks [8,12].

TRANSMISSION OF HPAIV

Highly pathogenic avian influenza viruses infect susceptible hosts either by inhalation or by ingestion. The viruses are shed in secretions and excretions of infected birds. When shed, HPAIV can survive for up to three months in poultry manure and for about 30 days, in water. Therefore, poultry manure, contaminated streams and other water sources are sources of the infection. Poultry workers, cars, poultry equipment and manure are vehicles of spread of HPAIV. Rodents, such as rats and insects which visit infected farms, also help to spread the infection. Migratory birds are major vehicles of region to region spread of HPAIV, because, when they converge at water points to drink, they contaminate the water [2,8,14]. This can lead to infection of other susceptible birds and man [15].

CLINICAL SIGNS OF AVIAN INFLUENZA

Infection by avian influenza virus leads to variable outcomes. Outcome of infection with HPAIV depends on the strain of the virus, the species, breed and age of the birds and environment of affected birds. Infection of susceptible birds by the H_5N_1, H_5N_2 or H_7N_7 would likely result in bird flu, because they are highly pathogenic. Chickens are more susceptible than geese and ducks while layer breeds of chickens show more clinical signs than the meat breeds [8]. Also, birds in confinement are reported to suffer more severely than free roaming birds.

Clinical signs by which bird flu can be recognized, include, high mortality (50% - 100%), anorexia, ruffled feathers, fever, diarrhoea, difficulty in respiration, and nasal discharges which could be bloody. Birds, sick of HPAIV, tend to drink more and have staggering gait. Infected hens lay soft shelled or shelless eggs. Wattles and combs of infected birds may become cyanotic or haemorrhagic. Unfeathered parts of infected birds, such as, the shanks may also become cyanotic or haemorrhagic. Chickens sick of HPAIV die within few hours or 1 – 2 days from onset of clinical signs but sick turkeys can last up to 3 days. Broilers may not show any observable signs before they die [8,16].

POST MORTEM FINDINGS

Birds which die of HPAIV show lesions which include dehydration of the carcases, extensive subcutaneous oedema of the head and/or neck region, congestion of muscles, haemorrhages in the larynx,

the trachea, the proventriculus, epicardial fats and serosal surfaces of abdominal organs. There could be gray focci on the spleen, liver, kidney and the lungs. Exudative fluid in the air sacs and haemorrhagic splenomegaly can also be seen [16].

DIFFERENTIAL DIAGNOSES

Other diseases of poultry with clinical signs and lesions similar to bird flu include:

Newcastle Disease [ND]

The difference between ND and bird flu is that birds which die of HPAIV tend to have more cases of sub-cutenous oedema, heamorrhages or cyanosis of unfeathered parts than cases of ND. However, when ND results from infection by the velogenic *Newcastle Disease Virus*, even these differences may not be distinct.

Avian Mycoplasmosis

The difference between avian mycoplasmosis and bird flu, is that bird flu results in higher mortality and has a shorter course.

Acute Fowl Cholera

The difference between HPAI and acute cases of Fowl Cholera is the absence of respiratory signs in fowl cholera.

Infectious Coryza

HPAI occurs more suddenly and causes higher morbidity and higher mortality than infectious coryza.

DIAGNOSIS OF HPAI

Tentative diagnosis of bird flu is based on the clinical signs and the lesions associated with the disease. Specimens to be collected from suspected birds for confirmation of the diagnosis include the spleen, lungs, kidney, trachea and intestines. In sick birds specimens for confirmation of diagnosis are faeces and sera. Confirmation of diagnosis of bird flu is by isolation of the virus and by typing and sub typing the isolates. Neuraminidase inhibition test, phylogenic sequencing, host virulence test and heamagglutination of chicken or goose red blood cells can also be used to confirm the diagnosis [8,17].

PUBLIC HEALTH AND ECONOMIC IMPLICATIONS OF OUTBREAK OF *BIRD FLU*

First human influenza pandemic occurred in 1918, forty years after the disease was reported in birds. The second human influenza pandemic occurred between 1957 and 1958; another forty years. Therefore, it appears that the avian influenza viruses, when not controlled, take about forty years to mutate into strains that cause disease in man. Since recent outbreaks of HPAI, only few cases of human infection have been reported. Out of 190 human cases reported between 2003 and 2006, 50% mortality was recorded. So, HPAIV are infections of wild birds which can spill over to domestic birds and to humans.

People at risk are those who ingest food or water contaminated with HPAIV or those who inhale air contaminated with the viruses. Therefore, the individuals mostly at risk of contracting HPAIV are poultry farmers, veterinarians or crop farmers who use poultry manure to fertilize their farms and those who drink stream water that is not adequately boiled. All the 190 human cases reported between 2003 and 2006 had close contact with poultry [15,18, 19, 20]. Consumption of poultry meat and eggs, if properly cooked may not expose humans to HPAIV infection, because they are enveloped viruses and viral envelops are easily destroyed by heat, disinfectants, soap or sunlight. When viral envelopes are destroyed, the viruses lose infectivity [21].

WORLD HEALTH ORGANIZATION`S [WHO] RECOMENDED OPERATING PROCEDURES FOR CONTROL OF HPAIV

The WHO has recommended standard procedures for people who handle poultry and poultry products, to prevent spread of HPAIV.

For Poultry Farmers and Poultry Handlers

The World Health Organization (WHO) recommends that poultry workers/farmers should, as a regular practice, wash their hands with soap and wear protective clothing, including hand gloves, nose masks, eye goggles and booths when handling birds. These clothing should be removed immediately after work and stored in the farm. Such practice would reduce chances of spreading HPAIV and other pathogens. Affected farms must be properly disinfected. The WHO also recommends that poultry workers be regularly vaccinated with human influenza vaccine to prevent HPAIV co-infecting human cells with human influenza viruses, as this can lead to the viruses exchanging their H and/or NA antigens and mutate to new strains of the influenza virus [22]. Workers handling outbreaks of HPAIV should take influenza virus drugs daily while those who become exposed should be quarantined and observed for one week. Thereafter, such people would be discharged if they do not manifest clinical signs of influenza.

For laboratory workers

The WHO recommends that there should be controlled movement into and out of laboratories where diagnosis of *Bird Flu* or research on HPAIV is done. Laboratory workers involved in handling HPAIV samples must wear protective clothing, including respirators. After work, the clothing must be changed and the workers shower before leaving the laboratory. All work tables and laboratory equipment must be properly disinfected immediately after work.

For doctors and other health workers who handle HPAI cases

WHO recommends regular washing of hands with soap. They must also wear protective clothing, including eye goggles. HPAI patients must be placed in isolated wards. If the patients are to be moved, they must be made to wear surgical masks, to avoid spreading the virus through exhaled air.

Other professionals

The WHO recommends that food handlers should avoid raw poultry meat touching cooked food, fruits or any other thing that can be eaten without further cooking. Chicken and eggs should be cooked well. Food handlers should wash hands with soap after handling chicken or eggs.

Air flight crews are expected to observe their passengers for symptoms of HPAI, including coughing, signs of sore throat and difficulty in breathing. When passengers suspected to be sick of HPAI are found on board, the crew should inform airport authorities before landing. Crew members should wash hands regularly if they have to handle blood or other body fluids from sick passengers. They are also advised to wear hand gloves before handling such patients [15].

FURTHER SUGGESTIONS ON HOW TO CONTROL *BIRD FLU* IN NIGERIA AND IN OTHER SUB SAHARAN AFRICAN COUNTRIES

Outbreaks of HPAI in sub-Saharan Africa make it necessary for veterinary doctors to be employed by each local government, to maintain animal health and prevent the transmission of infections from animals to man. Recent increases in the occurrence of zoonotic diseases, such as HPAI, mad cow disease, Lassa fever, infectious viral hepatitis, yellow fever, HIV/AIDS, malaria, tuberculosis, trypanosomosis, teaniasis etc makes close monitoring of the health of animals more important now than was previously the case. Abstaining from poultry meat and eggs could aggravate food crisis in Africa. Therefore, the public should be educated on the need to cook poultry meat, eggs and other animal products adequately before eating, as a general measure to prevent humans getting HPAI and other zoonotic diseases. The recommendations of WHO to food handlers should be observed. Poultry and piggery farms should not be located close to

one another since the HPAIV use pigs to resort their H and NA antigens. This will reduce chances of the HPAIV mutating into new strains different from the strains of existing vaccines. Biosecurity measures in poultry and livestock farms should be enforced while unnecessary visits to farms should be avoided. Since rodents and wild birds are reported to spread the infection [22], farms should be built to keep off rodents, insects and wild birds. To ensure effective surveillance, poultry farms should be made to register with veterinary offices at the local government level. Every veterinarian should acquaint himself with the clinical signs of HPAI to aid prompt recognition of the disease.

With over 84 % of poultry on free range in sub-Saharan Africa, it may be difficult to keep wild birds, rodents and insects away from domestic poultry. Some countries may find it difficult to continue present policy of stamping out for the HPAIV. It is therefore recommended that African nations adopt vaccination of commercial poultry with avian influenza vaccines of killed virus as a method of controlling HPAI. Then surveillance for the disease can be continued by detection of the virus, using poultry faeces as specimens. Farms that test positive should have all the inmate birds and incontact birds culled.

Erik De Clerck [23] had suggested that researchers should intensify effort to develop cheap antiviral drugs. In addition, the discovery that the neuraminidase antigen of the avian influenza virus has cavities that bind to ligands, has been suggested as an opportunity which scientists can explore to develop new antiviral drugs to replace the old ones to which the virus has developed resistance [24]. Furthermore, synthetic aluminum – magnesium silicate [25] which has been reported to have antiviral effect against viruses of four viral families, including the H_5N_1 *Avian influenza* virus [26,27,28,29, 30, 31] may be useful in the management of HPAI, should there be need to treat infected birds . It could also be a candidate for drug formulations for treatment of human cases of avian influenza disease.

REFERENCES

1. Treanor, J. .J (2009).Influenza Viruses including *Avian Influenza Viruses* and *Swine Influenza Viruses*. In: Principles and practice of infectious diseases. 7th ed., Philadephia.
2. Swayne, D. E., Beck, J. R. and Mickle, T. R. (1997). Efficacy of recombinant fowl poxvirus vaccine in protecting chicken against a highly pathogenic Mexican-origin H5N2 avian influenza virus. *Avian Dieases,* 41: 910-922.
3. Rohm, C., Horimoto, T., Kawaoka, Y., Suss, J. and Webster, R. G. (1995). Do haemagglutinin genes of highly pathogenic avian influenza viruses constitute unique phylogenetic lineages? *Virology,* 209: 664-670.
4. Garcia, M., Crawford, J. M., Latimer, J. W., Rivera-Cruz, E. and Perdue, M. L. (1996). Heterogeneity in the haemagglutinin gene and emergence of the highly pathogen phenotype among recent H5N1 avian influenza viruses from Mexico. *Journal of General Virology*, 77:1493-1504.
5. Perdue, M. L., Garcia, M., Senne, D. and Faire, M. (1997). Virulence associated sequence duplication at the haemagglutination cleavage site of avian influenza viruses. *Virus Researches,* 49: 173-86.
6. Magdalena, E., Lourdes, V., Sara, T. M., Andra, R., Edacardo, L. and Gerardo, M. N. (2008).*Avian Influenza Virus* : Genetic evolution under vaccination pressure. *Virology Journal* 5: 15 – 25.
7. Webster, R. G., Peiris, M., Chen, H. and Guan, Y. (2006). H5N1 outbreaks and enzootic influenza. *Emerging Infectious Dieases*, 12: 3-8.
8. Shinya, Y. (2006).Haemagglutinin mutation responsible for binding of H_5N_1 *Avian Influenza virus* to human – type receptors. *Nature*. 444 : 378 – 382.
9. World Health Organization (2005). *Avian Influenza Virus* A (H_5N_1) infection in humans. *New English Journal of Medicine* 353: 1374 – 1385.
10. Michael, V. B., Marion, K., Marina, D., Beest, H. and Hans, H. (2007).Detecting emerging transmissibility of *Avian Influenza Virus* in human households. *PLOS Computerized Biology,* Open Access Journal of public library.

11. Ahmed, S. A, Ahmad, E. A. and Salama, S. (2010).Isolation and characterization of Highly Pathogenic *Avian Influenza Virus* subtype H_5N_1 from Donkeys. *Journal of Biomedical Sciences,* 17: 25 – 34.
12. Webster, R. G., Bean, W. J., Gorman, O. T., Chambers, T. M. and Kawaoka, Y. (1992). Evolution and ecology of influenza A viruses. *Microbial Review,* 56: 152-79.
13. World Health Organization (2005). *Highly pathogenic avian influenza in Mongolia; in migratory birds*. http://www.oie.int/eng/info/hebdo/ais_55.ht –Accessed 31st October 2005.
14. Denis, N. (2006). China`s *Bird Flu* reporting. *Science* 312 (5782) : 1855 – 1857.
15. World Health Organization (2012). *Humans infected with H_5N_1, H_9N_2,H_1N_1 and H_3N_2.* http//www.who.int/influenza/human/animal interace/en/
16. Center for Disease Control (2007). *http;/www.cdc.gov/flu/avian/gen-info/avian-influenza.htm.9 May 2007.*
17. Suda, L., Hatairat, L., Witthawa, W., Kantima, S., Kridsha, C., Phisamu, P., Taweesak, S., Rungrueng, K., Pathom, S., Chinlaluk, K., Prasert, A. and Pitaipan, P. (2007). Erythrocyte binding preference of *Avian Influenza Virus* H_5N_1. *Journal of Clinical Microbiology,* 45 (7) : 2284 – 2286.
18. Avian Influenza Control Programm (2008). *Avian Influenza has been confirmed in twenty five states in Nigeria*. http// www.aicpnigeria.org.
19. Monne, I., Joannis, T. M., Fusaro, A., De Benedictis, P., Lombin, L. H., Ularamu, H., Egbuji, A., Solomon, P., Obi, T. U., Cattoli, G. and Capua, I. (2008). Reassortant *Avian Influenza Virus* (H_5N_1) in Poultry in Nigeria. *Emerging Infectious Diseases,* 14: 637 – 640.
20. Center for Disease Control (2012). *Use of protective clothing and face masks in control of Avian Influenza*. www.cdc.govt/flu/avian/outbreaks/currenthtm.
21. Muhammad, A ., Shahid, M. A., Sajid, H.and Shamaul, H. (2009). Avian Influenza Virus: Effects of physico – chemical factors on its survival. *Virology Journal,* 6: 38 – 43.
22. Nicolas, G. Julien, C., John, Y. T., Diann, J. P., Samuel, A. I., David, C. D., William, M. P., Taej, M and Scott, H. N. (2010). Potential spread of Highly Pathogenic Avian Influenza Virus H5N1 by wild fowl: Dispersal ranges and rates determined from large – scale satelite telemetry. *Journal of Applied Ecology,* 47: 1147 – 1157.
23. Erik, D. (2006). Antiviral agents active against Influenza A viruses. *Nature Review Drug Discovery* 5: 1015 – 1025.
24. Rupert, J. R., Lesley, F. H., David, J. S., Patrick, J. C., Yipu, L, Michael, B., Alan, J. H., Steven, J. G. and John, J. S. (2006). Structure of H_5N_1 Avian Influenza Virus suggests new opportunities for drug design. *Nature,* 443: 45 – 49.
25. Ezeibe, M. C. O. (2006). Admacine®. Federal Republic of Nigeria. Patents and Designs Act. Cap. 344 LDN 1990. No. 16448,
26. Ezeibe, M. C. O., Ijabo, O., Okoroafor, O. N., Orajaka, L. J. E., Ukomadu, N. M., Chukwu, O. S. and Ngene, A. A. (2009 a). Antiviral effects of Aluminium – Magnesium Silicate on *Peste des Petits Ruminants Virus*. *Animal Science Reporter* 3: 141 – 147.
27. Ezeibe, M. C. O., Mbuko, I. J., Okoroafor, O. N., Okonkwo, A. C., Animoke, P. C., Orajaka, L. J. E and Ngene, A. A. (2009b). *In vitro* and *in vivo* effects of Aluminium – Magnesium Silicate on *Infectious Bursal Disease Virus* of chickens. *Animal Science Reporter,* 3: 132 – 137.
28. Ezeibe, M. C. O., Okoroafor, O. N., Ijabo, O., Ukomadu, N. M., Ngene, A. A. and Eze, J. I. (2010a). Haemaglutination and Haemaglutination – Inhibition titres of *Egg Drop Syndrome 76 Virus* treated with Aluminium – Magnesium Silicate. *Animal Science Reporter,* 4: 87 – 90.
29. Ezeibe, M. C. O., Nwaogu, I. C., Nwaigwe, A. N., Okoroafor, O. N., Eze, J. I. and Ngene, A. A. (2010b). Aluminium – Magnesium Silicate inhibits *Canine Parvovirus* and cures infected dogs. *Health,* 2: 1215 – 1217.
30. Ezeibe, M. C. O., Ijabo, O., Uzopuo, C., Okoroafor, O. N., Eze, J. I., Mbuko, I. J., Sanda, M. E., Animoke, P. C. and Ngene, A. A. (2011a). Effects of Aluminium – Magnesium Silicate on *Newcastle Disease Virus* and on recovery of infected chicks. *International Journal of Biological and Chem*ical *Sciences,* 5: 835 – 839.

31. Ezeibe, M. C. O., Egbuji, A. N., Eze, J. I., Ijabo, O., Ngene, A. A., Okoroafor, O. N., Eze, I. C., Ugonabo, J. A. C., Sanda, M. E and Mbuko, I. J. (2011b). *Antiviral Effect of a Synthetic Aluminium-Magnesium Silicate on Avian Influenza Virus*. Nature Proceedings :hdl:10101/npre 2011 6591. Posted 9, October, 2011.