International Journal of Veterinary Sciences and Animal Husbandry 2019; 4(6): 29-34

ISSN: 2456-2912
VET 2019; 4(6): 29-34

www.veterinarypaper.com
Received: 19-09-2019
Accepted: 21-10-2019

Dr. Soubhagya Muduli
PG Department of Poultry Science, OUAT, Bhubaneswar, Odisha, India

Dr. Pritismita Sethi
PG Department of Poultry Science, OUAT, Bhubaneswar, Odisha, India

Dr. Amrut Roul
PG Department of Poultry Science, OUAT, Bhubaneswar, Odisha, India

Correspondence
Dr. Soubhagya Muduli
PG Department of Poultry Science, OUAT, Bhubaneswar, Odisha, India

Viral disease of poultry and public health issues

Dr. Soubhagya Muduli, Dr. Pritismita Sethi and Dr. Amrut Roul

Abstract
The Indian poultry market, consisting of broilers and eggs was worth INR 1,494 Billion in 2017. The market is further projected to reach INR 3,775 Billion by 2023, at a CAGR of 16.5% during 2018-2023. India today is the one of the world's largest producer of eggs and broiler meat. The poultry industry in India has undergone a major shift in structure and operation during the last two decades transforming from a mere backyard activity into a major industry with the presence of a large number of integrated players. However interactions with animals can pose a risk for zoonoses, diseases of animals that can be transferred to humans, leading to infection and disease. Poultry bird also carries some disease risk (Avian influenza, Salmonella etc.) for humans. Mostly the workers and occupationally related persons are at the high risk zone. Highly pathogenic avian influenza (HPAI) H5N1 virus first reported in 1996 in domestic geese. The West nile virus is maintained in a bird-mosquito cycle in nature. In India, Culex mosquitoes are tentatively incriminated as vectors of WNV. Various preventative measures are considered including rearing procedures for poultry, decontamination methods and education of the public.

Keywords: Poultry, disease, viral zoonosis, public health

Introduction
Poultry, the largest livestock group, account for more than 30% of all animal protein. However, this production is mainly based on commercial poultry, which accounts for only 20% of the total poultry population [1]. Based on the number of animals, poultry represents the largest domestic animal stock in the world [2]. Poultry represents an important sector in animal production, with backyard flocks representing a huge majority, especially in the developing countries. In these countries, villagers raise poultry to meet household food demands and as additional sources of incomes. Backyard production methods imply low biosecurity measures and high risk of infectious diseases. Anyone who keeps birds, whether as pets or as production animals, should be aware that certain avian diseases are zoonotic, that is, they can be transmitted to humans. People rarely catch avian diseases and should not be discouraged from keeping birds because avian diseases do not pose a serious threat to most people. Bird owners should be aware of zoonotic diseases, however, and should certainly seek medical assistance if they suspect they may have contracted a disease from a bird. Children and people in stress situations, such as those facing malnutrition, war or natural disasters, are especially at risk of food-borne pathogens.Animals provide many benefits to people. Many people interact with poultry in their daily lives, both at home and away from home. Poultry sometimes offer companionship and entertainment. We might come into close contact with birds at a farm, slaughter houses and backyard farming. Also, poultry birds are an important food source and provide meat, and eggs. However, some animals can carry harmful germs that can be shared with people and cause illness – these are known as zoonotic diseases or zoonoses. Zoonotic diseases are caused by harmful germs like viruses, bacterial, parasites, and fungi. These germs can cause many different types of illnesses in people and animals ranging from mild to serious illness and even death. Some animals can appear healthy even when they are carrying germs that can make people sick. Zoonotic diseases are very common around the world. Scientists estimate that more than 6 out of every 10 known infectious diseases in people are spread from animals, and 3 out of every 4 new or emerging infectious diseases in people are spread from animals. Anyone can become sick from a zoonotic disease, including healthy people. However, some people may be more at risk than others and should take steps to protect themselves or family members.

These people are more likely than others to get really sick, and even die, from infection with certain diseases. These groups of people include:

- Children younger than 5
- Adults older than 65
- People with weakened immune systems

Why Is Disease Such A Concern In Poultry?

Certain diseases have the potential to decimate a region's poultry industry. When one of these diseases strikes, a quarantine or embargo could suddenly be placed on a region or nation. This could cause widespread economic hardship for both commercial and small flock owners. To protect their animals and the poultry industry flock owners must be able to identify diseases quickly to prevent them from spreading to other animals. The sooner a disease is identified and action is taken, the better.

Poultry and Disease

Poultry plays an important role in the lives of humans, providing both psychological and physiological benefits. However interactions with birds can pose a risk for zoonoses, diseases of animals that can be transferred to humans, leading to infection and disease. In fact, reports indicate that over 75% of emerging pathogens in humans are considered zoonotic diseases. People who have close contact with animals, whether it is owners, poultry producers, or animal health providers, can be at increased risk for zoonotic diseases. Additionally, individuals with weakened immune systems, such as children, the elderly or pregnant women, can also be at increased risk. The zoonotic disease of poultry may be classified into several categories, depending on the causative agent, mode of transmission and the organ system affected in human.

Viral Zoonotic Disease of Poultry

Avian influenza

Avian influenza (AI) is a respiratory disease of birds. AI viruses can infect chickens, turkeys, pheasants, quail, ducks, geese, and guinea fowl, as well as a wide variety of other birds. Migratory waterfowl seem to be a natural reservoir/host for AI viruses. Type A influenza viruses are classified according to the severity of illness they cause. AI viruses can be classified into low pathogenic and highly pathogenic based on the severity of the illness they cause in birds.

Possible reasons for occurrence of Avian Influenza:

A number of factors contribute to make India vulnerable to primary incursion of Avian Influenza into the country. These include high density of poultry population; mixed rearing of chicken and ducks; three flyways of migratory birds passing through the country; illegal movement of poultry and poultry products from infected areas into the country; presence of large number of water-bodies visited by migratory / wild birds; inadequate bio-security in backyard rearing; inadequate sanitation of wholesale and retail poultry markets; endemic situation of Avian Influenza in the neighboring countries and porous nature of the border.

Infectious agents /Causative agents

Avian influenza A virus. All AI viruses are influenza A viruses which are further divided into subtypes determined by haemagglutinin (H) and neuraminidase (N) antigens. At present, 16 H subtypes and 9 N subtypes have been identified in birds. Each AI virus has one of each H and N subtype occurring in many different combinations. The virulence is associated with the genetic properties of the virus [4]. AI viruses are classified as highly pathogenic avian influenza (HPAI) and low pathogenicity avian influenza (LPAI) in conformity with criteria established in relation to poultry by the World Organisation for Animal Health (OIE) [5]. Hence the use of the terms HPAI or LPAI only refers to the virulence of the AI virus in birds. To date, only H5 and H7 subtypes have been known to cause outbreaks of HPAI in birds. Both LPAI and HPAI viruses can however rarely cause illness in humans following very close contact. It is believed that human pandemic influenza strains may arise from AI viruses. [4] No assumption can be made about the clinical significance of a novel AI virus in humans based on the pathogenicity designation in birds [6]. One HPAI strain, the H5N1 avian influenza virus, has caused serious infections in humans and deaths during poultry outbreaks overseas [7]. One LPAI, H7N9, has caused serious infections in humans and deaths in China however has not been linked with clinical disease in birds [8].

Reservoir

The species in the orders Anseriformes (ducks, geese, swans) and Charadriiformes (shorebirds, waders, gulls) are regarded as important reservoir hosts and disseminators of AI viruses, but rarely display clinical signs of infection [4]. In this document, these reservoir birds are referred to collectively as "water birds". However it is reasonable to assume all avian species are susceptible to AI infection [5].

Mode of Transmission of Ai

*** Bird-to-bird**

Infected birds may shed virus in their saliva, nasal and respiratory secretions, and faeces depending on many factors such as the type of bird, the virus subtype and the presence of other diseases. Faeces of infected birds can contain large amounts of virus with faecal-oral transmission the predominant mode of spread between birds. Asymptomatic waterbirds may directly or indirectly introduce the virus into poultry flocks via contaminated excretions from infected birds or via contaminated environments.7 Secondary dissemination is by fomites, movement of infected poultry, and possibly airborne. LPAI infection is primarily a localised infection in poultry and HPAI infection typically presents as a more systemic infection [9].

*** Bird-to-person**

Transmission of AI infection from birds to humans is rare. When it has occurred, it is believed to have resulted from close contact with infected poultry or breathing in dust contaminated with their excretions. The virus can survive on poultry products (including eggs and blood), [10] however no infection has been documented from eating properly cooked eggs and meat from infectious birds. Transmission has been thought to occur by ingesting uncooked poultry products (including raw blood) from H5N1 infected poultry [11].

*** Person-to-person**

The spread of AI viruses from one ill person to another through prolonged, unprotected, close contact has been reported very rarely, and has been limited, inefficient and not sustained [12-13]

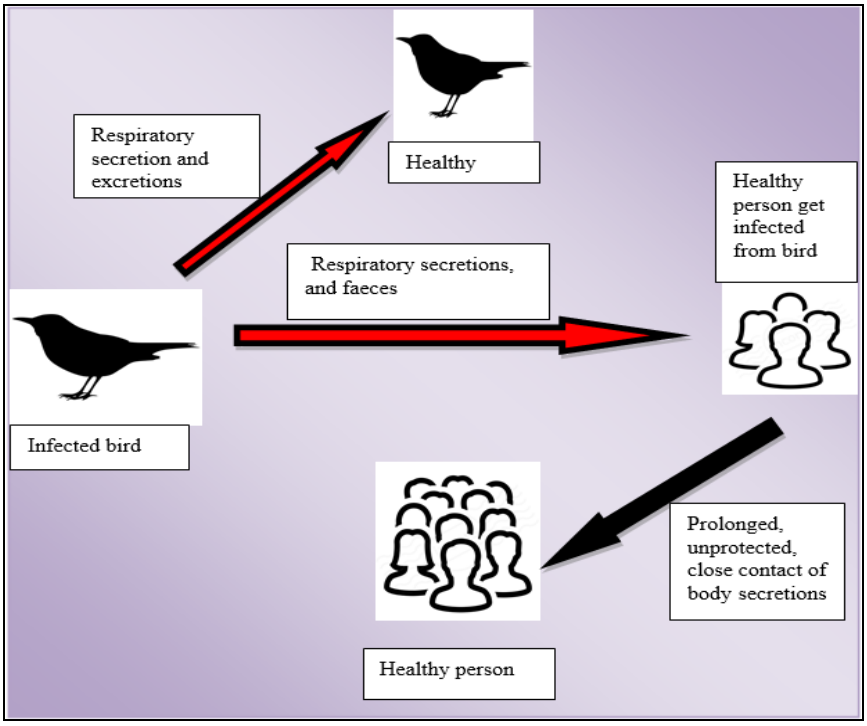

Fig 1: Mode of Transmission of AI

Signs and Symptoms of Ai In Birds

The AI affected birds exhibit wide range of signs and symptoms of disease. While infection with HPAI virus the birds exhibit reduction in feed intake, become lazy, dull and lethargic, along with increased mortality rate. The rate of mortality also depends on the type of birds, environment, external stress to the birds, concurrent disease, respiratory congestion, etc. The bird exhibits labored breathing along with it there is discharge from the nose and eyes. There may be inflamed head and nostrils of birds, along with dark coloration of comb and wattle, imbalances in the nervous system along with diarrhea. There is decreased egg production of layer poultry flocks, affected birds lay weak shelled, shell less eggs, along with uneven surface of egg shells. In case of attack of Highly Pathogenic Avian Influenza (HPAI) virus infection there may be very high rate of mortality of 90 – 100% in birds, on the other hand in case of attack of LPAI the birds only exhibit clinical signs and symptoms of flu and coryza of low category. The birds dying of AI exhibit swelling of head, face, legs and neck. The clinical signs of AI are highly variable. In HPAI, some time birds dye without showing any clinical sign, birds exhibit nervous signs , edema of the face and comb region. The differences in signs and symptoms of AI may be attributed to the difference in virulence of the infecting strains. In per acute cases birds also found dying without any predisposing illness along with edema of the face and comb region, vesicles and necrosis of the comb. Sometimes AI causes an asymptomatic infection, and some time an acute, fatal disease of chickens, turkey and many other avian species. LPAI virus occurs naturally in wild birds and in most cases causes no signs of infection or only minor symptoms in birds. HPAI is often fatal in chicken and turkeys and has importance of economic concern. The disease due to HPAI has sudden onset (after incubation period of 2 – 3 days) in birds. Fever, depression, decrease or loss of feed intake, prostration, lethargy, coughing, sneezing along with the nasal discharge, nasal discharge along with blood comes out while pressing the nose, gasping, muscle tremors, drooping wings, swelling and edema of head, eyelids, comb, wattles and neck, inflammation and discoloration of hock joint, purple discoloration of the wattles, combs and legs, progressive inflammation of the respiratory mucous membrane, lack of coordination, paralysis, resulting death of birds, and some times death without any clinical signs may be common sings and symptoms of AI infection. Symptoms of varying degree can be observed based on the type or subtype of infecting AI virus in poultry birds. In case of layer birds there is rapid drop in egg production. Production of soft-shelled, misshapen or shell less eggs may also be evident of AI infection.

Symptoms of avian influenza in human

The disease is transfused to human through direct contact with an infected birds nasal secretions, feces, or secretions from the mouth or eyes. Symptoms in the human being includes: Fever, Headache, Runny nose, Sore throat/Chesty cough Muscle pain, Brea thing shortness, Joint pain, Respiratory distress, Diarrhea.

Prevention and Treatment of Avian Influenza Viruses in People [14]

1. The Prevention is to Avoid Sources of Exposure: People who work with poultry or who respond to avian influenza outbreaks are advised to follow recommended biosecurity and infection control practices; these include use of appropriate personal protective equipment and careful attention to hand hygiene. Additionally, CDC recommends that people responding to poultry outbreaks should get a seasonal influenza vaccination every year, preferably at least two weeks before engaging in an outbreak response. Seasonal influenza vaccination will not prevent infection with avian influenza A viruses, but can reduce the risk of co-infection with human and avian influenza A viruses. These people should also be monitored for illness during and after responding to avian influenza outbreaks among poultry.
2. As a general precaution, people should avoid wild birds and observe them only from a distance

3. Avoid contact with domestic birds (poultry) that appear ill or have died
4. Avoid contact with surfaces that appear to be contaminated with feces from wild or domestic birds
5. Avoid visiting poultry farms, bird markets and other places where live poultry are raised, kept, or sold.
6. Avoid preparing or eating raw or undercooked poultry products.
7. Practice hygiene and cleanliness.

Newcastle Disease of Poultry and its Public Health Importance

Newcastle disease is a contagious bird disease affecting many domestic and wild avian species; it is transmissible to humans [15]. Newcastle disease is an important infectious disease of the poultry that is caused by virulent strains of Avian Paramyxovirus -1, which is a single strand nonsegmented negative sense RNA virus [16]. The epizootics of Newcastle Disease in poultry continue to occur in Asia, Africa, Central and South America while in Europe, sporadic epizootics occur [17]. In developing countries, human diet is deficient in the animal proteins; approximately 66% population has protein deficient diet [18]. Newcastle disease is an economically important disease and also a major threat to poultry industry [19]. According to variation in strains of NDV, the rate of mortality and morbidity in a flock is variable [20].

Etiology

Newcastle disease is caused by avian paramyxovirus serotype 1 [APMV-1] viruses, which, with viruses of the other eight APMV serotypes [APMV-2 to APMV-9], have been placed in the genus Avulavirus, sub-family Paramyxovirinae, family Paramyxoviridae, in the current taxonomy. Newcastle disease belongs to order Mononegavirales, family Paramyxoviridae, sub family Paramyxovirinae and genus Avulavirus which are negative sense, single stranded and non-segmented RNA genomes. All the avian paramyxoviruses APMVs are part of genus Avulavirus. Virions are roughly spherical; 150 nm or more in diameter and filamentous. The genome is about 15.2 kb in length, that codes for six structural and two non-structural proteins. Rule of six should be followed by genome because it should be of poly hexametric length to replicate rapidly. It encodes for six proteins in 3' to 5' direction; these are Nucleoprotein (NP), Large RNA polymerase (L), Fusion (F), Hemag-glutinin Neuraminidase (HN), Matrix (M) and phosphor protein (P). The proteins W and V are additionally created within the P gene during transcription of mRNA at editing site by insertion of guanines. In virus particles, NP is the most abundant protein which provides the NDV score helical nucleocapsid structure. NP is the main regulator in replication of viral genome. The genomic RNA is associated with NP, P and L proteins to form RNP complex, which serve as template for RNA synthesis. NP is found to be highly immunogenic, as it induces antibody responses in chickens.

Transmission

The transmission of NDV occurs through respiratory aerosols, exposure to fecal and other excretions from infected birds, through newly introduced birds, selling and giving away sick birds and contacts with contaminated feed, water, equipment and clothing. The usual 5 source of virus is an infected chicken, and spread is usually attributed to the movement of chickens through chicken markets and traders. Newcastle disease is very contagious and is easily spread from one bird to another. The infection is usually transmitted by direct contact with sick birds or unaffected birds carrying the virus. Even vaccinated birds that are clinically healthy can excrete virulent virus after they have been exposed. Virus can also be transmitted indirectly by people, other animals, equipment, vehicles, contaminated poultry products, feed and water. The infection takes place by inhalation or ingestion of the virus or by contact with mucous membranes, specially the conjunctiva. Infected birds shed virus in aerosol, respiratory discharge and faeces. Infected birds start to excrete virus during the incubations period and continue to excrete virus for a varying but limited time during convalescence. During the course of infection of most birds with NDV, large amounts of virus are excreted in the feces. Ingestion of feces results in infection; this is likely to be the main method of bird-to bird spread for avirulent enteric NDV and the pigeon variant virus, neither of which normally produces respiratory signs in infected birds.

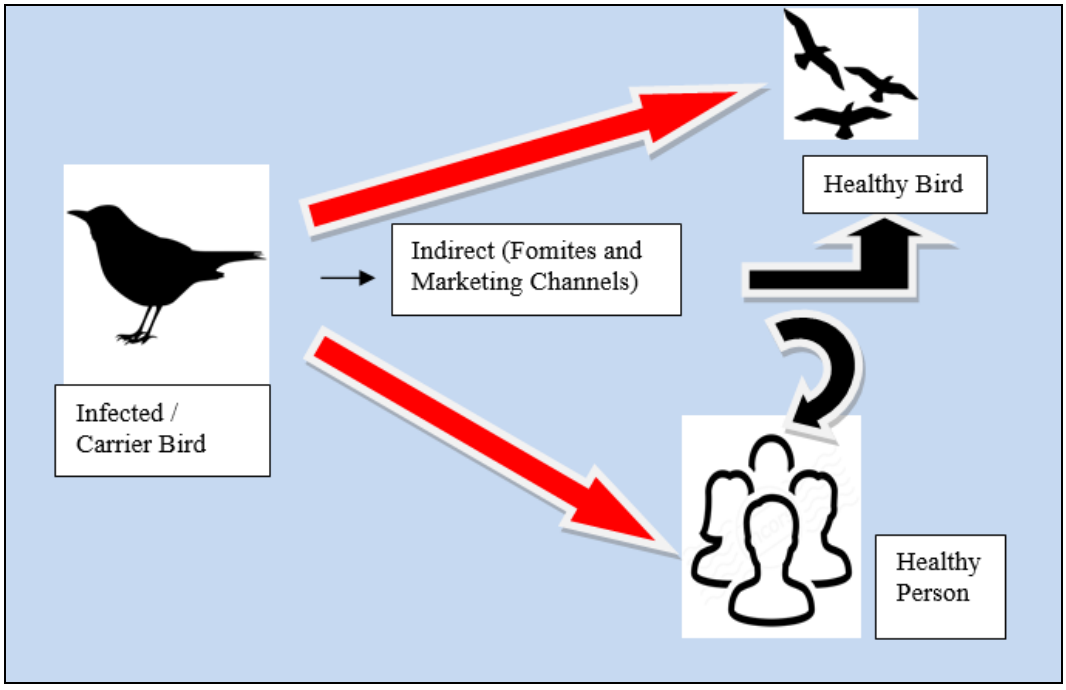

Fig 2: Transmission of NDV (*Red arrow shows the direct transmission)

Clinical Sign in Poultry Birds

The clinical signs in birds infected with ND virus vary greatly from very high morbidity and mortality to asymptomatic carriers. The severity of an infection is dependent on factors like the virulence and tropism of the virus, host species, age of host, immune status, other diseases and environmental conditions. Symptoms from the respiratory tract are gasping, coughing, sneezing and rales. Signs from the nervous system include tremors, paralyzed wings and legs, twisted necks, circling, clonic spasms and sometimes complete paralysis. Other general symptoms that can be seen are greenish diarrhoea, depression and inappetence, partial or complete drop in egg production and an increased production of deformed eggs. Clinical sign and course of disease can be grouped into four different pathotypes based on the strains of Newcastle disease virus. These all four pathotypes are listed as follow:

Viscerotropic velogenic: That can be seen are obvious depression, inappetence, substantial drop in egg production, increased respiration, a profuse greenish-yellow diarrhoea that rapidly leads to dehydration and collapse, swollen heads and cyanotic combs. Mortality can be up to 90% and infected birds usually die within one or two days. Birds that survive the initial phase often develop nervous signs. Sometimes birds desperately without previous clinical signs.

Neuroptopic velogenic: Acute signs from the respiratory tract and nervous system dominate. Sudden depression, inappetence and drop in egg production are seen together with coughing and other signs from the respiratory tract, followed by nervous signs within a few days. Mortality is usually around 10-20% for adult birds but can be higher for young birds.

Mesogenic: Coughing and other signs from the respiratory tracts dominate. Other symptoms are depression, loss of weight and decreased egg production for up to three weeks. Signs from the nervous system can develop late in the disease. Mortality is around 10%.

Lentogenic: Are often subclinical but mild respiratory signs and a small drop in egg production can be seen. No nervous signs and mortality is usually negligible.

Public Health Importance

Humans are among the many species that can be infected by NDV in addition to avian species. NDV may cause conjunctivitis in humans, when a person has been exposed to large quantities of the virus. Mostly, Laboratory workers and vaccinators are affected. The use of personnel protective equipment and biological safety cabinet has reduced the exposure of laboratory workers. Infection is rarely seen in the workers of a farm; moreover, persons handling or consuming poultry products do not appear to be at risk. The conjunctivitis usually resolves rapidly, but the virus will be shed in the ocular discharges from 4 to 7 days. In some cases, mild, self-limiting influenza like disease with fever and headache has also been reported in humans. There is no evidence found to support human to human transmission but the potential for human to bird transmission exists. Newcastle disease virus may also yield a future benefit to human health as it is the subject of much current research centered on its ability to induce apoptosis in several types of human cancer cells, including prostate and breast cancer. It is hoped that further research with Newcastle disease virus will be able to exploit its oncolytic ability for human tumor immunotherapy.

Prevention and Control

The general approaches to the control of Newcastle disease are hygiene and vaccination, this is always important, especially in the control of NCD in semi-intensive systems where birds are confined within a fenced yard or house. Hygiene includes measures such as cleaning, disinfection, limiting access to wild birds, and personal hygiene of the farm staff. Vaccination in combination with appropriate hygiene measures, this remains the most effective way of controlling NCD. Vaccination against NDV would result in immunity against infection and replication of the virus. Realistically, ND vaccination usually protects the bird from the more serious consequences of disease, but virus replication and shedding may still occur ·In case of human the preventive measures include proper measures during the visit of the poultry shed, preventive steps during the post mortem of the infected birds and at the time of vaccination. The poultry farm personels must be aware of the virulence of the disease and its preventive steps.

Conclusion

Although infections in humans are relatively rare; there are substantial zoonotic risks from poultry and poultry products that veterinarians and physicians alike should be aware of and keep in mind in their daily practice. Global outbreaks of poultry disease will likely continue to be headline news. Whether presented with a beloved pet chicken or simply questioned about a current event, veterinarians need to be prepared to counsel and educate the public on the myths and realities regarding the risks of poultry zoonoses. Efficient surveillance and control of zoonoses require that human and animal health issues be merged into a new public health agenda. Creating and responding to such an agenda depends on effective interactions between human and veterinary clinical, laboratory and public health professional organizations. These interactions are essential for implementing effective zoonosis control programmes. Intersectoral collaboration can be strengthened by establishing coordination structures that include technical and administrative support.

References

1. Pemin A, Pedersen G, Riise JC. Poultry as a tool for poverty alleviation: Opportunities and problems related to poultry production at village level. In ACIAR proceedings, 2001, 143-147.
2. FAO. Faostat. Production. Live animals, 2012
3. http://dahd.nic.in/sites/default/filess/AI_Note_updated_30.11.15.pdf01.pdf
4. Animal Health Australia Disease strategy: Avian influenza (Version 3.4). Australian Veterinary Emergency Plan (Ausvetplan), Edition 3, Primary Industries Ministerial Council, Canberra, ACT, 2011. (accessed December 2013). http://www.animalhealthaustralia.com.au/wp-content/uploads/2011/04/AI3_406FINAL16Feb11.pdf
5. World Health Organisation for Animal Health, Terrestrial Animal Health Code 2012 (accessed December 2013). http://www.oie.int/en/international-standard-setting/terrestrial-code/access-online/
6. World Health Organization. Avian influenza: Fact sheet, 2011 (accessed December 2013).

http://www.who.int/mediacentre/factsheets/avian_influenza/en/
7. World Health Organization Overview of the emergence and characteristics of the avian influenza A(H7N9) virus: 31 May 2013 (accessed December 2013). http://www.who.int/influenza/human_animal_interface/influenza_h7n9/WHO_H7N9_rev iew_31May13.pdf
8. World Health Organization Avian influenza: assessing the pandemic threat, 2005. (accessed December2013). http://whqlibdoc.who.int/hq/2005/WHO_CDS_2005.29.pdf
9. World Health Organization: Food Safety, Geneva, Switzerland. Avian influenza: food safetyissues(accessed December 2013)http://www.who.int/foodsafety/micro/avian/en/index1.html
10. Van Kerkhove MD *et al*. Highly Pathogenic Avian Influenza (H5N1): Pathways of Exposure at the Animal- Human Interface, a Systematic Review. PLOS ONE 6.1, 2011, e14582.
11. Ungchusak K *et al* Probable Person-to-Person Transmission of Avian Influenza A (H5N1). New England Journal of Medicine. 2005; 352:333-340.
12. Li Q *et al*. Epidemiology of Human Infections with Avian Influenza A(H7N9) Virus in China. New England Journal of Medicine. 2014; 370:520-532.
13. Nelson CB, Pomeroy BS, Schrall K, Park WE, Lindeman RJ. An outbreak of conjunctivitis due to Newcastle disease virus (NDV) occurring in poultry workers. Am J Public Health Nations Health. 1952; 42:672-678.
14. Ashraf A, Shah MS. Newcastle Disease: Present status and future challenges for developing countries. African J Microbiol Res. 2014; 8:411-416.
15. Naveen KA, Singh SD, Kataria JM, Barathidasan R, Dhama K. Detection and differentiation of pigeon paramyxovirus serotype-1(PPMV-1) isolates by RT-PCR and restriction enzyme analysis. Trop Anim Health Prod 2013; 45:12311236.
16. Maqbool A. Marketing of commercial poultry, poultry meat and eggs in Faisalabad City. MSc Thesis, University of Agriculture Faisalabad, Pakistan, 2002.
17. Narayanan MS, Parthiban M, Sathiya P, Kumanan K. Molecular detection of Newcastle disease virus using Flinders Molecular detection of Newcastle disease virus using Flinders Tehnology AssociatesPCR Tehnology Associates-PCR. J Veterinarski Arhiv. 2010; 80:51-60.
18. Haque MH, Hossain MT, Islam MT, Zinnah MA, Khan MSR. *et al*. Isolation and Detection of Newcastle disease virus from field outbreaks in Broiler and Layer chickens by Reverse transcription Polymerase chain reaction. Bangl J Vet Med. 2010; 8:87-92.
19. Choi KS, Lee EK, Jeon WJ, Kwon JH. Antigenic and immunogenic investigation of the virulence motif of the Newcastle disease virus fusion protein. J Vet Sci. 2010; 11:205-211.
20. Lamb RA, Collins D, Kolakofsky JA, Melero Y, Nagai MBA *et al*. Family Paramyxoviridae. In: van Regenmortel MHV (ed.), Virus Taxonomy, Seventh Report of the International Committee on Taxonomy of Viruses. Academic Press: New York, USA, 2000, 549-561.