

Review Article

## Three Significant Events in the Poultry Industry, During Last Three Decades

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### Abstract

This review is focused on important events in poultry industry, throughout the world, during last three decades. As an immense advancement in the shape of improved poultry husbandry practices, poultry vaccinology, poultry feeding and poultry breeding was noticed during last few decades; this progress was also accompanied with some new, devastating and emerging poultry diseases. The increasing demand for poultry production and consumption was also a motivating factor for this industrial growth. It was the emergence of Big Liver and Spleen disease which alarmed the Australian poultry industry during 1980's in the shape of decreased egg production. It was the time when Australian poultry industry was entering to its initial corporate marketing network. Its economic importance, as a result of death during productive life, was noticeable. After 15 years of BLS emergence, the Chinese poultry industry was stricken by Highly Pathogenic H5N1 Avian Influenza Viruses during 1996. The mortality ratio was of high concern along with its transfer from chicken to human. It was prevalent in widespread Chinese poultry industry, because the biosecurity measures adopted there, were of little standards. Also the poultry marketing system was also open, birds grown in open and biosecure farms were mixed in those markets. This was also communicated to the region and to the world by wild migratory birds. After 7 years of highly pathogenic H5N1 emergence in China, during 2003/04 the growing poultry industry of Pakistan has been struck by Outbreaks of Highly Pathogenic H7N3 Avian Influenza Virus. Unlike previous avian influenza outbreaks in Pakistan, this time the virus attack was more robust and localized in the highly poultry populated region of the country i.e. Karachi. No proper technique for its earlier identification, lack of strategic inputs for its control and failure of applying stamping out policy along with massive vaccination lead to the situation of mass mortality. The disease was then extended to other parts of the country and it resulted in a huge loss when it had stricken the breeder populated area of the country. All these three important happenings gave a demarcated blink of the importance of pre-preparedness for disease outbreaks and chalking out of applicable coping strategies. It is also important for all stakeholders of the industry to focus on a single point and come on a single page for collaboration against the emergence of new diseases outbreaks.

**Key words:** Poultry, Vaccinology, Feeding, Breeding, Avian Influenza

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### Introduction

In last few decades, the poultry industry expanded around the globe and it emerged as one of the leading entrepreneurships in several countries. Since 1970, an estimated increase of 436% has been recorded in poultry production, which is significant as compared to 186% and 57% for pork and beef, respectively [1]. Eventually, a boost in the consumption of poultry meat has also been observed and it crossed the beef and mutton consumption in various countries e.g. consumption of poultry surpassed beef production during 1992 in United States of America [2]. The need of intervention with modern techniques and technologies in poultry production system was felt. As a result, environmentally controlled and intense poultry farming almost replaced the conventional method of chicken rearing, where a large number of poultry reared in a confined area. Additionally, the frequent research work over the genetic makeup of different types of poultry resulted in their efficient and cost effective production e.g. layer, broiler and breeder. The application of recombinant and genetic vaccination provided a good coverage to disease outbreaks, although there are some limitations of its

use [3]. Furthermore, the execution of Hazard Analysis and Critical Control Point (HACCP) to poultry industry during late 1990's, was a bench mark for high quality poultry meat production and it was also an indication for future value addition of poultry products [4].

As a whole, the poultry production system modified to overcome the increasing demand for high quality animal protein, however, there are some unwanted outcomes of those modifications. Due to close contact of birds with each other and relatively increased stocking densities, rapid spread of the disease and overlooking of the individual sick birds are considered to be complications of intensive poultry farming, which carries high concerns about massive disease outbreaks and poultry welfare issues. Similarly, breeding and genetic improvements were made through technological interventions for increased poultry production, which resulted in loss of genetic variability. It is considered that genetic homogeneity increases the susceptibility of individuals to emerging diseases. The Big Liver and Spleen disease, which was for the very first time identified in Australia, emergence and re-emergence

of highly pathogenic strain of avian influenza in several regions of the world and its connection with human avian influenza disease are some important issues which has local and global consequences over the poultry industry. Keeping in view its importance, these issues are discussed in this review.

In the first part of the review, the emergence and economic perspective of first infectious disease in Australian poultry industry, the Big Liver and Spleen disease is discussed. The second part of the review describes the identification and persistent outbreaks of Highly Pathogenic Avian Influenza Virus (HPAIV) in China with the context of growing thirsts for increased production and competition in global meat market that lead to oversight the bio-security measures in poultry production/marketing system, which is considered to be the basic cause of frequent outbreaks of contagious diseases. The third part gives a brief overview of the avian influenza outbreak in Pakistan during 2003-04, its economic perspective, after-effects and coping strategies.

### **Big Liver and Spleen disease in Australia (1980)**

During the second last decade of the previous century, the poultry industry of Australia was badly stricken by a virus called Big Liver and Spleen Virus (BLSV), when it caused a condition that affected the liver and spleen of the broiler breeders [5]. It was 1980 when an abrupt decline in egg production and increased mortality rate in broiler breeders were noticed in New South Wales, Australia, which was then recognized as Big Liver and Spleen Disease (BLS) [6]. Although the causative agent of BLS was unknown, but it was thought to be of viral origin [7] and same as that of an infectious disease in spreading pattern as it was detected in one of the sheds of a farm, and then spread to all sheds in the vicinity within 3-10 weeks and gradually reached to the half of broiler breeders population in the country [6]. Since the emergence of this disease it is considered, economically, the most important disease of broiler breeders [6, 8].

It is productive life of the poultry flock when it returns the capital investment in the shape of egg or meat production. In laying hens an important phase in their production life is "Production Peaks", when the egg production reaches to its maximum. So it's apparent that during production phase, keeping good health status, feed intake and external environment of the bird is a pre requisite for healthy production. BLS has been reported entirely in mature broiler breeder flocks which were either in the initial weeks of

production phase or sometimes at later stages i.e. 24 weeks and 58 weeks of age, and resulted in a rapid fall in egg production that lasted for a month and followed by a 3 weeks recovery period to normal production [6, 8]. A decreased peak production was noticed in the flocks, which were affected by BLSV in the start of their production phase instead of post peak production fall [6]. The occurrence of this disease during crucial production time makes it highly important in economic perspective.

During its first emergence, it was estimated that loss of 8-10 eggs per chicken during egg laying cycle was happened [9]. During this decade the structure of commercial egg industry changed, as larger commercial hatcheries started supplying chicken and after sale services [10], so a rapid decrease in egg production of broiler breeders was also a matter of concern for those growing trends of the poultry industry, because this resulted in a decreased supply of eggs to hatcheries. Apart from production losses during BLS outbreak, chicken mortality also occurs from 0.1% to 1% per week and the initial drop in production accompanies the commencement of the mortality, which reaches to its maximum with the lowest production rates, and then slowly returns to its usual rate [6]. Increased mortality rates in a mature breeder flock, having considerable cost over its brooding, growing and production, adversely affects the farm economics.

Disease specific clinical findings are important in diagnostic point of view. In case of BLS the appearance of the flock remains normal during the entire disease course [6] and the disease remains unnoticed until the post-mortem examination of the bird is carried out, which causes delayed coping strategies against the disease. However, in severe flock outbreaks, diseased birds may be found in the flock. After two decades, in United States, avian hepatitis E virus (avian HEV) was collected and characterized from poultry having a disease called hepatitis-splenomegaly (HS) syndrome, which was related to BLS identified in Australia [11]. The causative agents of BLS in Australia and HS syndrome in America are considered to be the mutants of the same virus [12]. It gives a platform for working collectively over the preventive measures of both the diseases.

### **Emergence of Highly Pathogenic H5N1 Avian Influenza Viruses in China (1996)**

After one and a half decade of the BLS identification in Australia, poultry industry faced another challenge, when emergence of originator of Highly Pathogenic

H5N1 Avian Influenza Viruses (HPAIV's) occurred in a geese farm located in southern China during 1996 [13]. Southern China is known for its close relation with influenza pandemics, either it was the influenza pandemics of 1918, 1957 or 1968, all were considered to be originated from this part of the country [13]. The highly pathogenic strain of H5N1 avian influenza virus is responsible for the recent global outbreak of the disease in birds and a genetically identical virus in humans [1].

Due to globalization and huge growth of the industry, a widespread emergence of the disease occurred and was transmitted to Eurasia and as far west as England and Africa, which is, by this means, a serious threat to the poultry industry in American and Australian continents [14], this resulted in more than 300 human cases with HPAIV's, until now, and disposal of almost 400 million birds [15]. Migratory birds were thought to be responsible for global spread of the disease, because during 2005, an outbreak of H5N1 in wild migratory birds was reported in southern China and the statement is also supported by growing evidence regarding the capacity of wild migratory birds for distant transportation of the virus [14].

Although China's poultry production is second highest in the world [16], its poultry industry is facing a challenging situation in the shape of persistent influenza outbreaks. During the last decade, China has produced about 15 billion poultry each year, with more than 70% comes from backyard poultry [17, 18]. Due to higher percentage of production coming from backyard farming, it seems to be a challenging job to completely overcome or eradicate an infectious disease such as avian influenza in poultry, because bio-security levels of backyard poultry could not be kept up to the standards. The poultry production system in China is conducive for existence, mutation and transmission of avian influenza virus. Farming practices ranges from high levels of bio-security to backyard production with poly-culture farming i.e. rearing of different bird species at a single place, which facilitates the interaction and exchange of virus from different hosts [15].

Another factor is widespread live traditional poultry marketing in China, where birds are brought and kept together regardless of their health status or origin, therefore infected birds from backyard poultry could spread the virus to birds from highly bio-secured farms and it also signifies a public health risk for people involved in those markets [19]. Moreover, the silent circulation and persistence of HPAIV's in those markets is a new challenge for Chinese

concerned authorities [20]. The threat of avian influenza originated from China, is of great concern for researchers, public health workers and people related to poultry industry round the globe, because, apart from grand-scale economic losses, peoples working in the close vicinity of poultry flocks are also at high risk.

In order to cope with the situation, China has taken solid steps for controlling the disease outbreaks. Nationwide massive vaccination campaigns, movement controls along with necessary depopulation of poultry flocks were carried out since the disease emergence, but more emphasis has been given to vaccine coverage of the outbreak. Year 2005, was considered to be a turning point in controlling this disease, because a universal vaccination campaign was launched and vaccination against H5N1 became essential for all poultry [20]. Although China's vaccination against avian influenza is highest in the world, and more than 13 billion doses of the vaccines have been used since 2007 [21], but international distress regarding consistent appearance of the disease, still exists. Some countries rely only on vaccination to control HPAIV infection, but vaccinated birds do not show clinical signs and it became difficult to differentiate between vaccinated and diseased birds. Those birds became silent source of the disease, and regularly shed virus. Therefore, in case of avian influenza outbreak the depopulation of infected flocks should always be kept primary strategy, accompanied with mass vaccination. Otherwise, avian influenza outbreaks are expected every year, specifically, in Asian countries.

### **Outbreaks of Highly Pathogenic H7N3 Avian Influenza Virus in Pakistan (2003-04)**

Seven years after the identification of HPAIV in China, the growing poultry industry of Pakistan faced a devastating outbreak of Highly Pathogenic Avian Influenza Virus (HPAIV) of type H7N3 which affected the layer and boiler breeding region, during November 2003 and June 2004 [22]. This was the time when trends of environmentally controlled houses for poultry were increasing, and most of the open house poultry sheds were converted to environmentally controlled sheds, which eventually increased the number of poultry reared in the country. Previously, the poultry industry of Pakistan has exposure to avian influenza virus in 1995, 1998 and 2000 but the disease incidence was limited to almost an isolated area, where the outbreak was managed with vaccination and isolation strategies [23], and

further spread to highly congested poultry populated areas was prevented. The Indus flyway zone (Green Route) i.e. from north towards south along with mighty Indus river, which is an international path for different species of migratory birds, was considered to be the route of the virus induction in the country because approximately 0.7 to 1.2 million birds visit Pakistan through this flyway every year [24].

Unlike the earlier outbreaks, the April 2003 epidemic of Low Pathogenic Avian Influenza Virus (LPAIV), which then mutated to HPAIV, affected the highest poultry populated area with commercial layer, the coastal town of Karachi, where 70% of layer farming was carried out [22]. This LPAIV outbreak was not covered with proper surveillance and no epidemiological data regarding this epidemic is available. This resulted in a 70% decrease in production and 20% mortality rate in the affected flocks [23]. After six months of the LPAIV outbreak, the emergence of HPAIV occurred in the same area as an outcome of mutation from LPAIV and replicated to almost all layer flocks in the area within a few weeks [22], which resulted in a huge mortality rates in the affected poultry flocks, reaching to almost 80% [23]. Due to variability in the clinical signs there was delay in the reporting of the disease and identification of the causative agent which resulted in a considerable spread of the disease in a very short time period and caused a massive economic loss [23]. As direct transmission of avian influenza was recorded, this adversely affected consumer behaviour toward poultry meet. According to State Bank of Pakistan's report published by The Poultry Site [25] an abrupt change in chicken market was noticed and almost 40% decline in per kilogram of poultry meat was observed, which was far less than the cost of production. On the other hand, it badly affected the hatcheries, as the commercial broiler breeder farms located in unaffected areas were regularly producing fertile eggs, that were processed by hatcheries and normal production of Day Old Chicks (DOC's) was carried out, but the broiler farmers were hesitant to start next flock because of the market instability, and a huge number of DOC's were euthanized. Repeated avian influenza outbreaks caused an estimated loss of 7 million USD and resulted a 1.5% decline in growth of the poultry sector in the country [25].

Depopulation of the affected flocks in case of avian influenza should be the primary approach which is supported by vaccination as an additional control measure [26]. In case of this outbreak, the strategic failure occurred in respect of flock depopulation, and the reason was the impossibility of volunteer culling

of the diseased flocks by the farmers due to extensive financial crisis. Furthermore, there was no avian influenza surveillance network prior to 2003, and most of the outbreaks could only be noticed after dissemination of the avian influenza virus to most of the flocks in the vicinity. Due to these limitations in the strategic control measures of HPAIV, during outbreak, the virus reached to northern areas of the country, which was highly populated poultry rearing zone and held 80% of broiler breeding farms [23]. From the last few years after launching the avian influenza surveillance program throughout the country, strategic vaccination and strict bio-security measures, avian influenza outbreaks were controlled successfully.

### Discussion

This review enlightens some important happenings in poultry industry during last 30 years. Although the three events discussed in the review are important to the growing industry in different regions of the world having widespread impacts, but still there are some other events in the shape of technological intervention in the industry in a specific region. But the fact that, bio-security and health issues are of high concern in poultry industry, increases the importance of these three events. Also the impacts of events in last two decades are highly prevalent and global poultry industry was vulnerable to its after-effects. The emergence of these three diseases also changed the dimensions of industry management, as more attention was paid to the bio-security measures and handling of marketing birds, in order to avoid further loss due to these diseases. Another important factor involved was the possible transfer of the pathogen to humans and it was of great concern to public health bodies in the world. It was an immense threat to the industry as well, because the countries having open poultry farming and marketing systems were blamed to be a threat to human lives throughout the world. Although situation were handled smartly, but research to sort out causes of emergence and re-emergence of highly pathogenic poultry diseases along with its timely prevention with eradication measures.

### Conclusion

The identification, spreading pattern, severity among the affected flocks and economic impacts of Big Liver and Spleen disease outbreak in Australian poultry industry were discussed in the first part of the review. The emergence of highly pathogenic avian influenza virus in southern China is overviewed in the second



part of the review. The factors responsible for persistent outbreak of the disease were also identified. The thirds part encompasses the bird flu outbreak in Pakistan, which enormously affected all aspects of Pakistan poultry industry i.e. from production to consumers. Global existence and repeated outbreaks of avian influenza is a continuous threat, which can cause a considerable economic loss to poultry industry. Worldwide, combined and effective surveillance program for avian influenza will be helpful in fighting against this disease. Recent history of this disease, which shows a close relation of human infection with avian influenza virus, increases the importance of this disease in public health point of view. Collaborative efforts from all concerned groups i.e. researchers, poultry experts, public health authorities, towards the control and eradication of this infectious disease of poultry, will be considered of high importance.

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