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Prevalent Diseases and Mortality in Egg Type Layers: An Overview

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Abstract: Mortality plays a major role in determining profitability of egg type layers, as it is a function of culled and dead birds. Negative association between mortality and net profit has been reported. Higher mortality and culling were reported to be due to severe outbreaks of infectious/non-infectious diseases, accidental deaths, substandard health and management practices and poor quality of chicks and feed. Newcastle (ND), Infectious bursal disease (IBD), yolk sac infections and coccidiosis were found to cause maximum mortality (over 30%) in egg type layers. Infectious laryngotracheitis (IL) caused mortality within the range of 0.81 - 20% in layers. Cannibalism was also reported to be a major cause of death in egg type layers. A drop of 10-40% in egg production was found with the incidence of infectious coryza, *E. coli*, mycoplasmosis, coccidiosis, egg prolapse and aflatoxicosis. Salmonellae were abundantly found in bedding material of chicken (42%), drinkers (36%), feed (28%) and water tanks (17%) of the poultry farm. Maintenance of a healthy environment in a poultry shed, protection of birds from extreme climatic conditions, maintenance of standard hygiene measures and antibiotic therapy, were reported as key factors in the reduction of losses due to diseases and mortality in egg type layers.

Key words: Egg type layers, mortality, culling, poultry diseases

Introduction

Disease out-break, increased mortality and higher percentages of cull birds could adversely affect profitability of egg production. A negative association of mortality with net profit has been reported in egg type layers. Farooq *et al.* (2001) reported that an increased in mortality in a laying house will result to a significant decrease in net profit. North (1984) and Kitsopandis and Manos (1991) also reported a reduction in net profitability with increased mortality levels in chickens. Higher death rates in egg type layers could be due to several factors such as severe outbreak of diseases, substandard health measures and management practices, poor quality of chicks or feed and accidental deaths. Thus, due attention shall be given to infections, health care, management practices and predisposing factors in the avoidance of undue risks of mortality in chicken. Because, microorganisms deteriorating performance of chickens or resulting in morbidity or mortality could be abundantly found in and near the poultry sheds and any variation in rearing environment would provide a better chance for these microorganisms to invade chicken. Diseases of chicken are mostly infectious in nature and therefore, wide variability in losses due to such diseases is expected in egg type layers

Some important diseases causing mortality and or reduced productivity in egg type layers and possible preventive measures are reviewed in this paper.

Findings regarding mortality and prevalent diseases in egg type layers in different parts of the world are reviewed and discussed under various sub sections as follows:

Overall mortality in egg type layers: Overall mortality in layers was reported to between 12% (Petek, 1999, and Amin *et al.*, 1995) and 14.2% (Singh *et al.*, 1995). However, contrary to the findings of Petek (1999), Amin *et al.* (1995) and Singh *et al.* (1994), higher mortalities of 26.23% (during brooding), 24.56% (during growing) and 49.2% (during laying) were reported by Ghodasara *et al.* (1992) in egg type layers. These losses were higher than the optimized level of mortality (8-10%) reported by North (1984) in egg type layers for better profitability. The higher mortality in egg type layers could be attributed to severe outbreak of infectious and non-infectious diseases, substandard management and health practices, poor quality of chicks or feed and filthy environment. Infectious diseases of commercial chicken are regarded as sweeping diseases and any variation in health coverage or management could result in higher mortality. A disease outbreak could result in severe economic losses within a shortest possible time before its medicated recovery is ensured. In all probability, it is the delicate nature of the commercial chicken, their susceptibility to diseases and undesirable conditions that would not allow them to retain more resistance

against disease attacks. In commercial chickens, more emphasis had been placed upon its genetic potentials for higher production, rather than their acclimatization to odd environments or ability to resist diseases. Thus, they are to be reared in a healthy environment to avoid increased risks of mortality.

Tolimir and Masic (2000) reported a lower mortality (6.80%) among egg laying birds in recent decades and attributed it to improved health measures. Assurance of healthy drinking water, appropriate and timely vaccination, anti biotic therapy and filtration of water tanks reduced the incidence of mortality in India (Mukherjee and Khanapurkar, 1994; Khurshid *et al.*, 1995).

Distribution of various diseases: Prevalence of various diseases in layers is discussed in this section under various subsections as follows:

Newcastle disease (ND): Newcastle disease is another destructive disease of chickens characterized by severe mortality, greenish diarrhea and thirst. The disease was reported to be prevalent among layers in all seasons of the year causing mortalities ranging from 50-60% (Anjum, 1990 and Anjum *et al.*, 1993; Savic, 1999). In Nigeria, the disease has been reported to the greatest threat poultry industry causing up to 100% mortality among infected populations (Heath *et al.*, 1991; Baba *et al.*, 1998; Sonaiya *et al.*, 1999; Baba *et al.*, 2005). Aside from higher mortality, Newcastle disease caused a 15% drop in eggs of infected flocks and simultaneously resulted in a 5% soft shell eggs (Lambert and Kabar, 1994). The higher losses caused by ND could probably be due to the infectious nature of ND and its rapid spread from flock to flock within a shorter period of time. As it is a viral disease it can spread from one flock to another easily through the movement of workers from one farm to the another, wild animals and birds, visitors and transport vehicles used from farm to farm delivery. Thus, assurance of appropriate hygiene and effective and timely vaccination will be helpful in reducing losses.

Infectious bursal diseases (IBD): Infectious Bursal Disease (IBD) also known as Gumboro had been reported to cause heavier losses ranging from 10-75% (Sah *et al.*, 1995) to 80-100% (Chowdhury *et al.*, 1996). It is considered as AIDS of the chicken, because it adversely affects the chicken's immune system. Bursa fabricus, one of the organs responsible for antibody production in chicken was invaded virus and completely destroyed by IBD, resulting in higher (36.65-40.40%) losses in egg type layers (Rao *et al.* 1990; Singh *et al.*, 1994; Amin *et al.*, 1995; Birds of all ages were susceptible to IBD but losses were greater (20-76%) between the age of 2-12 weeks than at any other stage of life (Rao *et al.*, 1990; Philip and Moitra, 1993;

Prabhakaran *et al.*, 1997). Unexpectedly higher losses due to IBD had also been observed in chickens at the age of 17 weeks (Philip and Moitra, 1993). The higher incidence of IBD in egg type layers could probably be due to poor vaccination and susceptibility of chickens to IBD (Anjum *et al.*, 1993; Farooq *et al.* 2000), filthy environment and predisposing factors like concurrent infections with *E. coli*, coccidiosis and other bacterial infections (Singh *et al.*, 1994). Anjum *et al.* (1993) and Kouwenhoven *et al.* (1994) reported that vaccination against IBD at the age of 14-21 days partially controlled the problem, explaining that in spite of the vaccination, atrophy of bursa could not be protected even if there was a mild infection of IBD (Sultan and El-Sawy, 1997). Therefore, care must be taken to administer vaccines at stipulated times and successfully overcoming predisposing factors working as contusive media for outbreak of IBD. Prevention of concurrent infections like *E. coli* and coccidiosis and maintenance of standard hygiene will be helpful in reducing losses due to IBD in chickens.

Infectious coryza: Infectious coryza is also an important bacterial disease of chickens characterized by respiratory complications, swollen head syndrome, nasal discharge and severe drop in egg production. The most common cause is *Haemophilus gallinarum*. Conditions of poor hygiene, chilly environment and adverse climate exposure could work as predisposing factors for the onset of this disease. Chickens of all type and age were found susceptible to this infection and the disease caused 2-5% mortality and 35% drop in egg production (Reece *et al.*, 1986; Sandoval *et al.*, 1999). El-Houadfi and Vanmarcke (1991) also reported adverse effects of coryza on egg production and as the disease can spread slowly, results could be almost 100% morbidity (Bains, 1979). Protection of birds from extreme climatic conditions, maintenance of good hygiene and antibiotic therapy along with vitamin C or ascorbic acid were helpful in preventing losses due to coryza.

Infectious bronchitis (IB): Highly infectious viral disease characterized by respiratory symptoms, increased mortality and decreased egg production (Butcher *et al.*, 1990). Rikula *et al.* (1993) reported IB to the most prevalent disease in layers in Finland causing up to 67% mortality. The disease could occur at any stage of the chicken's life and during any season of the year. However, it was found to be more prevalent (35.7%) in 7 days to 5 weeks of age with special reference to its higher incidence (66.6%) in the winter season (Javed *et al.*, 1991). The higher incidence in young chickens was attributable to poor immunity development during the first few weeks of life. Similarly, winter conditions could have also favored the incidence of IB because of stressful conditions and chilly environment. Thus,

protection of birds from extremely cold conditions and the maintenance of a healthy environment would further reduce incidence of this disease.

Mareks disease: Mareks is one of the important diseases of chickens characterized by leg paralysis and lymphocyte infiltration of brachial and sciatic nerves (Nicholls, 1984), potentially causing 4.2-20.8% mortality in layers (Taylor *et al.*, 1999). The disease could be more prevalent in layers lacking immunization and additionally, further risk exists with calcium deficiencies during the laying phase. Chickens are vaccinated against mareks at the hatchery before they are transported to the farms. Losses due to this disease therefore, are avoided through effective vaccination and eliminating calcium deficiency in the egg laying period. Calcium is vital for the eggshell and its insufficiency will not only result in poor shell eggs, but it could work as a predisposing factor for mareks disease (Taylor *et al.*, 2000). In addition, the rearing of mixed age flocks increased risks of Mareks disease (Heier and Jarp, 2000). The authors also reported a higher risk of Mareks in laying birds reared on floor than those maintained in cages, probably due to the condition of a soiled environment.

Avian influenza: Avian influenza (AI) is an important poultry disease that had emerged with higher mortality in the recent decades. In 2006 AI resulted in the death of over 40,000 birds in Nigeria. This disease caused 90% morbidity and 80% mortality in 30-week old chickens (Morgan and Kelly, 1990). Pathogenicity of avian influenza was more in egg laying birds than in broilers (Swayne *et al.*, 1994). The higher incidence of avian influenza in layers could probably be due to the incidence of avian influenza at later stages of life as layers were retained in a flock for a longer duration than broilers.

Mycoplasmosis: Mycoplasmosis is a series of bacterial infections caused by Bacterium mycoplasma of various types in egg type layers. Mycoplasmosis results in severe economic losses in egg type layers in terms of reduced egg production and higher mortality. Eggs with Pimpled shells were also associated with Mycoplasma infections (Branton *et al.*, 1995). Flocks infected with Mycoplasma gallisepticum (MG) and Mycoplasma synoviae (MS) produced fewer eggs (Mohammad *et al.*, 1987). North (1984) reported 20-30% drop in egg production due to MS. These losses are very high and would narrow the margins between cost of production and net profit from commercial egg laying birds. Efforts shall always be made to reduce losses thereby increasing egg production. This could however, be possible through better health management and the application of improved husbandry skills. For effective

control of MG, a vaccine has now been prepared and is administered in drinking water when the layers are 12 weeks old. However, the disease is mostly transmitted through eggs from the infected or carrier birds to the newborn chickens. Thus, it is imperative for the breeders to have a regular blood test program and eliminate infected or carrier birds from the flocks. An effective measure to prevent its vertical transmission has been developed by heating eggs prior to incubator placement at a temperature of 46°C. At this temperature no mycoplasma will survive, however heating eggs at this temperature may have a slight impact on hatchability.

Salmonellosis: Salmonellae, one of the bacterial species, are abundantly found in most of the areas of the poultry premises where chances of contamination are greater. Sasipreeyajan *et al.* (1996) isolated salmonellae from litter 42%, drinking water (36%), feed (28%) and water tanks 17%. Majid *et al.* (1991) also reported higher prevalence of salmonellosis in layer flocks maintained under poor management condition in Faisalabad. These organisms usually contaminate feed and drinking water thereby, resulting in poor economic gains and higher mortality. Salmonellae caused pullorum, typhoid, paratyphoid and other related infections in chickens resulting in 50% losses (North, 1984). Salmonellae are vertically transmitted to the newborn chicks, therefore, regular blood testing of the parent flock and elimination of infected and carrier birds would be helpful in reducing its vertical transmission. In addition, preventing entry of rodents, vermin or other wild animals and the assurance of improved hygienic conditions would be helpful in reducing the incidence of salmonellosis.

Coccidiosis: Coccidiosis a protozoan disease, is one of the major problems of the chicken industry, characterized by blood tinged feces, ruffled feathers, loss of appetite, poor growth and reduced egg production. Coccidiosis has been reported to result in higher (51.38%) mortality (Demir, 1992) and economic losses (\$35 to \$200 million/year) in USA (Hofstad *et al.*, 1978). The most prevalent causative agents of coccidiosis among the coccidia species were sporulated oocysts of genus *emeria* that primarily invaded the small intestine and caecal pouches, leading to enteritis and thickening of the intestinal walls (Shukla *et al.*, 1990). Oocysts are usually passed through feces by infected chickens, undergoing the process of sporulation when conditions are favorable. Unclean environment, wet bedding material and house temperature in the range of 20-28°C favored sporulation of oocysts (Hofstad *et al.*, 1978). *Coccidia* were found to be the most resistant type of protozoa, remaining viable for several months in poultry sheds (Stayer *et al.*, 1995). However, deterioration of seeded oocysts started soon

after a 24-hour period when sporulation conditions were not favorable (Williams, 1995).

Coccidiosis could occur at any stage of the chicken's life and during any season of the year; however, it was found to be more prevalent in summer season (Boado *et al.*, 1991) probably when higher summer temperatures and wet bedding favored rapid sporulation of oocysts. Bushell *et al.* (1989) reported effective use of live attenuated coccidiosis vaccine in controlling the problem. Assurance of a healthy environment and the elimination of moisture and increased heat conditions within the house were reported to reduce chances of coccidiosis outbreak (Stayer *et al.*, 1995). Addition of coccidiostats in the ration had been one of the best options for the control of coccidiosis. However, egg laying birds are given coccidiostat-free ration during the egg laying period and an outbreak of coccidiosis at that stage will not only result in massive death casualties, but will lower egg production. The pullet should therefore, have complete immunity against coccidiosis before initiation of egg lay (North, 1984). Thus, management would be a key to avoid sporulation of oocysts when the layers are to be reared on the floor. With the introduction of cage systems, the coccidiosis problem has now been solved up to a greater extent. However, elimination of coccidiosis before the shifting of birds to cages should be ensured.

Yolk sac infection: It is one of the most common bacterial infections of chicken observed during the first few weeks of a chicken's life. Drowsiness, minimal mobility, vent pasting and the lack of interest of feeding in the chicken characterize yolk sac infection. There may be several predisposing factors such as poor hygiene and stressful conditions leading to this anomaly because, it is a general bacterial infection. Isolates of *Staphylococci* and *E. coli* were found to be the most common causes of yolk sac infection (Bains, 1979). Yolk (a reservoir of food for the embryo and chicken in the first few days after hatching as well) could easily become infected with the presence of any bacterium. The intact bacteria enter the inner content of the egg during the incubation process and cause infection of the navel area of chicken. Conversely, if the yolk is not affectively utilized after hatching, it could be easily infected and easily become rancid. The yolk usually becomes infected prior to hatching and during the first 48 hours after hatching. Yolk sac infection was found to cause 31.45% mortality in the early few days of a chicken's life (Ghodasara *et al.*, 1992). North (1984) and Reece *et al.* (1986) however, reported smaller losses (10 and 2.31% respectively) due to yolk sac infection in chicken than those reported by Ghodasara *et al.* (1992). As the infection is mostly transmitted through dirty shell eggs, frequent collection of eggs and keeping the conditions more favorable to obtain clean eggs will be helpful in the reduction of yolk

sac infection. In addition, better management of the chicks during brooding; avoiding overcrowding and other stressful conditions will further reduce the incidence of yolk sac infection.

Escherichia coli (E. coli): *E. coli* is one of the major problems in chicken production influencing heavier losses and severe drop in egg production. About 5.5% mortality and 10-20% drop in eggs was observed with *E. coli* infections in egg type layers reared in cages (Qu *et al.*, 1997). Zanella *et al.* (2000) also reported 5-10% mortality due to *E. coli* infections with no pronounced signs, suggesting that the infection may be there but couldn't be easily detected until regular tests are performed for its proper diagnosis. The situation leading to mortality with no pronounced clinical signs will be more critical as it would result in heavier losses of reduced egg production prior to the investigations. *E. coli* will not only result in reduced egg production and mortality, it could be a predisposing factor for other complications like IBD as has been stated by Singh *et al.* (1994). Prabhakaran *et al.* (1997) associated IBD with concurrent infections of *E. coli* and coccidiosis. Thus, it is important to control *E. coli* infections in chickens, thereby preventing losses due to this disease and other associated infections.

Egg prolapse and cannibalism: Egg prolapse has become one of the major issues in egg type layers during the past few years. Egg prolapse could cause higher mortality and in turn, would result in huge economic losses (Tablante *et al.*, 1994). The authors reported 9.4% egg prolapse cases in egg type layers. Cannibalism has been reported to be one of the major causes of death in commercial laying hens (Appleby and Hogarth, 1991; Glatz, 2000). Abrahamsson and Tauson (1998) reported mortality rates of 4-20% due to cannibalism. Mortalities even up to 30% as a result of cannibalism have been reported in laying hens (Wouw, 1995; Van Krimpen *et al.*, 2005). Deficiency of fiber in feed (North, 1984) and management faults such as increasing group size (Keeling, 1994; Bilcik and Keeling, 1999) and increasing light intensity (Kjaer and Vestergaard, 1999) have been reported as the major factors contributing to higher incidence of cannibalism. Reducing the metabolizable energy (ME) (Lee *et al.*, 2001) or increasing the crude fiber content (Esmail, 1997) of the diet has been reported to reduce the incidence of cannibalism. The effect of beak trimming on cannibalism has also been reported. Damme (1999) reported a smaller incidence of cannibalism (0.3%) in beak-trimmed birds than non-trimmed (7.5%).

Aflatoxicosis: Presently, aflatoxicosis is one of the major issues in chicken production. The common cause of aflatoxicosis is contaminated feed, resulting in higher mortality and severe drop in egg production.

Prathapkumar *et al.* (1997) reported 10% mortality and 20% drop in egg production due to aflatoxin B1 in the diet. Drop in egg production was as high as 26-55% with increased level of aflatoxin B1 (Mukopadhyay *et al.*, 2000). To avoid such losses it is important to regularly monitor feed quality. In case of aflatoxicosis, change of feed will be a better option. Choudary (1986) also reported reduction in mortality and gradual increase in egg production when feed suspected for aflatoxicosis was changed. Thus, it is advisable to store feed ingredients or ration in proper places to avoid its contamination by microorganisms. In addition, preference shall be given to fresh feed rather than stale or feed stored for longer durations. Inappropriate and prolonged storage conditions would encourage microorganism to contaminate feed rendering them unsafe for use and better performance.

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