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ANALYSIS OF DISEASE-RELATED MORTALITY TRENDS IN BROILER AND LAYER POULTRY FARMS IN PABA UPAZILA, RAJSHAHI

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ABSTRACT
Poultry farming is an important source of animal protein, employment and farm income in Bangladesh, but disease and management-related mortality continue to reduce farm productivity. The present study was conducted to assess and compare mortality patterns in commercial layer and broiler farms in Paba Upazila, Rajshahi. Data were collected from ten commercial farms, comprising five layer and five broiler farms, during July to September 2025. Information on flock size, mortality, clinical signs, post-mortem findings, vaccination, housing and environmental conditions was obtained through farmer interviews, farm records and field observations. The total number of birds included was 17,800, out of which 12,300 were layers and 5,500 were broilers. Mortality recorded was 17.32% and 13.64% in layers and broilers respectively. The difference was statistically significant ($z = 6.16$, $p < 0.001$) and risk ratio was 1.27 (95% CI: 1.18-1.37). Newcastle disease was the leading recorded cause of death in layers (29.6%), followed by Gumboro (19.2%) and heat stress (15.0%). In broilers, litchi-heart disease accounted for the largest proportion of deaths (26.7%), followed by Gumboro (22.7%), lack of ventilation (18.7%) and high stocking density (14.7%). For causes present in both production systems, Newcastle disease mortality was markedly higher in layers than broilers (5.12% vs. 0.91%; RR = 5.63, 95% CI: 4.23–7.50; $p < 0.001$), whereas Gumboro mortality did not differ significantly (3.33% vs. 3.09%; $p = 0.400$). The findings indicate that mortality patterns differed between production systems and that disease prevention should be combined with better environmental and management practices. Strengthening vaccination, biosecurity, ventilation and heat-stress control may help reduce avoidable losses in poultry farms in the study area.

1.0 INTRODUCTION

Poultry production is an important component of Bangladesh's livestock sector, contributing to the supply of animal protein, employment, household income, and rural economic activity. The expansion of commercial poultry farming has been accompanied by increasing intensification of production, particularly in broiler and layer systems. However, disease, environmental stress, and deficiencies in farm management and biosecurity continue to affect flock health and productivity. Field investigations in Bangladesh have documented a wide range of infectious and non-infectious conditions among commercial chickens, including Newcastle disease (ND), infectious bursal disease (IBD), colibacillosis, salmonellosis, mycoplasmosis, coccidiosis, and other diseases (Hossain et al., 2004; Rahman et al., 2017).

Disease-associated mortality is particularly important because its magnitude and causes can vary with production type, bird age, season, and farm-management conditions. A 20-month longitudinal field study in commercial layer farms in Bangladesh reported substantial mortality due to infectious diseases, including Newcastle disease, infectious bursal disease, Marek's disease, infectious bronchitis, salmonellosis, fowl cholera, and colibacillosis (Rashid et al., 2013). The study also demonstrated variation in mortality according to age and season, indicating that poultry mortality should be considered in relation to both disease occurrence and production conditions.

Newcastle disease remains an important health problem in commercial poultry production in Bangladesh. A case-control study of commercial layer farms in Kishoreganj and Gazipur identified several farm-level factors associated with ND outbreaks, including proximity to other poultry farms, surrounding environmental conditions, rearing birds of different ages together, and failure to isolate sick birds (Roky et al., 2022). These findings highlight the importance of farm structure, bird movement, environmental conditions, and routine disease-control practices in the epidemiology of ND.

The distribution of poultry diseases may differ between broiler and layer production systems. Broilers are generally reared for a relatively short production cycle and undergo rapid growth, whereas layers remain in production for a considerably longer period. Consequently, the duration and nature of exposure to infectious and environmental hazards may differ between the two systems. In Gazipur, Bangladesh, Rahman et al. (2017) documented a range of diseases in both broilers and layers, with differences in the disease profile between the two production groups.

Environmental conditions are also important determinants of poultry health. High temperature and humidity can affect feed and water intake, physiological stability, production performance, and survival, particularly where ventilation is inadequate. Recent research in Bangladesh found that elevated temperature and humidity were associated with increased mortality among commercial layer chickens, although the strength of these relationships varied among sheds and farms (Parvin et al., 2025). Such environmental effects are particularly relevant during the hot and humid periods of the year.

Farm biosecurity and management practices can further influence mortality by affecting the introduction and transmission of infectious agents. A study of commercial poultry farms in Rajshahi District found variation in biosecurity practices between broiler and layer farms, including visitor control, litter management, vaccination, and mortality recording (Islam et al., 2023). In small-scale broiler farms in Bangladesh, biosecurity-based interventions were also associated with reductions in crude mortality during the early production period (Faroque et al., 2023). These findings support the importance of routine biosecurity, hygiene, vaccination, isolation of sick birds, and appropriate farm management in reducing avoidable losses.

Despite the availability of national and regional information on poultry diseases, farm-level information describing the relative contribution of different diseases and management-related factors to mortality in Paba Upazila of Rajshahi District remains limited. Rajshahi is an important poultry-producing region, and local epidemiological information is useful because disease occurrence and mortality may vary according to production system, management practices, environmental conditions, vaccination, and local disease pressure. Therefore, the present study was undertaken to investigate and compare mortality rates and the major recorded causes of mortality in commercial layer and broiler farms in Paba Upazila, Rajshahi, and to describe important disease, environmental, and management-related factors associated with mortality under field conditions.

2.0 MATERIALS AND METHODS

2.1 Study area and period

The study was conducted in Paba Upazila of Rajshahi District, north-western Bangladesh. The area has a subtropical climate, with high temperature during summer and high humidity during the monsoon. The study was carried out from July to September 2025, covering the monsoon and post-monsoon period.

2.2 Study population

Ten commercial poultry farms were included in the study: five layer farms and five broiler farms. The total population comprised 12,300 layer birds and 5,500 broiler birds. Farms were selected purposively to include different management conditions. Information was obtained from farm records and through direct communication with farmers.

2.3 Data collection

Data were collected using a structured questionnaire and an observation checklist. The information included flock size, number of deaths, clinical signs, post-mortem findings, vaccination practices, feeding and housing management, stocking density, ventilation and environmental conditions. Farmer-reported histories were considered together with field observations and post-mortem findings when assigning the recorded cause of death.

2.4 Diagnosis of diseases

Disease identification was based on clinical signs, post-mortem findings and farm history. The main diagnostic indicators used in the study are presented in Table 1.

Table 1. Diagnostic indicators used for field identification of major causes of mortality.

Disease	Main diagnostic indicators
Newcastle disease (ND)	Greenish diarrhoea, torticollis, haemorrhages in proventriculus and high mortality.
Gumboro (IBD)	Swollen bursa, haemorrhagic thigh muscles and white diarrhoea in growers.
Avian influenza (AI)	Cyanosis, haemorrhagic comb and petechiae on shanks.
Infectious coryza	Nasal discharge, facial swelling and laboured breathing.

Marek's disease	Enlarged peripheral nerves, paralysis and grey foci on liver.
Heat stress	Panting, open-mouth breathing and deaths during peak daytime heat.
Litchi-heart disease	Sudden death, heart enlargement, ascites and congestion.
Poor ventilation/high density	Respiratory distress, wet litter and increased deaths in crowded pens.

2.5 Mortality calculation and statistical analysis

Mortality was calculated as the number of deaths divided by the total number of birds and expressed as a percentage. Descriptive statistics were used to summarise flock mortality and disease-specific mortality. Ninety-five percent confidence intervals were calculated for proportions using Wilson's method. A two-proportion z-test was used to compare mortality between layers and broilers. Risk ratio (RR) and risk difference (RD) were calculated to describe the size of the difference. For diseases recorded in both production systems, cause-specific mortality was compared on a per-bird basis. The statistical calculations were performed using Python-based statistical scripts, and $p < 0.05$ was considered statistically significant.

3.0 RESULTS

3.1 Mortality rates in broiler and laying farms as a whole

The study involved a total of 17,800 birds, including 12,300 laying hens and 5,500 broiler chickens. There were 2,130 reported deaths on laying farms and 750 on broiler farms. In broilers, the total mortality rate was 13.64%, while in layers it was 17.32%. The discrepancy was statistically significant ($z = 6.16$, $p < .001$). The risk ratio was 1.27 (95% CI: 1.18–1.37), indicating a higher observed risk of mortality in layers. The risk difference was 3.68 percentage points (95% CI: 2.55–4.81).

Table 2. Overall mortality and statistical comparison between layer and broiler flocks.

Flock type	Deaths	Total birds	Mortality (%)	95% CI	z-value	p-value
Layers	2,130	12,300	17.32	16.66–18.00	6.16	<0.001
Broilers	750	5,500	13.64	12.75–14.57	—	—

3.2 Disease-wise mortality in layer farms

Newcastle disease was the primary cause of mortality in layer farms, responsible for 29.6% of the recorded deaths. Gumboro contributed 19.2%, while heat stress accounted for 15.0%. Additionally, infectious coryza, avian influenza, and Marek's disease were responsible for 13.6%, 12.7%, and 9.9% of deaths, respectively. The proportions and their confidence intervals are detailed in Table 3.

Table 3. Disease-wise mortality recorded in layer farms.

Cause	Dead birds	Percentage (%)	95% CI

Newcastle disease (ND)	630	29.6	27.7–31.5
Gumboro (IBD)	410	19.2	17.5–20.9
Heat stress	320	15.0	13.5–16.6
Infectious coryza	290	13.6	12.1–15.1
Avian influenza (AI)	270	12.7	11.2–14.1
Marek's disease	210	9.9	8.6–11.2
Total	2,130	100	—

3.3 Disease-wise mortality in broiler farms

In broiler farms, litchi-heart disease was the leading recorded cause of death, accounting for 26.7% of all deaths. Gumboro represented 22.7%, followed by lack of ventilation (18.7%) and high stock density (14.7%). Infectious bronchitis and Newcastle disease accounted for 10.7% and 6.7%, respectively. Details are shown in the Table 4.

Table 4. Disease- and management-related mortality recorded in broiler farms.

Cause	Dead birds	Percentage (%)	95% CI
Litchi-heart disease	200	26.7	23.7–29.8
Gumboro (IBD)	170	22.7	19.8–25.6
Lack of ventilation	140	18.7	16.0–21.5
High stock density	110	14.7	12.2–17.3
Infectious bronchitis (IB)	80	10.7	8.5–13.0
Newcastle disease (ND)	50	6.7	4.9–8.6
Total	750	100	—

3.4 Comparison of overlapping diseases

Newcastle disease and Gumboro were observed in both layer and broiler farms, allowing for a compar ison based on the total number of birds at risk. The perbird mortality rate for Newcastle disease was re corded at 5.122% in layers and 0.909% in broilers. The corresponding risk ratio was 5.634 (95% CI: 4 .232-7.501), indicating a highly significant difference ($z = 13.549$, $p < 0.0001$). In contrast, the mortalit y rate for Gumboro was 3.333% in layers and 3.091% in broilers, resulting in a risk ratio of 1.078 (95% CI : 0.904–1.286) with no statistically significant difference ($z = 0.842$, $p = 0.400$).Information regarding these are presented in the Table 5.

Table 5. Comparison of cause-specific mortality for diseases recorded in both production systems.

Cause	Layers % (95% CI)	Broilers % (95% CI)	RR (95% CI)	RD % (95% CI)	z	p

Newcastle disease	5.122 (4.746–5.526)	0.909 (0.690–1.196)	5.634 (4.232–7.501)	4.213 (3.750–4.676)	13.549	<0.0001
Gumboro (IBD)	3.333 (3.030–3.665)	3.091 (2.665–3.582)	1.078 (0.904–1.286)	0.242 (−0.314–0.799)	0.842	0.400

4.0 DISCUSSION

The present study recorded mortality of 17.32% in layers and 13.64% in broilers. The difference was statistically significant, with a risk ratio of 1.27 and a risk difference of 3.68 percentage points. Thus, among the farms investigated in Paba Upazila during July–September 2025, recorded mortality was higher in layers than in broilers. This finding should be interpreted as a field observation from the study farms rather than as a representative estimate for all poultry farms in Bangladesh, because only 10 purposively selected farms were included. The higher mortality observed in layers may partly reflect differences in production duration and cumulative exposure to infectious and environmental hazards. Layers remain in production for considerably longer than broilers and therefore have a longer period during which disease, environmental stress, vaccination-related factors, and management problems may influence survival. Rashid et al. (2013) reported substantial infectious-disease mortality in commercial layer farms in Bangladesh and found variation in mortality with age and season. However, the present study did not follow equivalent flocks over the same production period; therefore, production duration alone cannot explain the observed difference between layers and broilers.
Newcastle disease was the leading recorded cause of mortality in the layer farms, accounting for 29.6% of deaths. This finding is consistent with previous evidence showing that ND is an important cause of mortality in commercial poultry in Bangladesh. Rashid et al. (2013) identified ND as one of the major infectious causes of mortality in commercial layers. In addition, Roky et al. (2022) identified farm-level factors associated with ND outbreaks in commercial layer farms, including proximity to other poultry farms, environmental conditions, rearing different-aged birds together, and failure to isolate sick birds.
The relatively high contribution of ND to layer mortality in the present study may therefore reflect a combination of disease pressure and farm-level conditions. However, the study was observational, and disease identification was based principally on clinical signs, post-mortem findings, and farm history rather than laboratory confirmation. The findings should consequently be described as recorded causes of mortality rather than laboratory-confirmed aetiological diagnoses.
Gumboro was another important recorded cause of mortality, accounting for 19.2% of layer deaths and 22.7% of broiler deaths. The per-bird mortality estimates for Gumboro did not differ significantly between the two production systems. This indicates that no statistically significant difference was detected in recorded IBD mortality under the conditions studied. It should not, however, be interpreted as evidence that the two production systems had identical

IBD epidemiology, because detailed vaccination histories, maternal antibody status, and laboratory confirmation were not available for all observations.

The broiler farms showed a different mortality pattern. Litchi-heart disease was the leading recorded cause, accounting for 26.7% of deaths, followed by Gumboro (22.7%), inadequate ventilation (18.7%), high stocking density (14.7%), infectious bronchitis (10.7%), and ND (6.7%). The contribution of ventilation and stocking-density problems indicates that mortality in these farms was not attributable solely to infectious diseases. Rapid growth, high environmental heat load, crowding, and inadequate air exchange may increase physiological stress and respiratory problems in broilers.

The importance of environmental conditions is supported by recent evidence from Bangladesh. Parvin et al. (2025) reported that higher temperature and humidity were associated with increased mortality among commercial layer chickens, although the relationship differed among sheds. In the present study, heat stress accounted for 15.0% of recorded layer deaths, and the study period included July to September, when high temperature and humidity are common. The contribution of heat stress is therefore plausible, although the present study did not quantify individual bird-level exposure to temperature or humidity.

Management and biosecurity practices are also relevant to interpretation of the mortality pattern. Islam et al. (2023) reported variation in biosecurity practices among commercial broiler and layer farms in Rajshahi, including visitor restriction, litter management, vaccination, and mortality recording. Faroque et al. (2023) further demonstrated that biosecurity-based interventions were associated with reduced crude mortality in small-scale broiler farms in Bangladesh. These studies support the importance of farm-level preventive practices, although the present study did not formally test the independent effects of individual biosecurity measures.

The comparison of ND mortality between the two production systems was notable. The recorded per-bird ND mortality was 5.122% in layers compared with 0.909% in broilers, corresponding to a risk ratio of 5.634. The difference was statistically significant. This indicates that, within the investigated farms, the recorded ND mortality burden was considerably greater among layers. Possible contributing factors include the longer production period of layers, differences in vaccination schedules, farm structure, exposure opportunities, and disease-control practices. Nevertheless, these factors were not tested in a multivariable model and therefore should not be interpreted as demonstrated causes of the difference.

In contrast, Gumboro mortality was similar between the two groups. The recorded mortality was 3.333% in layers and 3.091% in broilers, with a risk ratio of 1.078 and no statistically significant difference. The result indicates similarity in the observed mortality burden in these farms, but further investigation would be required to determine whether vaccination practices, age at infection, maternal immunity, or other factors contributed to the pattern.

An important strength of this study is that it provides farm-level information from Paba Upazila and compares mortality patterns between commercial broiler and layer systems. Nevertheless, several limitations should be considered. Only 10 farms were included and farms were selected purposively, limiting generalization beyond the study area. Disease identification was based mainly on clinical findings, post-mortem observations, and farm history rather than laboratory confirmation. The study period covered only July to September 2025, limiting

assessment of seasonal variation. In addition, the statistical analysis treated individual birds as independent observations and did not account for clustering within farms. Detailed vaccination and management histories were also not available for all observations. These limitations mean that the results should be interpreted as field observations rather than causal or population-level estimates.

Taken together, the findings suggest that mortality in the investigated farms was influenced by both infectious diseases and environmental and management conditions. In layers, ND was the leading recorded cause of death, whereas broiler mortality showed a greater contribution from litchi-heart disease, IBD, inadequate ventilation, and high stocking density. The findings therefore support production-specific approaches to mortality prevention, including appropriate vaccination and biosecurity in layer farms and greater attention to ventilation, stocking density, and heat-stress management in broiler farms.

5.0 CONCLUSION

Mortality patterns differed between commercial layer and broiler farms in Paba Upazila, Rajshahi. Layers recorded a higher overall mortality than broilers, with Newcastle disease being the leading recorded cause of death. Broiler mortality was more strongly associated with litchi-heart disease, Gumboro and management-related problems such as inadequate ventilation and high stocking density. Newcastle disease mortality was substantially higher in layers, whereas Gumboro mortality did not differ significantly between the two production systems. The findings support production-specific disease prevention, with stronger attention to vaccination and biosecurity in layers and environmental and management control in broilers.

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7.0 FUNDING

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8.0 CONFLICT OF INTEREST

The authors declare that there is no conflict of interest related to this study.

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