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Article

Temperature and humidity effects on nutrition and mortality of layer chickens in controlled environments

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Abstract: Temperature and humidity play a crucial role in shaping the feed and water intake as well as mortality rates of layer chickens. This study examined the influence of these environmental factors on chicken survival in commercial poultry farms in Bangladesh, using data collected from two commercial layer farms over multiple years (2017–2020) and across different chicken strains. Variations in temperature and humidity were monitored in sheds L2, L3, and L4 at PHL, and L1 to L7 at DEL. The data were analyzed to calculate mean values and correlations among temperature, humidity, feed and water intake, and mortality rates. The results showed that elevated internal and external temperatures, combined with high humidity levels in sheds, were associated with increased water and feed intake as well as higher mortality rates among layer birds. A statistically significant difference was observed in shed L1 of DEL in 2020 (P = 0.0006), where significant correlations among the variables were also identified. Specifically, at PHL, a moderate positive correlation (r = 0.61) between internal temperature and mortality suggested that higher internal temperatures contributed to bird deaths due to heat stress. In contrast, at DEL, internal temperature exhibited only a weak positive correlation (r = 0.29) with mortality, implying that while heat stress played a role, it may not have been the dominant factor. These findings highlight the importance of maintaining optimal environmental conditions in controlled housing systems to safeguard the health, welfare, and productivity of layer chickens. The study also provides practical guidance for farmers and policymakers to implement improved environmental management strategies aimed at enhancing poultry production efficiency and minimizing economic losses in Bangladesh.

Keywords: poultry management; climate stress; production performance; animal welfare; poultry industry

1. Introduction

Poultry production represents one of the most rapidly expanding sectors of the livestock industry in developing nations. Environmental variability is a critical determinant of the sustainability of livestock production systems, particularly in tropical climates (Yan *et al*., 2022). In Bangladesh, poultry farming is a vital livelihood for many, as chickens rearing is both accessible and cost-effective for households. The number of commercial poultry farmers in Bangladesh continues to grow, driving the consistent expansion of this sector (Kamruzzaman *et al*., 2021). Furthermore, this sector plays an instrumental role in fostering rural economic development and promoting women's empowerment. Poultry is an important subsector of livestock and contributes approximately 1.6% in national GDP and provides 6 million peoples direct and indirect employment in Bangladesh (Nath *et al.*, 2024). However, layer production faces significant challenges, including suboptimal management practices, environmental stress, and various systemic and infectious diseases. Environmental factors such as temperature and humidity exert a substantial influence on poultry production, with elevated temperatures and humidity levels potentially inducing heat stress, thereby compromising poultry health and performance (Wasti *et al*., 2020). Heat stress arises from the interplay of several factors, including high ambient temperatures, humidity, radiant heat, and air movement (Saeed *et al.*, 2019; Wasti *et al*., 2020). This condition occurs when poultry are exposed to conditions outside their thermoneutral zone, leading to discomfort and impaired thermoregulation (Mangan and Siwek, 2023; Oke *et al.*, 2024).

The climate of Bangladesh has been progressively warming and becoming increasingly severe in recent years. The agriculture and water sectors are particularly susceptible to the adverse impacts of rising temperatures (Chowdhury *et al.*, 2022). The average annual temperature in Bangladesh is approximately 26 °C, with a range between 15 °C and 34 °C throughout the year. The hot and humid climate of Bangladesh poses significant challenges to poultry thermoregulation. Chickens are particularly vulnerable to high-temperature environments due to their feather coverage and lack of sweat glands, which substantially limit their ability to dissipate heat effectively (Kang *et al*., 2020). Mortality is one of the most detrimental, observable, and irreversible outcomes in animals subjected to stressful environmental conditions and causes economic losses. Research has established a direct correlation between rising ambient temperatures and increased mortality rates in poultry (Mignon-Grasteau *et al*., 2015).

Environmental factors such as temperature and humidity are critical determinants of poultry health and productivity. Heat stress arises from the combined effects of elevated environmental temperatures, high humidity, and insufficient air movement (Boichard and Zerjal, 2015). In laying hen flocks, environmental stress particularly heat stress represents one of the most pervasive and significant challenges within poultry production systems worldwide. Prolonged exposure to high temperatures and humidity levels exceeding optimal thresholds induces physiological impairments by exacerbating stress, ultimately compromising both mortality rates and productivity (Tesakul *et al.*, 2025).

Bangladesh has a substantial population of layer chickens and a significant number of layer poultry farms. The environmental conditions in the country play a pivotal role in influencing this sector. The impact of environmental factors on the production, performance, and mortality of layer chickens is integral to understanding the economic implications for the industry (Masud *et al.*, 2020; Shahriar *et al.*, 2025). Poultry production is a vital sector in Bangladesh, but it faces significant challenges due to environmental stressors such as high temperature and humidity, which directly affect feed intake, water consumption, and mortality of layer chickens. Although environment-controlled sheds are designed to mitigate these impacts, limited research has evaluated their effectiveness under Bangladeshi conditions. This study addresses that gap by testing the hypothesis that temperature and humidity significantly influence the nutrition and survival of layer chickens in controlled environments. Specifically, it investigates annual variations in feed intake, water intake, and mortality, examines how elevated environmental factors affect consumption patterns and survival, and explores the relationship between these stressors and production performance. This study aims to evaluate the effects of temperature and humidity on feed intake, water consumption, and mortality of layer chickens reared in environment-controlled sheds in Bangladesh. The findings will provide evidence-based guidance for developing effective environmental management strategies to enhance poultry health, reduce mortality, and improve overall productivity in Bangladesh's poultry industry.

2. Materials and Methods

2.1. Ethical approval

Ethical approval for this study was obtained from the Ethics Committee for Animal Experiments, Gazipur Agricultural University, Bangladesh (FVMAS/AREC/2023/59).

2.2. Study area and periods

This quantitative study used secondary data (2017–2020) from shed logbooks of Protein House Limited (PHL) and Diamond Eggs Limited (DEL) in Kapasia Upazila, Gazipur, Bangladesh, providing valuable insights into egg production performance (Figure 1). The research was carried out between 2021 and 2024.

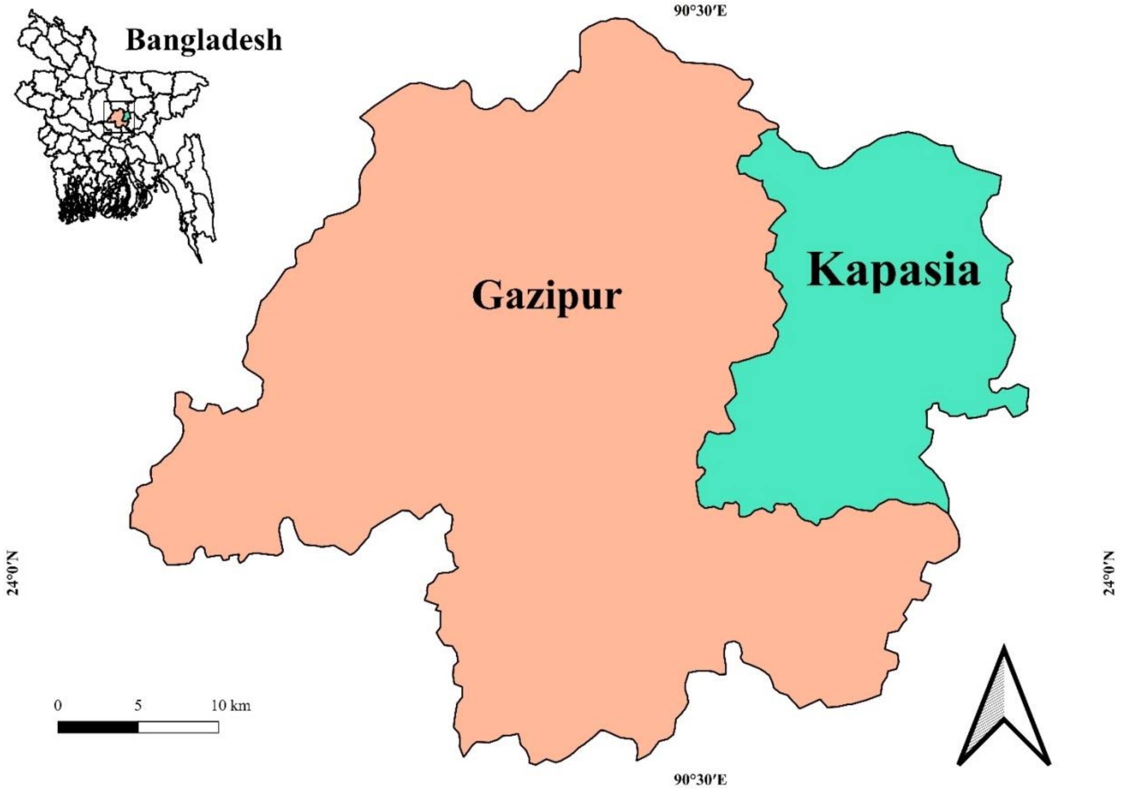

Figure 1. The study was conducted in the Kapasia upazila, Gazipur, Bangladesh.

2.3. Population size of birds

The study began with varying numbers of birds across different sheds, which changed over time due to flock replacement. The population size and layer strains in the sheds of PHL and DEL, showing that PHL reared Isa Brown across its sheds, while DEL maintained multiple strains, including Novogen, Isa Brown, Hyline, and Bovans Brown, with flock sizes ranging from about 29,739 to 277,485 birds (Table 1).

Table 1. Population size of layer chickens at PHL and DEL.

Sheds of PHL	Number of birds	Strains of layer	Sheds of DEL	Number of birds	Strains of layer
L2	70514	Isa Brown	L1	133021	Novogen
L3	79110	Isa Brown	L2	113120	Isa Brown
L4	78248	Isa Brown	L3	131575	Hyline
			L4	29739	Isa Brown
			L5	134000	Isa Brown
			L6	277485	Novogen
			L7	111908	Bovans Brown

2.4. General farm management

The layer farms were managed with strict attention to productivity, bird welfare, and biosecurity. Housing facilities were thoroughly cleaned and disinfected before flock introduction. Birds were provided with quality feed and fresh water, with proper records maintained. Ventilation systems were adjusted to regulate temperature and humidity. Vaccination schedules and routine health checks were strictly implemented to prevent disease outbreaks. Waste management practices ensured sanitation, while production, health, and mortality records were systematically tracked for continuous improvement. All management practices complied with environmental and biosecurity guidelines set by the Directorate of Livestock Services (DLS), Bangladesh.

2.5. Data acquisition

For PHL, data were retrieved from farm logbooks for 2017 and 2018, while for DEL, records from 2018 to 2020 were collected. Both farms maintained consistent daily record-keeping, from which a subset of key parameters was extracted to generate a reliable dataset for analysis.

2.5.1. Temperature measurement

Internal temperature (°C) was measured inside the sheds using digital thermometers (Model: DT-388, ThermoPro, USA) positioned at bird height to accurately reflect the ambient conditions experienced by the birds. External temperature (°C) was measured outside the sheds using a shaded digital thermometer (Model: Hobo MX2301, Onset, USA) to prevent interference from direct sunlight and ensure accurate readings of the surrounding environment.

2.5.2. Humidity measurement

Relative Humidity (%) inside the sheds was measured using a digital hygrometer (Model: HTC-1, ThermoPro, USA) installed at bird level to capture ambient moisture conditions accurately.

2.5.3. Mortality

The number of deceased birds in each shed was recorded daily by manual counting. Mortality rate was calculated using the formula,

Mortality rate (%) $=\frac{Number\ of\ dead\ birds}{Total\ number\ of\ birds}\times 100$

2.5.4. Water intake (ml/bird/day)

Water consumption was measured using calibrated water meters attached to nipple drinkers (Brand: Lixit, Model: Nipple Drinker System, USA). Daily water intake per bird was calculated as,

Water intake per bird (ml) $=\frac{Total\ water\ consumed\ in\ shed\ (ml)}{Number\ of\ birds\ in\ shed}$

2.5.5. Feed intake (g/bird/day)

Feed offered and remaining feed were weighed daily using a digital weighing scale (Model: OHAUS CS200, USA). Feed intake per bird was calculated as,

Feed intake per bird (g) = $\frac{Feed\ offered\ (g) - Feed\ remaining\ (g)}{Number\ of\ birds\ in\ shed}$

2.6. Statistical analysis

Data from PHL (2017–2018) and DEL (2018–2020) were compiled into annual averages for temperature, humidity, feed intake, water intake, and mortality. Descriptive statistics were generated to summarize environmental and production parameters. One-way analysis of variance (ANOVA) was performed to assess the effects of environmental factors (temperature and humidity) on feed intake, water intake, and mortality across sheds and years, with statistical significance set at $P < 0.05$. Pearson's correlation coefficients (r) were calculated to examine the strength and direction of relationships among temperature, humidity, feed intake, water intake, and mortality. Positive values indicated direct associations (e.g., higher temperature with increasing mortality), while negative values reflected inverse relationships (e.g., higher humidity with reduced feed intake). All statistical analyses were conducted using SPSS version 26, and the map was prepared with QGIS 3.4.

3. Results

3.1. Annual environment and performance metrics of PHL

In 2017, the mean inside shed temperature ranged from 30.14 ± 0.88 °C to 30.78 ± 0.94 °C, while outside temperatures were slightly higher, ranging from 32.1 ± 1.59 °C to 32.42 ± 0.91 °C. Relative humidity remained consistently high, between 83.87 ± 3.13% and 86.15 ± 2.39%. Mortality during this year varied considerably across sheds, with the lowest in L3 (18.36 ± 6.35 birds) and the highest in L4 (24.39 ± 6.95 birds). Feed intake ranged between 94.66 ± 7.12 g/bird in L2 and 108.55 ± 1.25 g/bird in L3, while water intake followed a similar trend, ranging from 163.48 ± 17.95 ml (L2) to 183.86 ± 1.62 ml (L3). In 2018, mean inside temperatures were notably lower, ranging from 28.47 ± 0.78 °C to 29.02 ± 0.71 °C, with outside temperatures between 29.15 ± 1.67 °C and 29.92 ± 1.62 °C. Relative humidity also declined compared to 2017, remaining around 72–73% across all sheds. Mortality rates were reduced in 2018, ranging from 9.74 ± 2.45 (L3) to 12.31 ± 4.29 birds (L4). Water intake was higher than in 2017, with values between 188.64 ± 0.91 ml (L4) and 193.52 ± 1.44 ml (L2). Similarly, feed intake improved, reaching 109.26 ± 0.50 g/bird in L3 compared with 106.34 ± 2.40 g/bird in L4 (Table 2).

Table 2. Annual average environmental conditions, feed and water intake, and mortality of layer chickens at PHL farm (2017–2018).

Year	Shed No.	Temperature (°C) [inside]	Temperature (°C) [outside]	Humidity (%)	Mortality	Water intake (ml)	Feed intake (g/bird)	*P* value
2017	L2	30.14±0.88	32.10±1.59	83.87±3.13	23.254±13.47	163.482±17.95	94.656±7.12	9.84
	L3	30.78±0.94	32.42±0.91	86.15±2.39	18.36±6.35	183.86±1.62	108.55±1.25	2.90
	L4	30.50±0.85	32.28±1.28	86.10±2.50	24.39±6.95	178.59±1.07	105.38±2.61	0.00
2018	L2	29.02±0.71	29.65±1.57	72.77±1.38	9.77±2.92	193.52±1.44	109.00±1.24	1.02
	L3	28.70±0.78	29.92±1.62	72.56±1.23	9.74±2.45	191.90±1.39	109.26±0.50	5.12
	L4	28.47±0.78	29.15±1.67	72.29±1.08	12.31±4.29	188.64±0.91	106.34±2.40	1.86

3.2. Annual environment and performance metrics of DEL

In 2018, internal temperatures ranged from 28.01 ± 0.41 °C (L7) to 30.60 ± 0.50 °C (L1), while external temperatures varied from 27.97 ± 1.46 °C (L7) to 31.85 ± 0.60 °C (L6). Humidity levels were generally high, ranging from 73.74 ± 3.87% (L7) to 78.83 ± 1.72% (L5). Mortality varied substantially across sheds, with the highest observed in L7 (63.07 ± 16.91 birds) and the lowest in L1 (18.54 ± 4.28 birds). Water intake was highest in L5 (217.87 ± 16.41 ml/bird) and lowest in L4 (98.97 ± 4.37 ml/bird), whereas feed intake ranged from 97.31 ± 4.61 g/bird (L1) to 130.97 ± 24.77 g/bird (L4). In 2019, internal temperatures ranged between 29.56 ± 0.46 °C (L3) and 30.94 ± 0.59 °C (L4 and L5), while external temperatures varied from 30.03 ± 1.12 °C (L2) to 31.34 ± 0.94 °C (L4). Humidity levels ranged from 66.98 ± 7.87% (L2) to 77.00 ± 4.32% (L7). Mortality peaked in L6 (113.45 ± 12.76 birds) and L7 (103.55 ± 3.55 birds), whereas the lowest mortality was recorded in L1 (36.10 ± 3.49 birds). Feed intake and water consumption showed variation among sheds, reflecting strain- and environment-specific responses to temperature and humidity fluctuations. In 2020, internal temperatures ranged from 28.79 ± 1.12 °C (L6) to 29.45 ± 0.82 °C (L1), and external temperatures varied between 29.58 ± 1.77 °C (L3) and 30.06 ± 1.43 °C (L1). Humidity remained high, from 78.45 ± 3.27% (L3) to 80.23 ± 3.21% (L1). Mortality was highest in L6 (93.86 ± 6.33 birds) and lowest in L3 (24.61 ± 1.90 birds). Water intake ranged from 107.80 ± 0.41 ml/bird (L1) to 249.15 ± 3.94 ml/bird (L6), while feed intake varied from 108.68 ± 0.57 g/bird (L6) to 199.05 ± 7.55 g/bird (L1). The one-way ANOVA indicated significant variation in at least one of the measured parameters across sheds and years, with the lowest *P*-value observed in shed L1 of 2020 ($P = 0.0006$), suggesting a strong influence of environmental conditions on bird mortality, feed, and water intake (Table 3).

Table 3. Annual average environmental conditions, mortality, and feed/water intake of layer chickens at DEL farm (2018–2020).

Year	Shed No.	Temperature (°C) [inside]	Temperature (°C) [outside]	Humidity (%)	Mortality	Water intake (ml)	Feed intake (g/bird)	*P* value
2018	L1	30.60±0.50	30.62±0.63	78.11±1.88	18.54±4.28	205.94±15.82	97.31±4.61	4.67
	L2	29.52±0.43	30.34±0.79	76.67±1.81	31.97±5.82	208.68±13.72	102.77±4.14	2.37
	L3	30.21±0.40	31.25±0.41	76.79±2.07	32.84±7.15	108.23±1.39	121.94±5.80	3.92
	L4	29.91±0.40	30.74±0.65	77.35±1.61	39.80±11.16	98.97±4.37	130.97±24.77	3.09
	L5	30.08±0.47	30.70±0.70	77.83±1.72	29.08±11.40	217.87±16.41	99.94±7.00	7.85
	L6	30.29±0.55	31.85±0.60	77.66±1.71	53.43±12.17	212.21±15.43	100.74±3.62	1.19
	L7	28.01±0.41	27.97±1.46	73.74±3.87	63.07±16.91	195.77±10.50	101.51±4.92	8.49
2019	L1	30.53±0.57	30.57±0.77	76.15±4.57	36.10±3.49	96.82±3.62	125.58±13.35	4.07
	L2	29.73±0.54	30.03±1.12	66.98±7.87	35.79±2.53	270.29±5.70	109.20±1.63	8.344
	L3	29.56±0.46	30.78±0.71	75.32±4.40	49.42±6.75	229.82±9.52	106.00±2.20	2.14
	L4	30.94±0.58	31.34±0.94	74.59±5.29	45.50±5.63	274.83±4.32	111.28±0.65	5.27
	L5	30.94±0.59	30.88±0.74	76.25±5.04	41.10±4.12	266.78±5.12	110.09±0.64	6.95
	L6	30.06±0.57	31.12±0.71	75.47±3.89	113.45±12.76	220.70±13.25	101.69±4.27	6.62
	L7	30.20±0.52	30.35±0.96	77.00±4.32	103.55±3.55	284.02±8.74	112.10±0.96	1.7
2020	L1	29.45±0.82	30.06±1.43	80.23±3.21	43.52±5.80	107.80±0.41	199.05±7.55	0.0006
	L3	28.99±0.80	29.58±1.77	78.45±3.27	24.61±1.90	242.27±5.80	112.77±0.48	1.33
	L6	28.79±1.12	29.99±1.73	78.51±3.31	93.86±6.33	249.15±3.94	108.68±0.57	4.15

3.3. Mortality rate over years in PHL and DEL

The mortality rates of PHL strains L2, L3, and L4 were consistent across both 2017 and 2018, showing a decrease from 0.02 in 2017 to 0.01 in 2018 for all strains (Table 4).

Table 4. Mortality rate of layer chickens in PHL during 2017 to 2018.

Strains	Mortality rate	
	2017	2018
L2	0.02	0.01
L3	0.02	0.01
L4	0.02	0.01

The mortality rates of DEL strains (L1–L7) from 2018 to 2020 reveal fluctuating trends, with most strains showing an increase in 2019 before stabilizing or declining in 2020. For instance, the mortality rate in rate rose from 0.01 (2018) to 0.03 (2019), then dropped back to 0.01 (2020), while L3 and L6 exhibited similar rises in 2019 and partial recovery in 2020. Mortality rate in the L7 recorded the highest increase, reaching 0.05 in 2019 (Table 5).

Table 5. Mortality rate of layer chickens in DEL during 2018 to 2020.

Strains	Mortality rate		
	2018	2019	2020
L1	0.01	0.03	0.01
L2	0.02	0.03	
L3	0.02	0.04	0.02
L4	0.03	0.03	
L5	0.02	0.03	
L6	0.02	0.04	0.02
L7	0.03	0.05	

3.4. Correlation analysis among the variables of PHL

Internal temperature showed a moderate positive correlation with mortality (r = 0.61). External temperature had a moderate positive correlation with water intake (r = 0.57). Humidity exhibited a moderate positive correlation with mortality (r = 0.60) (Table 6).

Table 6. Correlation among the variables of PHL.

Parameters	Temperature °C (inside)	Temperature °C (outside)	Humidity (%)	Mortality	Water intake (ml/bird)	Feed intake (g/bird)
Temperature (inside)	1					
Temperature (outside)	0.90	1				
Humidity (%)	0.92	0.88	1			
Mortality	0.61	0.33	0.60	1		
Water intake (ml/bird)	0.30	0.57	0.17	-0.52	1	
Feed intake (g/bird)	-0.44	-0.16	-0.61	-0.75		1

3.5. Correlation analysis among the variables of DEL

Internal temperature showed a weak positive correlation with mortality (r = 0.29). External temperature had a weak positive correlation with mortality (r = 0.27) and a weak negative correlation with water intake (r = -0.28). Humidity exhibited a very weak positive correlation with mortality (r = 0.20) and a moderate negative correlation with feed intake (r = -0.58) (Table 7).

Table 7. Correlation among the variables of DEL.

Parameters	Temperature (°C) [inside]	Temperature (°C) [outside]	Humidity (%)	Mortality	Water intake (ml/bird)	Feed intake (g/bird)
Temperature (inside)	1					
Temperature (outside)	0.96	1				
Humidity (%)	0.63	0.60	1			
Mortality	0.29	0.27	0.20	1		
Water intake (ml/bird)	-0.37	-0.28	-0.13	0.15	1	
Feed intake (g/bird)	-0.64	-0.54	-0.58	-0.05	-0.37	1

4. Discussion

The inner (shed) and outer (environmental) temperature, humidity, number of deceased birds, daily water and feed consumption, and the total bird count in each shed were recorded daily at PHL. These findings contribute to sustainable poultry production, addressing challenges in food security, economic viability, and animal welfare within the context of climate variability. These findings were corresponded with (Khan *et al.*, 2019; Juiputta *et al.*, 2023).

At DEL, daily measurements were recorded for internal (shed) and external (environmental) temperature, humidity, bird mortality, water and feed consumption, and total bird population per shed. Feed intake is relatively consistent across both farms, with slight variations observed. Sheds with higher mortality rates tend to have slightly lower feed intake, which suggests a potential link between bird health and environmental stress were also reported (Khan *et al.*, 2019). Environmental conditions were relatively similar across all sheds; however, the mortality rates, water intake, and feed intake reported in the last three tables indicate that higher mortality occurred under more extreme conditions, potentially influenced by additional unmeasured stress factors (Kang *et al*., 2020).

The monthly averages of internal and external temperature, humidity percentage, daily feed intake per bird, daily water intake, and the number of deceased animals were calculated. The moderate negative correlation between humidity and feed intake our results align with research indicating that high humidity levels can lead to decreased feed intake. Previous studies found that poultry under high humidity conditions (above 70%) exhibited lower feed consumption, primarily due to difficulty in heat dissipation (Wasti *et al.*, 2020; Mangan and Siwek, 2023). Our finding showed that humidity negatively affects feed intake reinforces the findings of Liu *et al*. (2015), which demonstrated that poultry consume less feed in humid environments because the body's ability to release heat is compromised, leading to discomfort and lower feed consumption. This study showed a slight decrease in water intake as internal and external temperatures rise, which is somewhat unexpected based on the typical understanding that birds drink more water in hotter conditions to regulate body temperature. This outcome may suggest that extreme heat stress leads to a reduction in overall activity, including water intake, a previous study found, they were found that extreme heat could reduce bird activity, leading to lower water consumption (Vandana *et al.*, 2021). Study also found that improving ventilation systems and managing temperature and humidity levels could significantly reduce stress-related diseases and mortality in poultry (Wang *et al*., 2019; Oluwagbenga and Fraley, 2023).

The significant relationship between temperature and mortality is consistent with findings from other studies in poultry research. For example, a study that high internal temperatures, particularly in the range of 30–35°C, can lead to increased mortality rates in poultry due to heat stress (Melesse *et al.*, 2011; Amaz and Mishra, 2024). Similarly, previous studies reported that heat stress significantly increases mortality in poultry by affecting metabolic processes, leading to severe physiological strain (Wasti *et al*., 2020; Kim *et al.*, 2025).

The results of this study indicate that both internal and external temperatures significantly influence bird mortality, water intake, and feed intake. A moderate positive correlation between internal temperature and mortality (r = 0.61) suggests that higher shed temperatures are associated with increased mortality, likely due to heat stress, while external temperature shows a moderate positive correlation with water intake (r = 0.57), reflecting the birds' increased water consumption as a thermoregulatory response to rising temperatures. These findings are consistent with previous studies, which reported that elevated temperatures in poultry environments can induce physiological stress, reduce feed intake, and compromise overall health (Goo *et al*., 2019; Kang *et al*., 2020).

The data indicates that humidity also plays a significant role in bird mortality and feed intake. Additionally, humidity shows a moderate negative correlation (r = -0.61) with feed intake, indicating that birds consume less food in humid conditions, possibly because high humidity makes it harder for them to dissipate heat, leading to discomfort. These findings were emphasized the need for proper ventilation and humidity control in poultry environments to minimize stress and maintain bird health and were also reported by others (Nawab *et al*., 2018; Salvia and Valderama, 2021).

The data suggests that temperature, both internal and external, influences bird mortality, water intake, and feed intake, though the effects vary in strength. However, internal temperature has a moderate to strong negative correlation (r = -0.64) with feed intake, meaning birds significantly reduce their food consumption as temperatures rise, a typical response to heat stress. Similarly, external temperature has a weak positive correlation (r = 0.27) with mortality, implying that while it plays a role, other factors such as humidity and internal temperature may be more influential. Unexpectedly, external temperature also shows a weak negative correlation (r = -0.28) with water intake, which may suggest that extreme heat stress lowers bird activity, leading to decreased drinking. However, external temperature has a moderate negative correlation (r = -0.55) with feed intake, reinforcing the idea that birds eat less in hotter conditions to reduce metabolic heat production. The similar results were also reported by Kim and Lee (2019) and Yan *et al.* (2022).

The data indicates that humidity has a limited effect on bird mortality but a more noticeable impact on feed intake. However, humidity has a moderate negative correlation (r = -0.58) with feed intake, indicating that birds consume less food in humid conditions, likely due to discomfort and the difficulty of dissipating body heat. These findings suggest that while humidity alone may not strongly impact bird survival, it plays a significant role in reducing feed intake, which could indirectly affect overall health and productivity. Proper ventilation and humidity control remain essential for maintaining optimal conditions in poultry farming. These results were also supported by finding of other authors (Kumari and Nath, 2018; Apalowo *et al.*, 2024).

5. Conclusions

This study investigated feed and water intake and mortality in layer chickens, focusing on the effects of temperature, humidity, and strain differences at two commercial poultry farms in Bangladesh. Results showed that higher temperatures and humidity increased mortality and reduced feed and water intake, highlighting the strong influence of environmental conditions on bird health. These findings emphasize the need for interventions to improve farm environments and develop heat-tolerant chicken strains in Bangladesh.

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Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of interest

None to declare.

Authors’ contribution

Md. Golam Haider: designed the study, facilitated to conduct research work, analyzed and interpreted the data, wrote the first draft of the manuscript; Monalisa Parvin and Sheikh Arafatur Rahman: data collection, interpreted the data, writing-reviewing and editing; Md. Taimur Islam and M. Nazmul Hoque: analyzed the data and wrote the first draft of the manuscript; Md. Golam Haider: involved in fund acquisition, supervision and critically reviewed the manuscript. All authors have read and approved the final manuscript.

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