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Productivity and profitability of commercial broiler chickens under various farming conditions

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KEYWORDS

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ABSTRACT

Broiler farming plays a vital role in fulfilling global protein requirements. Although broiler farming is considered profitable, profitability might be affected by factors such as genetics, feed quality, and management practices. In the current study, the productivity and profitability of commercial broiler farming were studied under various farming conditions, such as farm size, location of the farm, and mortality of the broilers. Data were collected through farmers' interviews and farm record books and processed and analyzed to determine the productivity and profitability of broiler farming. Productivity and profitability did not differ significantly across farm sizes and locations. The results of the study reported mortality as a factor affecting productivity and profitability in broiler farming. It was manifest that mortality adversely affected the productivity and profitability of broiler farming. A significant positive relationship was recorded between mortality and feed conversion ratio. Moreover, mortality was negatively correlated with the gross margin of broiler farming, meaning that the low gross margin was due to the high mortality at broiler farms. The farms were more profitable when the mortality was <5%, compared to >10%. It is recommended to reduce the mortality percentage of broiler chickens as minimum as possible, preferably <5%. Good quality chicks, better management, and the prevention of diseases might play an important role in keeping the mortality rate at a minimum level in broiler farming.

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1 Introduction

Poultry is the fastest-growing agricultural sub-sector and is essential in supplying meat and eggs worldwide. Thousands of people are engaged in this sub-sector to support their livelihoods (Kabir et al. 2016) and contribute to enriching the global economy (Hamid et al. 2016). Among poultry enterprises, broiler farming is widespread due to its quick returns, and such farmers have been profitable by rearing the broilers (Chowdhury and Chowdhury 2015). Recently, contract broiler farming has been initiated, where farmers are assured of getting a reasonable product price by following the rules of contracted feed companies (Saha et al. 2021).

Although broiler farming is profitable, several risk factors and challenges are associated with this sub-sector (Islam et al. 2014). The biosecurity of farms sometimes falls due to improper planning and management. Despite regular vaccination and medication, diseases and deformities might occur at broiler farms, which might cause a loss in broiler farming (Akintunde et al. 2015). Moreover, there are natural calamities and disasters that affect the productivity and profitability of broilers.

Among the factors affecting the productivity and profitability of broiler farming, mortality is a significant concern in achieving profitability in broiler farming. Farm data analysis from different aspects needs to be analyzed to find out the factors affecting the productivity and profitability of broiler farming. Since broiler mortality is common in broiler farming, it may adversely affect the productivity and profitability of broiler farming (Chauvin et al. 2011). The study of how mortality affects productive performances and gross returns has received less attention. The extent of losses in productivity and profitability of broiler enterprises at the level of farmers needs to be investigated. The current study aimed to investigate mortality at broiler farms and its effects on productivity and profitability. In this regard, the relationship between mortality rate and productive or economic parameters in broiler farming was investigated in the present study. The current study findings will help to understand the productivity and profitability of broiler farming under various farming conditions.

2 Materials and Methods

2.1 Data collection

The current study was conducted from January to December 2019. A total of 436 broiler farmers who reared the Ross 308 broiler strain were included from the Bogura, Rangpur, and Dinajpur districts of Bangladesh. The selected farms were of various sizes and ranged from 200 to 9,200 broilers per farm. A structured and pretested questionnaire was used to collect data. Data related to production (live weight of broilers, daily weight gain, and feed

conversion ratio [FCR]) and economic parameters (gross cost, gross return, and gross margin) were collected from all the selected broiler farms.

2.2 Rearing and management

Commercial broiler strain Ross 308 was reared at a stocking density of 9 birds/m² for five weeks. Standard commercial broiler diets (starter, grower, and finisher) were used *ad libitum*. The farms were regularly monitored and supervised by poultry production specialists.

2.3 Productivity and profitability

The productivity and profitability of broiler farming were calculated according to Sarkar et al. (2008). The record of chick weight, amount of feed intake, mortality, and final body weight were considered for the productivity analysis of broilers. Then, daily weight gain and FCR were analyzed. The cost of chicks, feed, vaccines, medicines, and miscellaneous costs was investigated for the gross cost analysis.

2.4 Productivity and profitability at various farm sizes

To determine the effects of farm size on the productivity and profitability of broiler farming, the farm size was divided into three groups: <2000, 2001–5000, and >5000 broilers/farm. The productive and economic parameters were calculated according to the farm size category.

2.5 Mortality analysis

To know the adverse effects of mortality on economics in broiler farming, the mortality was categorized into three groups: <5%, 5–10%, and >10%. The productive and economic parameters were calculated according to the category of mortality rates.

2.6 Data analysis

Means and standard deviations are used to represent data. Percentage mortality data were arcsine transformed before analysis, and analysis was performed based on the transformed data. A one-way analysis of variance (ANOVA) using MS Excel was used to determine the significant differences between means. Differences between treatments were analyzed using Tukey's honestly significant difference test, and the significance level was declared based on a $P < 0.05$.

3 Results and Discussion

Although broiler chickens could yield a reasonable return and are considered profitable, farmers often face challenges in gaining the expected productivity and profitability through broiler farming. Several factors influence the productivity and economics of

broilers, such as the strain of the broiler, feed quality, management, and the market price of broiler chickens (Bandara and Dassanayake 2006; AL-Masad 2010; Rana et al. 2013; Baracho et al. 2019). The current study looked at broiler productivity and profitability across various farm sizes, locations, and broiler mortality rates. The mean values of the productive performances and economic analysis of the studied farms, irrespective of farming conditions, are presented in Table 1. The study's results revealed that a broiler consumed 3.12 kg of feed and achieved a body weight of 1.88 kg. The daily weight gain of the broiler was 55.24 g, with an FCR of 1.66. Overall economic parameters of gross cost, gross return, and gross margin (Tk./kg broiler) were 108.37, 114.99, and 6.62, respectively. Regardless of farming conditions, overall mortality was 10.39%. The gross margin obtained from broiler farming was not high, but the FCR of the broilers might have coincided with the previous study. The FCR of broilers was reported to be 1.64 in Bangladesh (Husna et al. 2017). The FCR has improved in the poultry industry over time due to

improvements in strains, feed quality, management, and nutritional biotechnology (Havenstein et al. 1994; Islam et al. 2016). Regardless of seasons or farm sizes, improved management interventions may increase productivity (Kawsar et al. 2017; Kawsar et al. 2018). One of the major challenges of the broiler industry is earning profitability and financial stability. In many countries, there is a fluctuation in the cost of chickens, feed, and the sale price of broiler chickens. Even with high productivity, profitability might not be achieved due to the lower demand for broiler chickens (Fouzder et al. 2021). Therefore, the expected level of gross margin might not be achieved due to the instability of gross cost and gross return.

Tables 2 and 3 show the results under various farm sizes and locations, respectively. The feed intake (kg/bird), live weight (kg/bird), and FCR ranged from 3.03–3.25; 1.83–1.93; and 1.65–1.72, respectively, under various farm sizes and locations. The gross margin (Tk./kg broiler) ranged from 4.51 to 7.04. These

Table 1 Productivity and profitability of broiler chickens regardless of farming conditions

Parameters	Mean \pm Standard deviation
Rearing period (days)	34.16 \pm 2.82
Feed intake (kg/bird)	3.12 \pm 0.31
Live weight (kg/bird)	1.88 \pm 0.16
Daily weight gain (g)	55.24 \pm 5.14
Feed conversion ratio	1.67 \pm 0.162
Mortality (%)	10.39 \pm 5.14
Gross cost (Tk./kg)	108.37 \pm 9.75
Gross return (Tk./kg)	114.99 \pm 3.51
Gross margin (Tk./kg)	6.62 \pm 9.86

Data are expressed as mean \pm standard deviation.

Table 2 Productivity and profitability of broilers at various farm sizes

Parameters	<2000 broilers/flock	2001–5000 broilers/flock	>5000 broilers/flock
Rearing period (days)	33.83 \pm 2.81 ^a	34.84 \pm 2.77 ^a	35.18 \pm 2.27 ^a
Mortality %	10.21 \pm 4.91 ^a	10.70 \pm 5.63 ^a	11.91 \pm 5.22 ^a
Feed intake (kg/bird)	3.12 \pm 0.31 ^a	3.10 \pm 0.32 ^a	3.25 \pm 0.33 ^a
Live weight (kg/bird)	1.88 \pm 0.17 ^a	1.86 \pm 0.15 ^a	1.93 \pm 0.18 ^a
Daily weight gain (g)	55.9 \pm 5.07 ^a	53.76 \pm 5.18 ^a	54.76 \pm 3.14 ^a
Feed conversion ratio	1.66 \pm 0.16 ^a	1.67 \pm 0.18 ^a	1.69 \pm 0.09 ^a
Gross cost (Tk./kg)	108.21 \pm 9.08 ^a	108.67 \pm 11.42 ^a	109.25 \pm 5.67 ^a
Gross return (Tk./kg)	115.17 \pm 3.54 ^a	114.54 \pm 3.34 ^a	115.46 \pm 4.6 ^a
Gross margin (Tk./kg)	6.95 \pm 9.37 ^a	5.87 \pm 11.22 ^a	6.21 \pm 3.91 ^a

Data are expressed as mean \pm SD. A similar superscript means there are no significant differences among treatments within the same row ($P < 0.05$)

Table 3 Productivity and profitability of broilers at various farm locations

Parameters	Bogura	Rangpur	Dinajpur
Rearing period (days)	32.81 ± 2.09 ^a	32.96 ± 1.98 ^a	34.99 ± 2.97 ^a
Mortality %	11.19 ± 5.73 ^a	10.66 ± 5.30 ^a	10.08 ± 4.89 ^a
Feed intake (kg/bird)	3.17 ± 0.31 ^a	3.03 ± 0.27 ^a	3.14 ± 0.32 ^a
Live weight (kg/bird)	1.85 ± 0.16 ^a	1.83 ± 0.16 ^a	1.91 ± 0.16 ^a
Daily weight gain (g)	56.63 ± 4.91 ^a	55.5 ± 5.04 ^a	54.78 ± 5.19 ^a
Feed conversion ratio	1.72 ± 0.19 ^a	1.67 ± 0.17 ^a	1.65 ± 0.15 ^a
Gross cost (Tk./kg)	111.54 ± 11.34 ^a	109.57 ± 10.53 ^a	107.08 ± 8.72 ^a
Gross return (Tk./kg)	116.05 ± 3.58 ^a	116.46 ± 3.31 ^a	114.13 ± 3.30 ^a
Gross margin (Tk./kg)	4.51 ± 11.73 ^a	6.88 ± 11.15 ^a	7.04 ± 8.68 ^a

Data are expressed as mean ± standard deviation. A similar superscript means there are no significant differences among treatments within the same row ($P < 0.05$)

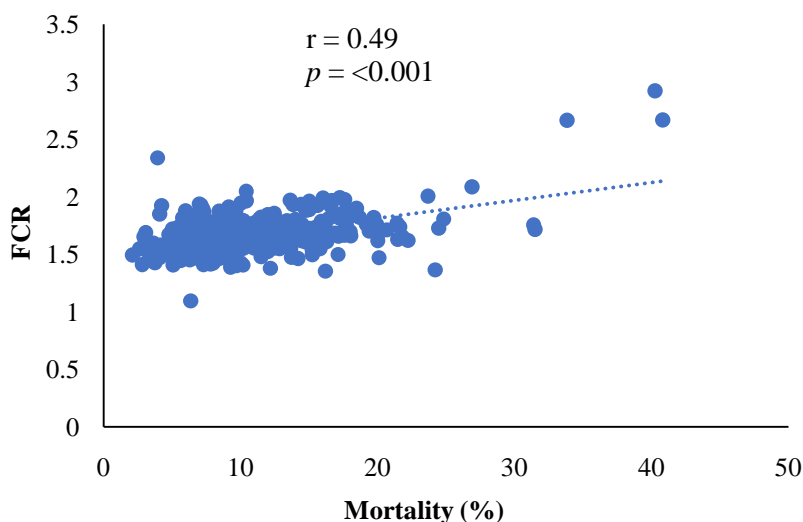


Figure 1 Correlation between mortality rate and feed conversion ratio in 436 independent broiler farms

results demonstrate no significant differences among the various farm sizes and locations. This could be due to the high mortality of broilers in different farm sizes and locations. Table 4 tabulates the results in which significant differences in the gross margin of broiler farming were found when the mortality rate was categorized and analyzed. In the present study, the effects of mortality on productive and economic performances were highlighted. According to Figure 1, broilers had a significant positive correlation between mortality rate and FCR value ($r = 0.49$, $P < 0.05$). The results manifested that FCR could be increased with the increased mortality percentage of broilers in the flock, as feed consumed by the dead birds was also included in the calculation of the FCR. In broiler farms, mortality occurs at various stages of the rearing period. Usually, mortality occurs during the first week of the rearing period due to poor management at the breeder and the types of housing (Yerpes et al. 2020).

Moreover, broiler chicks are more susceptible to mortality since the immune system is not well-developed at an early stage. Mortality after the brooding period is usually due to the outbreak of diseases on the farm (Delabougliise et al. 2019). If a broiler dies in a flock, the amount of feed consumed by the dead broiler is also calculated as part of the flock's cumulative FCR. In this circumstance, the broilers have consumed feed without contributing to the cumulative live weight of broiler chickens. The higher level of FCR depends on the occurrence of mortality at the final stage of the rearing period. Increases in FCR negatively correlate with broiler productivity (Ali and Hossain 2010).

We found a significantly negative correlation between mortality and gross margin in broiler farming ($r = -0.61$, $P < 0.05$; Figure 2), which indicates that the gross margin will be reduced with increased mortality and vice versa. Detailed information on how

Table 4 Productivity and profitability of broilers at various rates of mortality

Parameters	Mortality < 5%	Mortality 5–10%	Mortality > 10%
Rearing period (days)	34.41 ± 2.56 ^a	34.09 ± 2.77 ^a	34.22 ± 2.96 ^a
Feed intake (kg/bird)	2.95 ± 0.24 ^a	3.08 ± 0.28 ^b	3.19 ± 0.33 ^c
Live weight (kg/bird)	1.87 ± 0.15 ^a	1.89 ± 0.16 ^{ab}	1.86 ± 0.17 ^c
Daily weight gain (g)	54.57 ± 4.66 ^a	55.81 ± 4.95 ^a	54.47 ± 5.43 ^a
Feed conversion ratio	1.58 ± 0.11 ^a	1.63 ± 0.12 ^{ab}	1.73 ± 0.19 ^c
Gross cost (Tk./kg)	101.64 ± 7.66 ^a	105.84 ± 6.55 ^b	113.18 ± 11.52 ^c
Gross return (Tk./kg)	114.85 ± 3.88 ^a	115.37 ± 3.78 ^a	114.47 ± 1.30 ^a
Gross margin (Tk./kg)	13.21 ± 7.74 ^a	9.53 ± 6.97 ^{ab}	1.30 ± 11.15 ^c

Data are expressed as mean ± standard deviation; ^{a,b,c} Meaning significant differences among treatments within the same row ($P < 0.05$)

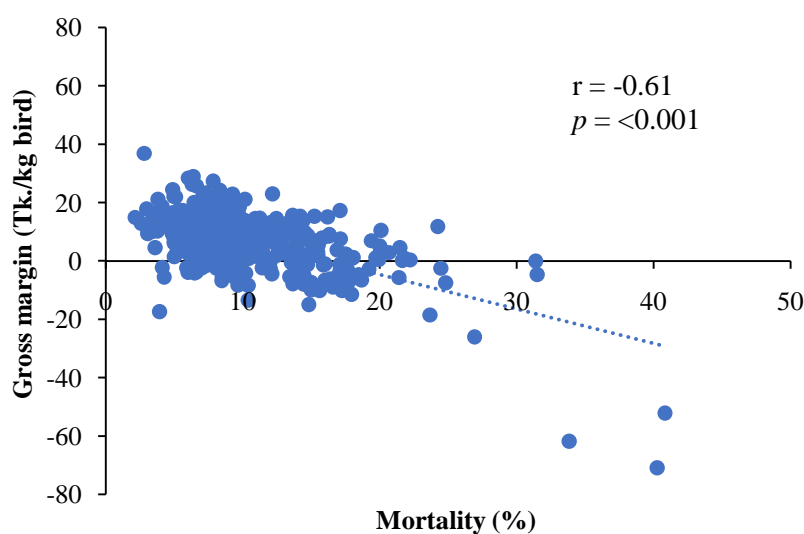


Figure 2 Correlation between mortality rate and gross margin in 436 independent broiler farms

mortality affects productivity and economics in broiler farming is shown in Table 4. The FCRs for the mortality rates of <5%, 5–10%, and >10% were 1.58, 1.63, and 1.73, respectively. The gross margin (Tk./kg broiler) was 13.21, 9.53, and 1.30 for the mortality as mentioned earlier rate. When mortality was compared between <5% and >10%, feed intake and live weight (kg/broiler) differed significantly. When mortality was >10%, feed intake increased, and live weight decreased. In farms where mortality was <5%, the FCR was significantly lower. In this situation, the gross cost (Tk./kg broiler) was significantly low, reflecting the farms' gross margin. The gross margin (Tk./kg broiler) was high in the farms where mortality was <5%, compared to the farms where mortality was >10%. In a case where the overall mortality was 10.39%, the gross margin (Tk./kg broiler) was 6.62. At farms with a mortality rate of around < 5%, the gross margin (Tk./kg broiler) was doubled by 13.21 compared to the mortality rate of 10.39%. To earn high productivity and profitability, the mortality rate should be kept as low as possible, preferably below 5%. The primary concern for

earning a high gross margin is the outbreak of infectious diseases on farms and the unstable market price of broiler chickens (Delabouglise et al. 2016). Despite the availability of vaccines against most poultry diseases, outbreaks of diseases are common in broiler farming due to biosecurity issues. The outbreak of diseases represents high morbidity and mortality in broiler farming (Sahoo et al. 2022). Although prediction and monitoring of the market for broilers are demanding, mortality can be minimized through improved management and strict biosecurity. In these circumstances, the knowledge and skills of farmers need to be improved to make the farms more profitable (Paul et al. 2017).

Conclusion

The productivity and profitability of broilers in various farm sizes and areas were not found to be significant due to high mortality. Mortality adversely affected the productivity and profitability of the broiler chickens. The feed conversion ratio was high when the

mortality rate increased, while the gross margin was negatively correlated with the mortality rate. To achieve high productivity and profitability, the mortality rate at broiler farms should be kept as low as possible through improved management and strict biosecurity.

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Authors' Contribution

Sharif Uddin Khan collected the data from the broiler farms. Swapon Kumar Fouzder contributed to the writing of the manuscript. Prodip Kumar Sarkar planned and designed the study, analyzed the data, prepared graphs and tables, and wrote the manuscript. All the authors confirmed the data and the final manuscript.

Competing Interests

The authors declare no conflict of interest.

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