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Article

Comparative fertility and hatchability of broiler grandparent stocks in Bangladesh

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Abstract: Checking the fertility and hatchability of broiler grandparent lines is important for improving chicken production. The Cobb-500, Ross-308, and Indian River (IR) grandparent strains were studied to determine their initial egg weight, fertility, hatchability, embryonic mortality, hatching weight, and chick survival rates. We studied a total of 2700 eggs from three different age/treatment, each consisting of three replicates with 100 eggs for each of the three genotypes. Using an automated incubator, eggs were incubated. Cobb-500 had a significantly higher mean egg weight (67.52 g) at later stage of their age compared to Ross-308 (64.22 g) and IR (65.05 g). Study also found that a higher egg weight reflects a higher day-old chick weight. The fertility rates of the Ross-308, IR, and Cobb-500 genotypes were high at 35 weeks (96.00%, 87.00%, and 93.00%) but declined after 45 weeks (64.22%, 65.05%, and 67.52%), respectively. The hatchability of Ross-308, IR, and Cobb-500 eggs at 35 weeks was 85.00%, 75.00%, and 80.00%, respectively. By 45 weeks, all genotypes had higher hatchability, with Ross-308 having the highest at 89%. But at 55 weeks, all genotype showed lowest hatchability where IR was the lowest 67%. Statistically significant variations were observed across strains at later stage. As age increased, embryonic mortality and brood mortality were higher. Compared to the other two, Ross-308 showed the lowest mortality in both embryonic and brooding cases in all three stages of their age of life. However, the IR breed consistently displayed the highest mortality rate. Same pattern showed dead in shell and culling chick's percentages. Strain-wise, the parameters differ from each other. However, regarding overall performance, the Ross-308 strain outperformed the other two strains.

Keywords: Ross-308; Cobb-500; IR; egg weight; DOC weight; embryonic mortality

1. Introduction

Poultry, a significant livestock industry, providing the cheapest animal protein for human consumption in the shortest time. Moreover, poultry industry is a wealthy contributor to the country's livestock economy, attracting both local and international investment (Islam *et al*., 2016; Ali *et al*., 2019; Hasan *et al*., 2021). It also functions as a farmer's bank, assisting developing country people like Bangladesh in dealing with emergencies (Sarker *et al*., 2020). In Bangladesh, the consumption of chicken products has increased notably, with individuals averaging 8.5 kg of poultry meat and 5.1 kg of eggs in 2019. The industry is expected to develop further, with annual per capita consumption levels in then five years. The overall estimated chicken meat industry growth is 34%, while the Bangladeshi layer sector grows at 49%. Moreover, the shift towards antibiotic-free production systems in Bangladesh has sparked concern from producers and consumers. Pathogenic multidrug-resistant microbes can be found in food, food established area, raw vegetables, farm animals, and even healthy pets (Shahid *et al*., 2021; Ripon *et al*., 2021; Meghla *et al*., 2021; Zihad *et al*., 2021; Farhad *et al*., 2021; Das *et al*., 2023 a, b). Eggs can also be contaminated with pathogenic organisms, leading to horizontal transmission and the risk of Salmonella contamination (Edema and Atayese, 2006). A single fresh, contaminated free egg means a batter fertility and hatchability ratio. As a result, maintaining a contamination-free manufacturing chain is crucial and challenging.

Poultry production in Bangladesh has grown dramatically in the last three decades, with grandparent farms meeting 80% of the total demand for parent stock, and imports accounting for the remaining 20%. But still Bangladesh's poultry sector is underdeveloped compared to other Asian markets, with 82 parent stock farms producing between 55 and 70 lakh day-old chicks (DOC) broiler and 5 lakh DOC of layers per week (Haque *et al*., 2020). Despite being fragmented, there are several larger integrated parties in the poultry business in Bangladesh such as ACI-Godrej, Aftab, CP, New Hope, Nourish, Provita, and Quality. These players have a controlling position in the breeding business, manufacture feed for third parties, and cater to urban consumers with processed poultry meat. To fulfill expanding local demand, Bangladesh's poultry sector productivity needs be raised by better production techniques, such as generating healthier DOC from top grandparent stocks with greater fertility and hatchability rates.

Fertility, hatchability, and survivability are crucial factors that influence the profitability of the hatchery sector (Peters *et al*., 2008). The age of the flock plays a pivotal role in both egg production and the hatchability of broiler eggs, as it is a multifaceted trait that changes with time (Perić *et al*., 2022). Numerous factors affect hatchability, including the duration of pre-incubation storage, fertility rates, and specific incubation conditions like temperature, humidity, ventilation, egg handling practices, and candling (Mahmud *et al*., 2022). Egg hatchability also may vary depending on diet content. Aside from these, additional variables such as breeding hen nutrition, embryo genetic composition, illness, egg size, age, and shell quality all have a significant impact on hatchability (King'ori, 2011). Because the broiler business relies heavily on DOC, embryonic mortality and chick survivorship are critical considerations. Furthermore, in order to get desired features in the nucleus and accelerate the transfer of genetic improvement from the nucleus into production, chickens must have a high reproductive ability. According to a research, around 20% of broiler embryos die during the pre-hatching stage each year, with virtually identical figures recorded for commercial laying hybrids (Wang *et al*., 2023). Several variables impact embryonic survivorship, including dietary inadequacies, breeder flock health, hatching method, egg quality, and genetics (Liptoi and Hidas, 2006).

Previously, only a few experiments were undertaken to compare the performance of various Grand Parent (GP) broiler strains. Similarly, in Bangladesh, there is a shortage of accessible data on the poultry business, particularly on GP farms, where just a few studies have been undertaken. Breeders can find the most productive and efficient GP broiler strains by comparing hatchability and egg weight. Higher hatchability rates and egg weight usually mean healthier, bigger chicks. This information optimizes breeding strategies, boosts flock output, and boosts poultry enterprise profitability. Understanding these parameters may also help manage poultry production and assure its sustainability. We coined a research question such as how do different broiler genotypes—Ross-308, IR, and Cobb-500—compare in terms of egg weight, fertility, hatchability, embryonic mortality, and DOC quality at various age intervals? While we hypothesized that the Cobb-500 genotype would produce heavier eggs and DOCs compared to Ross-308 and IR, owing to its genetic predisposition for larger body mass. It also hypothesized that Ross-308 would outperform in fertility and hatchability, making it a more productive strain in terms of reproductive efficiency. On the other hand, the IR strain was expected to show higher embryonic mortality and chick culling rates due to its relatively lower adaptability, leading to reduced performance compared to Cobb-500 and Ross-308. So, this research was done to determine the performance of several broiler Grandparent Stock breeds at GP farms of C.P. Bangladesh Co., Ltd. The primary purpose of this research was to examine the fertility, hatchability, embryonic mortality, and chick survival rates of the Cobb-500, IR, and Ross308 broiler strains. This research will help the poultry industry by identifying the most suitable broiler genotype for improved productivity, reducing embryonic and chick mortality, and enhancing economic returns through better breeding and management practices.

2. Materials and Methods

2.1. Ethical approval

Ethical approval was not required to conduct the study.

2.2. Experimental design

A data collection related experiment was carried out at Grand Parent Hatchery and Grandparent Stock Farm, C.P. Bangladesh Co., Ltd., Dinajpur, Bangladesh. The experiment was conducted during February 2021 to July 2022 (Figure 1).

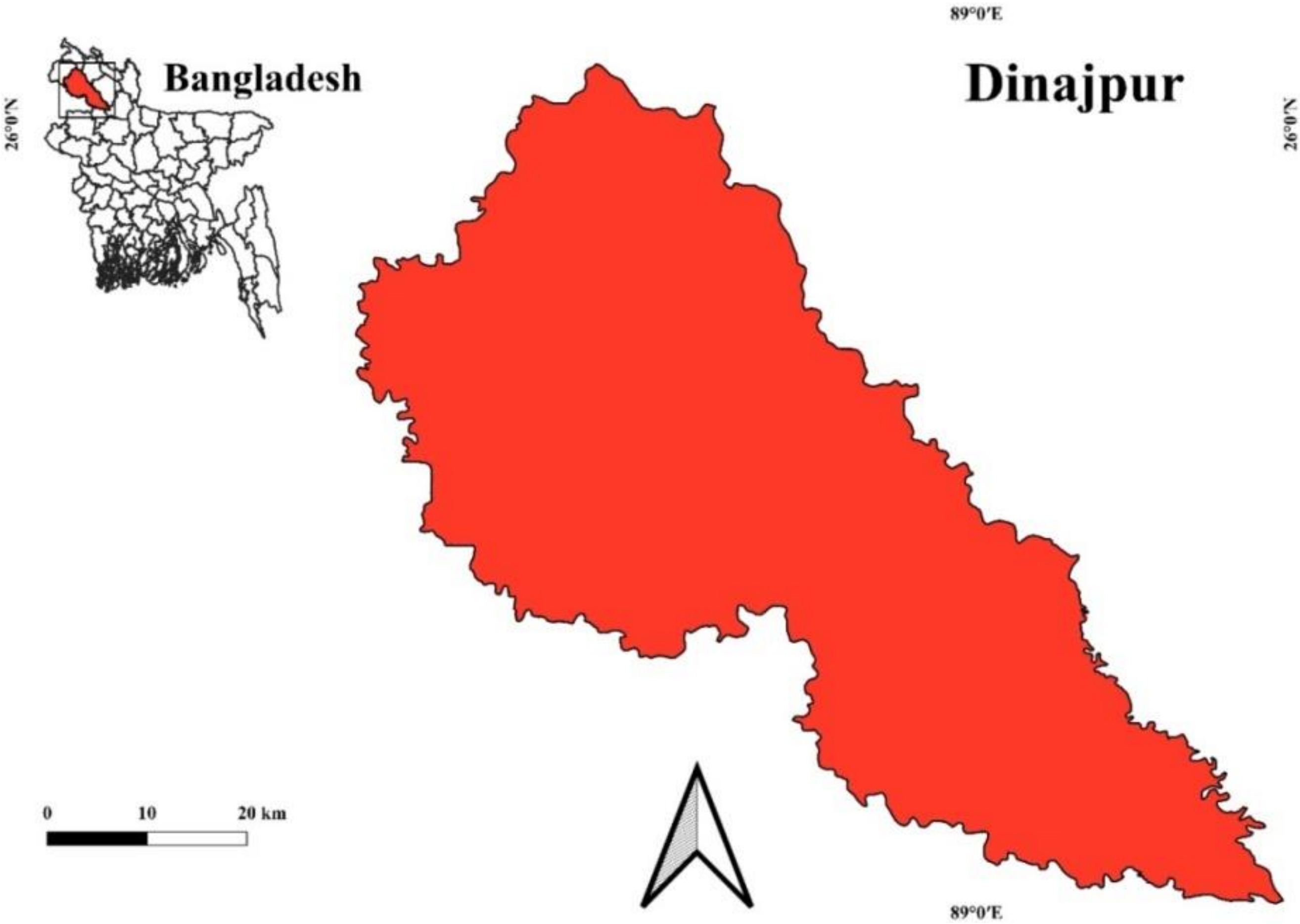

Figure 1. The study was conducted at Grand Parent Hatchery and Grandparent Stock Farm, C.P. Bangladesh Co., Ltd., Dinajpur, Bangladesh.

The original sources of three GP stocks were: Cobb-500: USA; Ross-308: UK; Indian River (IR): France. To conduct this study eggs from three strains were collected at three different stages of their life: 25 to 35 weeks (treatment 1; T_1), 36 to 45 weeks (treatment 2; T_2) and 46 to 55 weeks (treatment 3; T_3). In each strain at 24 weeks of their age the hens start egg production. Eggs were collected from Cobb-500, Ross-308 and Indian River (IR) strains. A total of 2,700 hatching eggs were collected from three strains and were set in the same incubator in 27 batches, each batch/replicate had 100 eggs for 3 replicate and each treatment had 900 eggs which means 300 eggs from each strain (Table 1). James's way (machine: platinum controller V3.85 and display: platinum display V4.12) incubator was used for hatching the chicks. The age of the birds was 26 to 60 weeks. For light, temperature, humidity, water, feeding, vaccination, biosecurity; C.P. Bangladesh Co., Ltd followed the standard guideline issued by The Department of Livestock Services (DLS) of Bangladesh and The Parent Stock individual guidelines to rare the broiler breeders. All the work was done inside the C.P. industry by their manpower, author just collect the data after every step.

Table 1. Layout of the experimental birds.

Treatment	Strain	Number of replication			Total
		R1	R2	R3	
T_1	Ross-308	100	100	100	3 batches
	IR	100	100	100	3 batches
	Cobb-500	100	100	100	3 batches
T_2	Ross-308	100	100	100	3 batches
	IR	100	100	100	3 batches
	Cobb-500	100	100	100	3 batches
T_3	Ross-308	100	100	100	3 batches
	IR	100	100	100	3 batches
	Cobb-500	100	100	100	3 batches
Total		900	900	900	27 batches

2.3. Bird Management

2.3.1. The housing condition of the experimental broiler breeders

The broiler breeders were housed in a climate-controlled facility featuring a slat and floor system, allowing for 1.5 to 2.0 square feet of floor space for each bird.

2.3.2. Feed management

Broiler GP chicks were fed ad libitum from day to 2 weeks. Restrictive feeding began at 4 weeks per breeder's instructions. From 4 to 60 weeks, feed was given in the morning. At 18 weeks, the male was put with the female and fed separately with a top grill in the female and a male feeder above it. Male breeders received 150g CP and 11.3 MJ ME per kg. The female ate 180 g CP and 11.3 MJ ME per kg breeder hen diet. Broiler breeders received parental meals from C.P. Bangladesh Co., Ltd., Birganj, Rangpur feed mill. Target body weight determined starter, grower, pre-breeder, breeder-1, breeder-2, and breeder male diet feeding times. Feeding guidelines for broiler GP include age limits for each diet type: starter (day old to 5 weeks), grower (6-18 weeks), pre-breeder (19-23 weeks), breeder-1 (24-45 weeks), breeder-2 (46 weeks+), and breeder male (18 weeks+).

2.3.3. Litter management

Rice husk was utilized as the litter material, with a depth of 2.5–3 cm during summer and 3–4 cm in winter. Damp litter and droppings were regularly removed and discarded as needed. Additional litter was added to maintain the required depth, and the litter was stirred 3–4 times daily to ensure proper management (Baishnab *et al*., 2023).

2.3.4. Water management

Broiler breeders received free water to meet their needs. Experimental broiler breeders utilized nipple drinkers. All broiler breeders received clean, cold, fresh water, and the flow rate was varied with age, starting at 30 cc per minute.

2.3.5. Light management

Broiler breeders received 24 hours of light till 7 days old. Lighting hours lowered daily from 8 days to 8 hours at 4 weeks and 20 weeks. Starting at 25 weeks, light hours were steadily increased 16 hours till experiment ended. The male-female ratio was 1:8-10 for natural mating. Cold room temperature was 18-20 °C and RH% 75-80%. Each KPI tray holds 42 eggs and was kept wide end up.

2.4. Data collection and record keeping

The recorded data from the experimental period were used to perform various calculations, including egg weight (g), DOC weight (g), fertility percentage (%), hatchability percentage (%), embryonic mortality percentage (%), dead-in-shell percentage (%), and brooding mortality percentage (%).

Fertility was expressed as the “percentage of total egg set” by using the formula,

$$\text{Fertility (\%)} = \frac{\text{No. of fertile eggs}}{\text{No.of eggs set in incubation}} \times 100$$

According to the total number of eggs intended for incubation, poultry men use the word "hatchability". By looking at how many eggs really hatched out, hatchability was determined. Hatchability of the chicks has been calculated using the formula,

$$\text{Hatchability} = \frac{\text{No.of hatched out chicks}}{\text{No.of total eggs}} \times 100$$

The percentage of early embryonic mortality was determined by counting the number of embryos that did not survive.

$$\text{Early Embryonic mortality (\%)} = \frac{\text{No. of quitters}}{\text{No.of fertile eggs in incubation}} \times 100$$

Brooding mortality was calculated using the following formula,

$$\text{Brooding mortality (\%)} = \frac{\text{No.of dead chicks during 3 weeks of brooding}}{\text{No.of chicks at onset of brooding}} \times 100$$

2.5. Statistical analysis

The collected data were processed and organized using Excel 2016, followed by analysis of quantitative variables with the Statistical Package for the Social Sciences (SPSS) version 25. This analysis involved calculating the mean and standard error (SE) for each genotype, while one-way ANOVA was conducted to assess the significance levels of various traits among the genotypes. Duncan's Multiple Range Test (DMRT) was applied to identify significant differences between the means.

3. Results

3.1. Egg weight and day-old chick (DOC) weight among three genotypes

Ross-308, IR, and Cobb-500 had mean egg weights of 56.61, 57.65, and 58.86 g at 35 weeks (T_1), whereas DOC weights were 38.38, 39.08, and 39.63 g. At 45 weeks (T_2), the mean egg weight of the three breeds grew to 61.52, 62.67, and 64.32 g, with Cobb-500 DOC at 43.59 g and Ross-308 weighing 41.86 g. Significant (P<0.001) differences were seen across strains at 45 weeks of age. Results indicate substantial (P<0.001) variations in egg weight across strains after 45 weeks (T_3) age, with Cobb-500 eggs weighing 67.52 g and Ross-308 eggs weighing 64.22 g. The results indicate substantial (P<0.001) differences in DOC weight across strains. Ross-308, IR, and Cobb-500 had mean DOC weights of 43.80, 44.38, and 46.08 g (Table 2).

Table 2. Egg weight and day-old chick (DOC) weight among three genotypes.

Broiler Strain	Egg weight (g)			DOC weight (g)		
	T_1	T_2	T_3	T_1	T_2	T_3
Ross 308	56.61 ± 0.31^a	61.52 ± 0.20^a	64.22 ± 0.22^a	38.38 ± 0.23^a	41.86 ± 0.16^a	43.80 ± 0.14^a
IR	57.65 ± 0.18^b	62.67 ± 0.25^b	65.05 ± 0.22^b	39.08 ± 0.14^b	42.55 ± 0.20^b	44.38 ± 0.18^b
Cobb-500	58.86 ± 0.27^c	64.32 ± 0.23^c	67.52 ± 0.31^c	39.63 ± 0.22^c	43.59 ± 0.16^c	46.08 ± 0.26^c
Significance	***	***	***	***	***	***

Values= Mean±SE; SE = Standard Error, a, b, c means with different superscripts in the row differ significantly, *** = significant at 1% level of probability (P<0.001), NS = Non-significant. T_1 =25 to 35 weeks; T_2 =36 to 45 weeks; T_3 =46 to 55 weeks.

3.2. Fertility and hatchability

Fertility (%) for Ross-308, IR, and Cobb-500 genotypes was 96.00, 87.00, and 93.00 at 35 weeks (T_1) and 91.00, 83.00, and 89.00 at 45 weeks (T_2). After 45 weeks (T_3), Ross-308, IR, and Cobb-500 genotypes showed falling trends of 64.22, 65.05, and 67.52. The hatchability (%) of Ross-308, IR, and Cobb-500 eggs at 35 weeks was 85.00, 75.00, and 80.00, respectively; by 45 weeks, all genotypes had higher hatchability (89.00, 79.00, and 86.00). Ross-308 had the highest hatchability (82.00%) after 45 weeks, whereas IR strain had the lowest (67.00%). Statistical (P<0.001) variations in hatchability were seen across strains after 45 weeks of age (Table 3).

Table 3. Fertility and Hatchability of different broiler parent stock.

Broiler strain	Egg weight (g)			DOC weight (g)		
	T_1	T_2	T_3	T_1	T_2	T_3
Ross 308	96.00±0.02	91.00±0.03	64.22±0.22[a]	85.00±0.04	89.00±0.03	82.00±0.04[a]
IR	87.00±0.03	83.00±0.04	65.05±0.22[b]	75.00±0.04	79.00±0.04	67.00±0.05[b]
Cobb-500	93.00±0.03	89.00±0.03	67.52±0.31[c]	80.00±0.04	86.00±0.04	75.00±0.04[c]
Significance	NS	NS	NS	NS	NS	*

Values= Mean±SE; SE = Standard Error, a, b, c means with different superscripts in the row differ significantly, * = significant at 5% level of probability (P<0.05), NS = Non-significant. T_1 =25 to 35 weeks; T_2 =36 to 45 weeks; T_3 =46 to 55 weeks.

3.3. Embryonic death and chick mortality during brooding

There was no significant difference in embryonic death and chick mortality rates during brooding (Table 4). IR had the greatest embryonic mortality (13%) at 35 weeks, followed by Cobb-500 (7%) and Ross-308 (4%), however by 45 weeks it was 9%, 17%, and 11% for Ross-308, IR, and Cobb-500 respectively. After 45 weeks, Ross-308 had the lowest embryonic mortality (15.00%) and IR the highest (25.00%). There was no significant difference in chick mortality rates during brooding at 35 weeks (T1). On T2 and T3, brooding mortality was highest in IR (6% and 7.57%), and lowest in Ross-308 genotype (2.30% and 2.53%).

Table 4. Embryonic and chick's mortality up to brooding among the genotypes.

Broiler strain	Egg weight (g)			DOC weight (g)		
	T_1	T_2	T_3	T_1	T_2	T_3
Ross 308	4.00±0.02	9.00±0.03	15.00±0.04	1.10±0.01	2.30±0.02	2.53±0.02
IR	13.00±0.03	17.00±0.04	25.00±0.04	2.32±0.02	6.00±0.02	7.57±0.03
Cobb-500	7.00±0.03	11.00±0.03	20.00±0.04	2.27±0.02	3.70±0.02	4.17±0.02
Significance	NS	NS	NS	NS	NS	NS

Values= Mean±SE; SE = Standard Error, a, b, c means with different superscripts in the row differ significantly, NS = Non-significant. T_1 =25 to 35 weeks; T_2 =36 to 45 weeks; T_3 =46 to 55 weeks.

3.4. Embryo dead in shell (DIS) and culling after grading

Ross-308 had the lowest culling rate (2.13%) and IR the greatest (3.41%) while for DIS, Ross-308 was lowest, and IR was the highest percentage at 35 weeks (Table 5). IR chicks had the greatest rates of DIS (4.00%) and culling (5.06%) at 45 weeks of age, compared to Ross-308 (4.00% and 5.06%) and Cobb-500 (3.45% and 3.57%). Ross-308 chicks had the lowest culling rate (3.66%) after hatch, the highest 7.04% in IR, and moderate for Cobb-500 (4%).

Table 5. Dead in Shell (DIS) and culling chicks among the three genotypes.

Broiler strain	Egg weight (g)			DOC weight (g)		
	T_1	T_2	T_3	T_1	T_2	T_3
Ross 308	2.08±0.02	2.19±0.02	3.00±0.02	2.13±0.02	2.25±0.02	3.66±0.02
IR	3.00±0.03	4.00±0.02	8.00±0.03	3.41±0.02	5.06±0.03	7.04±0.03
Cobb-500	2.15±0.02	3.45±0.02	5.00±0.02	2.22±0.02	3.57±0.02	4.00±0.02
Significance	NS	NS	NS	NS	NS	NS

Values= Mean±SE; SE = Standard Error, a, b, c means with different superscripts in the row differ significantly, NS = Non-significant. T_1 =25 to 35 weeks; T_2 =36 to 45 weeks; T_3 =46 to 55 weeks.

4. Discussion

The study shows, at every treatment Cobb-500 produced larger eggs rather than IR and Ross-308. An earlier study AbUCābOS (2010) found that, at 26 and 44 week of age the egg weight of the Cobb-500 strain was 58.2 and 75.8 g respectively, whereas in the Ross-308 strain at 32 and 36 week it was 57.4 and 66.4 g respectively. This is in alignment with the findings of the present study. Among these three strains, egg weight was increased with the age forward, the highest 15% weight of the egg was increased in Cobb-500 strain, whereas 12% for each IR and Rocc-308. This match with the earlier findings of Lourens *et al.* (2006) who found a strong relationship between breeder age and egg weight such as older hen produce larger eggs. According to (AbUCābOS, 2010), Cobb strains egg weight increased by 20% between the 26 to 44 weeks of age. Islam *et al.* (2007) reported that, body weight had no effect on egg weight. They noted that egg weight increased with the bird's age, which corroborates the findings of the present study.

The weight of DOC and their quality can be affected by various factors, including egg characteristics, the duration of pre-incubation storage, and the breeder's age (Hossen *et al*., 2022). Indrijani *et al.* (2024) found that egg weight plays a crucial role in determining chick weight at hatching. Additionally, research indicates that the impact of these factors may vary based on the breeder's age, storage time, and incubation duration, with older breeders producing heavier embryos and chicks due to the greater egg weights at the time of setting (Kowalska *et al*., 2021).

The study summarizes that both fertility and hatchability were decreasing with the increment of age that support the previous study of Campo *et al.* (2007). The decline in older hens' ability to store sperm in the uterovaginal sperm host gland (UV-SHG) or the reduced quality of follicles may contribute to lower fertility and hatchability rates, as these eggs may either fail to fertilize or not survive to hatching. Numerous factors, including egg quality, turning frequency, storage conditions, humidity, shell strength, egg size, and genetic traits of the chickens, also play a role in determining fertility and hatchability. Egg quality, which has a genetic component, varies among different strains of hens, and encompasses various characteristics such as egg weight, length, breadth, shell weight, and thickness (Tumova *et al*., 2007; Adedeji *et al*., 2015). Furthermore, interactions between age and breed can influence eggshell quality, with research indicating that exterior features, along with yolk and albumen composition, contribute to increased egg weight as hens age, reaching a peak by the end of the laying cycle (Campo *et al*., 2007).

Though a huge number of mortalities during the embryonic stage was found in all strains and the rate of embryonic mortality is different among the studied strains. Hristakieva *et al.* (2014) also reported that there are no statistically significant differences with regard to the embryonic death rate between Ross-308 and Cobb-500. Some factors like nutritional deficiencies in the broiler breeder diet, embryonic abnormalities, abnormal positioning, lethal genes, etc. affect embryonic development (Khan *et al*., 2021). Additionally, the genetic strain and age of the parent flock influence daily embryonic metabolism during both the early and late stages of incubation, which is associated with an increased rate of embryonic mortality during these periods (Hamidu *et al*., 2007).

Long storage times in farms or hatcheries can contribute to embryonic death. The handling of eggs during transportation, along with proper disinfection and incubation practices, is crucial (Jacobs *et al*., 2016). Hatching eggs should not be stored for extended periods, as this can lead to higher early embryo mortality rates (Bergoug *et al*., 2013). Incubation factors such as humidity, temperature, ventilation, and egg movement also significantly affect the quality of DOC (Ipek and Sozcu 2013; Nowaczewski *et al*., 2016). It is widely recognized that storing eggs for more than seven days adversely impacts hatchability, as prolonged storage can trigger cellular death, resulting in increased embryonic mortality (Fasenko, 2007).

In previous research, McClelland *et al.* (2021) found that eggs from younger breeders tend to have thicker shells, resulting in the production of smaller chicks that struggle to break through the shell during hatching, which can lead to embryo death after pipping and increased instances of dead in shell. Additionally, the reduced eggshell conductivity in young breeders hinders the adequate transport of water vapor and respiratory gases during incubation (Yassin *et al*., 2008). These observations are consistent with the findings of the current study.

The culling rate of chicks is significantly influenced by their quality, as vigorous and healthy DOC are crucial for a successful broiler flock (Yassin *et al*., 2008). Chicks that are sick, underweight, dehydrated, or stressed are unlikely to achieve their genetic potential. The quality of DOC is affected by several factors, including the strain and age of the breeders, the weight of the eggs, storage conditions and duration, and incubation parameters such as temperature, humidity, gas levels, and altitude. Additional factors, such as rearing season, shipping distance and route, stocking density, flock size, feeding management, drinking systems, ventilation, and floor insulation at the broiler farm, also play a role in mortality rates (Nowak *et al*., 2019). Ultimately, the quality of DOC chicks is primarily determined by genetic traits, the biological value of the eggs, and the management practices applied post-hatching (Othman *et al*., 2014; Hristakieva *et al*., 2014; Jacobs *et al*., 2016). Proper care of the parent flock, appropriate breeder age, adequate nutrition, and high welfare standards are essential for producing high-quality hatching eggs (King'ori 2011; Nowaczewski *et al*., 2016; Kejela *et al*., 2019). But importantly industries are approaching different strategies to increase the hatchability and decrease the environmental stress. In developed countries, embryonic thermal manipulation is another strategy to increase the hatchability, thermo-tolerance, muscle proliferation and liver metabolism of broiler embryos (Al Amaz *et al*., 2024 a, b). Additionally, farmers' economic status, knowledge level, disease control capacity, meat seller and consumer awareness, animal slaughter practice, insufficient vaccination coverage, and inadequate implementation of current legislation have all led to a future disease resurgence and livestock advancement (Hashem *et al*., 2017; Sarker *et al*., 2023).

5. Conclusions

The study reveals that broiler production performance is significantly influenced by their strains. The Cobb-500 strain chicken egg had higher weight, while the Ross-308 group had the highest fertility and hatchability. The IR genotype had higher embryonic mortality and lowest survivability during brooding, leading to higher culling rates. The Ross-308 strain was found to be the best performer, and further research on genotype level could help select a suitable genotype for 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.

Author’s contribution

Md. Rashed Hasnath, and Md. Tanbir Anjum Kakon designed the study. Md. Rashed Hasnath, Md. Shafi Islam, Amitush Dutta collected the data from the hatchery. Md. Tanbir Anjum Kakon, Md Ahosanul Haque Shahid, Samira Akter Pinky analyzed the data and prepared the draft manuscript. Md. Rashed Hasnath supervised the study programs, provided technical support, and finalized the manuscript. All authors have read and approved the final manuscript.

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