EFFECT OF PREINCUBATION STORAGE PERIOD AND FLOCK AGE ON HATCHABILITY OF EGGS OF COBB 500 BROILER STRAIN

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Introduction

Livestock is one of the most vibrant sectors in agriculture in Sri Lanka since animal products such as milk, meat, and egg have become a vital component in the Sri Lankan diet. The contribution made by this sector to the gross domestic production (GDP) of the country is almost 1% (Department of Animal Production and Health, Statistical Bulletin 2019). The poultry industry is the main sub-sector of the livestock sector which shows fastest growth. In the year 2019 poultry contributed 0.38% to the GDP of the country which is 64% of the total contribution of the livestock sector in Sri Lanka (Department of Animal Production and Health, Poultry Sector Analysis and Forecast 2020). The poultry industry consists mainly of layer sector which produces chicken eggs and broiler sector which produces broiler chicken meat.

Broiler meat is an easily available good source of high quality animal protein and other nutrients with low amount of fat. It is non-fattening and prevents hardening of arteries and is beneficial for human beings compared to red meat (Khan, 2012). Chicken meat contributes about 70% to the meat industry in Sri Lanka. Though there are different meat types in the market namely beef, mutton and pork available, chicken meat is the most popular meat type among Sri Lankan consumers (Silva *et al*., 2010). Changes in consumer preference, increased income and lower meat prices have increased the meat consumption compared to other agricultural commodities in countries having emerging economies in the world (Devine, 2003). In Sri Lanka also the demand for chicken meat is growing (Prabhakaran, 2003). Data revealed that the chicken meat production has increased by 4.6% in the year 2019 compared to 2018 and the per capita availability of chicken meat per year has increased from 9.7kg in 2018 to 10.2kg in 2019 (Department of Animal Production and Health, Statistical Bulletin 2019). The active participation of the private sector also induced the growth of chicken meat industry (Department of Census and Statistics, 2014a). To satisfy the ever increasing demand for high quality chicken meat, the poultry breeders were able to breed and select fast growing broiler breeds which reach a body mass of 2.5kg within 6 weeks of intensive fattening. Cobb 500, Hubbard Classic, Ross 308 and Indian River are the common broiler strains found in Sri Lanka (Department of Animal Production and Health, Poultry Sector Analysis and Forecast 2020).

Though there is a big potential for the expansion of broiler meat production in Sri Lanka, the entire industry depends on continuity of supply of day old broiler chicks from the breeder farms. Therefore, the aim of modern breeder farms is to produce more and more fertile eggs per pullet and increase the hatchability. However numerous factors have an effect on the success of hatchability of chicken eggs. The influence of some of these factors is important long before the incubation commences. Breed or strain, flock age, breeder flock health, nutrition, breeder flock management and microenvironment surrounding the eggs before incubation are the some of the factors which result in significant variations on hatchability. Further selection of eggs for incubation, handling and pre-incubation egg storage have an effect on viability of the embryo. During incubation temperature, humidity, ventilation, turning of eggs in the incubators and proper hatchery management are the critical factors which determine maximum hatchability.

In the Sri Lankan scenario pre-incubation egg storage is one of the critical factors which affect hatchability since breeder farmers are compelled to store eggs for a certain period during the period where demand for day old chicks is low especially during non-festive

season or the off season from May to November. December to April is considered as the festive season. The other critical factor is flock age because maintaining unproductive hens in a breeder stock is a waste of resources. Therefore, the present study was carried out with the objectives of determining the suitable storage period for eggs and to reveal the most productive flock age of a breeder stock which maximizes the hatchability.

Methodology

The experiment was carried out with broiler strain Cobb 500 in the hatchery of New Anthony's Farms (Pvt) Ltd at Lunugama. In this study the effect of six storage periods (0, 3, 6, 9, 12 and 15 days) and four group of flock age (25, 32, 49 and 60 weeks) on hatchability of eggs were evaluated. A total of three thousand and six hundred (3600) carefully selected fertile eggs (a batch of 900 eggs from each age group) of Cobb 500 broiler strain were used for the experiment. A batch of 900 eggs which represent an age group were arranged into the six different storage periods of 150 eggs per storage period of 0, 3, 6, 9, 12, and 15 days. Similar arrangement was made for rest of the three batches of eggs. The eggs under 0 day storage were set for the incubation on the same day of collection of eggs and rest of the five groups were stored for 3, 6, 9, 12, and 15 days under 18˚C temperature and 75% relative humidity throughout the storage period. At the end of indicated storage period the relevant batch of eggs was set for the incubation. A temperature of 37.8˚C and 80% - 85% relative humidity were maintained in the incubator while turning eggs by 90º hourly. At the 18th day of incubation all eggs were candled and only the fertile eggs with developing embryo were transferred to the hatcher. A completely randomized design with the 4 x 6 factorial arrangement was adopted for the experiment i.e., flock age 25, 32, 49 and 60 weeks and storage periods 0, 3, 6, 9, 12, and 15 days. On the 21st day of incubation all unhatched eggs and hatched chicks under each treatment were counted separately and recorded. Finally, the hatchability was calculated by using the equation,

$$Hatchibility\ \% = \frac{Number\ of\ saleable\ chicks\ hatched\ per\ treatment}{\text{Number of fertile eggs set per treatment}}\ X\ 100$$

All effects and interactions were tested for significance ($P < 0.05$) by using Microsoft Excel and GLM procedure of Minitab 17 version software. The Duncan multiple range test was performed to separate the mean differences between treatments. All data were subjected to a general linear model for completely randomized design with factorial arrangement based on two factors flock age and storage period.

Results and discussion

The present experiment was designed to evaluate the effect of flock age and storage period of eggs on hatchability of Cobb500 broiler strain. The statistical analysis of data shows that the F value computed for interaction effect (Breeder flock age x Storage period) was 0.74 and the p-value associated with the F value was 0.728 which was greater than 0.05. Therefore, there is no interaction effect of two treatments of breeder flock age and storage duration. Since there is no interaction effect, the main effects of the two treatments were studied. The F value computed for the main effect of breeder flock age was 4.97 and the P-value associated with the F value was 0.004 which is less than 0.05. Therefore, the effect of breeder flock age on hatchability is significant (Table 1).

Table 1 Effect of breeder flock age on hatchability (%)

Breeder flock age (weeks)	**Hatchability (%)**
25	82.56[b]
32	90.78[a]
49	80.00[b]
60	81.89[b]

[a, b] Means along the column with different superscripts are significantly ($P < 0.05$) different

The highest hatchability was recorded by the 32 weeks old breeders (90.78%) while the lowest hatchability percentage was recorded by the 49 week old breeders (80.0%).

The results of the present study agreed with the findings of Rosa *et al.*, (2002) where 62 weeks old breeders and 34 weeks old breeders had 82.80% and 86.60% of hatchability respectively. Deterioration of quality of egg shell with the increased age of breeders cause higher embryo mortality (Vieira and Moran, 1998) which is a reason for poor hatchability.

The current study revealed that there was no significant ($P > 0.05$) effect of storage period on hatchability (Table 2). However, the highest hatchability of 25 weeks old flock has been achieved in 3 days storage (87.34%) where the lowest has been recorded in 15 days storage (73.3%). In 32 weeks old flock, highest hatchability (93.3%) was showed in 9 -12 days storage while 3 days storage resulted in the lowest hatchability (73.6%). Further breeder eggs of 49 weeks old flock recorded their highest hatchability when eggs have been stored for 15 days (86.0%) and the lowest hatching was observed in 6 days (80.6%) storage. The oldest breeders (60 weeks) achieved their higher hatchability in 6 days (92.0%) storage while they tended to lose their hatchability when eggs incubated on the same day they were laid (78%).

Table 2 Effect of storage period of eggs on hatchability (%) of different flock age groups.

Storage period (days)	Flock age (weeks)			
	25	32	49	60
0	87.25[a]	75.34[a]	84[a]	78[a]
3	87.34[a]	73.65[a]	81.21[a]	87.25[a]
6	83.34[a]	90[a]	80.67[a]	92[a]
9	81.34[a]	93.34[a]	84[a]	88[a]
12	81.34[a]	93.34[a]	85.34[a]	86[a]
15	73.33[a]	89.34[a]	86[a]	82[a]

[a,] Means along the column with similar superscripts are not significantly ($P < 0.05$) different

Present results suggest that, under the conditions of this investigation, eggs stored for 3 to 6 days had a tendency of increased hatchability.

Conclusion

There is no interaction effect of breeder flock age and storage period on hatchability % of Cobb 500 broiler strain. Hatchability is significantly impacted by breeder flock age and the hatchability of fertile eggs declined as breeder hen age increased. No significant effect was noted of storage period up to fifteen weeks from laying eggs on hatchability.

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