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EFFECT OF PRE-INCUBATION STORAGE ON HATCHABILITY AND EMBRYONIC MORTALITY IN KUTTANAD DUCK EGGS

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ABSTRACT

This study was aimed to standardise the pre-incubation storage period of hatching eggs of Kuttanad ducks for getting better hatchability. The hatching eggs were collected from breeding flocks of Kuttanad ducks for seven consecutive days and the eggs collected on each day were stored at a temperature of 17 to 18°C with 75 per cent relative humidity (RH). The eggs which were subjected to 1-7 days storage period formed the treatments and were incubated at 37.5°C with the RH of 60 per cent in the setter for first 24 days and at 36.9°C with the RH of 68 per cent for the remaining 4 days in the hatcher. The process was repeated for four consecutive weeks. The breakout study was carried out in the discarded eggs at 9th, 24th and 28th days of incubation to assess the stage of embryonic death. The percentage of fertility, hatchability on total egg set (TES), hatchability on fertile egg set (FES) and also percentage of early embryonic mortality (EEM), mid-embryonic mortality (MEM), late embryonic mortality (LEM), pipped eggs with live chick (PL) and weaklings (W) on fertile egg set were calculated and analysed. This study revealed no significant difference in fertility among treatments. The hatchability on FES were significantly ($p<0.05$) higher in egg stored for 1-2 days followed by 3-4, 5 and 6 days stored eggs and the same was lowest in 7 days stored eggs due to the significantly ($p<0.05$) higher early embryonic death. This could be due to loss of carbon dioxide (CO_2) and water from the egg, increase in pH of egg albumen, liquefaction of albumen and deterioration of yolk due to prolonged storage.

Keywords: Kuttand duck eggs, pre-incubation storage, hatchability, embryonic mortality

INTRODUCTION

The hatchability of duck egg is affected by several factors like fertility, frequency of collection, cleanliness of the eggs, cleaning of eggs, egg quality, pre-incubation storage conditions and incubation conditions apart from the breeder flock management, age of the breeder flock, disease condition of breeder flock and genetic variations. The chicken eggs are stored for about 7 days at 17-18°C with the RH of 75 per cent, without any significant reduction in hatchability to make the hatchery operation easy. Studies on effect of pre-incubation storage period of duck eggs on hatchability are scanty. Therefore, this study was aimed at standardizing the pre-incubation storage period for getting better hatchability in Kuttanad duck eggs.

MATERIALS AND METHODS

The breeding flocks of Kuttanad ducks were reared under semi-intensive system with a sex ratio of 1: 8 at University Poultry and Duck Farm (UPDF), Kerala Veterinary and Animal Sciences University, Mannuthy. The hatching eggs were collected from 56 to 67 weeks aged flocks for seven consecutive days which forms the treatments of this study and the sound eggs were fumigated at 1X concentration and stored at the temperature of 17 to 18°C with the RH of 75 per cent. The egg collection and storage was done for four consecutive weeks with total number of 1096, 1176, 1021 and 1065 eggs, respectively and each weeks collection was treated as a replicate.

After seven days of collection and storage, the eggs were taken out and kept at room temperature overnight for pre-incubation warming and incubated at 37.5°C with the RH of 60 per cent in the setter for first 24 days and at 36.9°C with the RH of 68 per cent in the hatcher for the remaining 4 days. The eggs were sprinkled with lukewarm water containing commercially available glutaraldehyde solution at 0.1 per cent level twice a week from second week of incubation till hatch out. After 9^{th} and 24^{th} day candling and immediately after hatchout, the discarded and unhatched eggs were subjected to breakout study to find the number of infertile eggs, early embryonic mortality (EEM), mid-embryonic mortality (MEM), late embryonic mortality (LEM), pipped eggs with live chicks (PL) and weaklings (W) and their percentage was calculated. The data were analysed by one-way ANOVA using SPSS version 21.

RESULTS AND DISCUSSION

The results of the study presented in the Table. 1, reveals that pre-incubation storage of Kuttanad duck eggs did not affect the fertility percentage among the

treatments. Similar findings were made by Onbasilar *et al*. (2007) and Sözcü and Ipek (2018) in duck eggs.

The hatchability percentage on FES was significantly ($p<0.05$) higher in the eggs stored for 1-2 days, followed by 3-4, 5 and 6 days stored eggs and the value was lowest in 7 days stored eggs. There was linear reduction in both hatchability on TES and FES as the days of storage advanced. This reduction in hatchability was due to significantly ($p<0.05$) higher percentage of EEM without affecting the MEM, LEM, PL and W (Table 1 and Figure 1). The reduction in hatchability due

Table 1. Effect of pre-incubation storage on incubation parameters of Kuttanad duck eggs

Pre-incubation storage period in days	n	Fertility (%)	EEM (%)	MEM (%)	LEM (%)	Pipped live %	Weakling (%)	Hatchability on TES (%)	Hatchability on FES (%)
1	4	95.58 ±0.82	6.05^{d} ±0.60	1.35 ±0.54	5.70 ±0.66	0.37^{ab} ±0.36	0.83 ±0.33	81.29^{a} ±1.90	85.02^{a} ±1.35
2	4	95.95 ±0.62	5.44^{d} ±0.52	1.37 ±0.50	7.28 ±0.80	0.51^{ab} ±0.33	1.00 ±0.58	80.36^{ab} ±1.84	83.73^{a} ±1.54
3	4	93.88 ±0.72	13.20^{bc} ±2.62	0.45 ±0.15	6.43 ±0.49	0.00^{b} ±0.00	0.16 ±0.16	73.63^{abc} ±2.47	78.49^{ab} ±3.15
4	4	94.27 ±0.40	11.73^{cd} ±0.81	1.28 ±0.26	8.54 ±2.09	0.63^{ab} ±0.27	0.49 ±0.33	71.60^{bcd} ±1.97	75.96^{ab} ±2.15
5	4	94.04 ±0.93	17.98^{abc} ±1.49	1.63 ±0.80	5.94 ±1.21	0.87^{ab} ±0.56	1.55 ±0.67	66.07^{cd} ±3.92	70.22^{bc} ±3.91
6	4	94.51 ±1.24	19.31^{ab} ±4.32	0.99 ±0.44	8.60 ±0.88	1.06^{ab} ±0.62	1.45 ±0.53	63.11^{de} ±4.84	66.68^{cd} ±4.54
7	4	94.79 ±0.30	22.66^{a} ±1.98	2.50 ±1.11	8.96 ±1.34	2.07^{a} ±1.21	1.99 ±1.37	56.60^{e} ±2.49	59.73^{d} ±2.70
p value		0.442	0.0001	0.440	0.286	0.328	0.516	0.0001	0.0001

Means bearing different superscripts differ significantly ($p<0.05$) within a column

to prolonged pre-incubation storage might be due to increase in albumen pH from the normal 7.6 due to loss of moisture and carbon dioxide from the egg, which could have led to thinning of egg white due to the change of ovalbumin into S-ovalbumin and also dissociation of ovomucin-lysozyme complex with the destruction of ovomucin gel and subsequent liquefaction (Seibel *et al*., 2005). The deterioration of chalazae and flattening of yolk due to diffusion of water from albumen to yolk might also have led to embryo touching the egg shell membrane and death during pre-incubation at early incubation period (Hester, 2017). The other reasons for early embryonic mortality could be attributed to less water content in the egg to be exchanged for oxygen during incubation and deterioration of vitelline membrane which might have affected the respiration through vitelline membrane that occurs up to five days of embryonic life (Onagbesan *et al*., 2007; Rocha *et al*., 2013). There was no relationship between pre-incubation storage time and mid and late embryonic mortality.

Similar to this finding, Saha *et al.* (1992) reported lower hatchability percentage in Khaki Campbell duck eggs stored for 7 days compared to 3 days stored eggs due to increased embryonic mortality. Onbasilar *et al*. (2007) found significantly ((p<0.001) higher hatchability in eggs stored for 0 and 3 days against 11 days stored eggs. The reduction in hatchability in 11 days stored egg was due to higher early embryonic mortality without affecting the fertility, mid and late embryonic mortality. Contrary to this finding Sözcü and Ipek (2018) did not find any significant difference in hatchability percentage on TES and FES of Pekin duck eggs till 10 days of pre-incubation storage at 17°C with 75 per cent RH.

Increasing the pre-incubation storage without affecting the hatchability is possible by reducing the storage temperature to 13°C with the RH of 75 per cent for duck eggs (Dean and Sandhu, 2014) or 12°C with the RH of 80-85 per cent for storing the duck eggs for 14 days (Waehner *et al*., 2015). For eggs from aged flock, increase in RH above 75 per cent is beneficial to get better hatchability in prolonged pre-incubation storage (Brake *et al*., 1997).

CONCLUSION

The present study concludes that Kuttanad duck eggs can be stored up to 4 days at 17-18°C with 70-75 per cent RH without significant reduction in hatchability percentage. The reduction in hatchability in eggs of prolonged storage was due to increase in early embryonic mortality caused by loss of moisture and

carbon dioxide from eggs which resulted in liquefaction of egg white and deterioration of chalazae and vitelline membrane.

REFERENCES

Brake, J., Walsh, T.J., Benton Jr, C.E., Petitte, J.N., Meijerhof, R. and Penalva, G. 1997. Egg handling and storage. *Poult. Sci.* **76**(1): 144-151.

Dean, W.F. and Sandhu, T.S. 2014. *Hatching Duck Eggs*. Cornell University College of Veterinary Medicine, New York State Veterinary Diagnostic Laboratory, Animal Health Diagnostic Center, Ithaca, NY, United States. Available from: http://ahdc.vet.cornell.edu/sects/duck/hatching.cfm.

Hester, P.Y. 2017. Effects of temperature and storage conditions on eggs. In: *Egg innovations and strategies for improvements*, Academic Press, pp. 125-133.

Onagbesan, O., Bruggeman, V., De Smit, L., Debonne, M., Witters, A., Tona, K., Everaert, N. and Decuypere, E. 2007. Gas exchange during storage and incubation of avian eggs: effects on embryogenesis, hatchability, chick quality and post-hatch growth. *World's Poult. Sci. J.* **63**(4): 557-573.

Onbasilar, E.E., Poyraz, I. and Erdem, E. 2007. Effects of egg storage period on hatching egg quality, hatchability, chick quality and relative growth in Pekin ducks. *Archiv Fur Geflugelkunde*, **71**(4): 187-191.

Rocha, J.S.R., Baião, N.C., Barbosa, V.M., Pompeu, M.A., Fernandes, M.N.S., Lara, L.J.C., Matias, C.F.Q. and Batista, J.V.M.S.P., 2013. Negative effects of fertile egg storage on the egg and the embryo and suggested hatchery management to minimise such problems. *World's Poult. Sci. J.* **69**(1): 35-44.

Saha, S.K., Chowdhury, S.D. and Hamid, M.A. 1992. A study on the incubation of indigenous (Desi), Khaki Campbell crossbred (Indian Runner X Khaki Campbell, F1) duck eggs under two pre-incubation holding periods. *Am. J. Appl. Sci*. **5**: 541-544.

Seibel, N.F., Barbosa, L.N., Gonçalves, P.M. and Souza-Soares, L.A. 2005. Physical and chemical quality of eggs from quails fed with modified diets. *Rev. Inst. Adolfo Lutz,* **64**: 58-64.

Sözcü, A. and Ipek, A. 2018. Increasing of storage period alters embryo development and hatching characteristics of Pekin duck eggs. *Agric. Forest.* **64**(4): 65-70.

Waehner, M., Pingel, H. and Haidong, S. 2015. Effect of prolonged storage of eggs of Pekin ducks with periodical warming on internal egg quality and hatchability. In: *Proceedings of the 4th International Congress on New Perspectives and Challenges of Sustainable Livestock Production*, October 7-9, 2015, Belgrade, Serbia, pp. 140-144.