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EFFECTS OF HATCHING EGGS STORAGE AT ROOM TEMPERATURE ON HATCHING PERFORMANCE AND DAY OLD CHICK QUALITY OF ARAB CHICKENS

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ABSTRACT

This study evaluated the effect of hatching egg storage at room temperature on hatching performance and day old chick quality of Arab chickens. Two hundreds hatching eggs were obtained at the same day from 55-weeks-old Arab chicken flocks. Hatching eggs were then randomly distributed into four treatments, including 1 day storage (1DS), 4 days storage (4DS), 7 days storage (7DS), and 10 days storage (10DS). Each of those treatment using five replicates and each of replicate consisted of 10 hatching eggs. Temperature and relative humidity in the storage room were 27.9 ± 0.55 °C and 55.4 ± 4.84%, respectively. At the end of each storage duration, hatching eggs were incubated at temperature and relative humidity of 37.8 ± 0.08 °C and 58.94 ± 5.66%, respectively, for 516 hours. Result showed that egg storage duration for up to 10 days did not affect ($P > 0.05$) fertility. However, 4DS treatment had a higher ($P < 0.05$) hatchability of set eggs and hatchability of fertile eggs. Embryonic mortality was also lower ($P < 0.05$) in 4DS than the other treatments. Egg storage duration had no effect ($P > 0.05$) on chick length, hatch yield, and Pasgar score. Whereas, chick weight in 1DS and D4S was higher ($P < 0.05$) than 7DS and 10DS. Furthermore, saleable chicks in 4DS also higher ($P < 0.05$) than the other treatments. It could be concluded that hatching egg storage at room temperature for 4 days provides optimum hatching performance and day old chick quality of Arab chickens.

Keywords: Arab chickens; hatchability; day old chick; storage duration.

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INTRODUCTION

Arab chickens play a pivotal role in addressing the increasing demand for eggs in Indonesia (DGLAH, 2023). This unique breed is the result of a crossbreeding between Braekel chickens and Indonesian chickens, initiated around 1995 (Indarsih and Tamzil 2022; Sartika et al., 2023). Arab chickens possess valuable traits such as remarkable adaptability to tropical climates, high egg production, and egg characteristics equal to those of local chickens (Andri et al., 2016; Iswati et al., 2021; Syafwan et al., 2023).

Despite these merits, the contribution of Arab chickens to meeting the national egg demand remains low. This may be attributed to suboptimal hatching performance and chick quality. Hatching egg storage stand as a critical determinant influencing hatching performance and chick quality. This practice is unavoidable, as it is necessary to strike a balance between the supply and demand for day-old chicks.

Nonetheless, the extended storage of eggs frequently gives rise to adverse outcomes, negatively affecting not only egg quality (Edi et al., 2018; Nowaczewski et al., 2022) but also hatching performance and chick quality (Bilalissi et al., 2022; Okasha et al., 2023; Yulianti et al., 2023). Therefore, it is essential to carefully consider the duration of egg storage to mitigate potential drawbacks and optimize the overall success of the hatching process. While the practice of hatching egg storage is extensively studied in broilers and layers, research on its effects specifically in Arab chickens is currently limited.

Thus, this study aimed to fill this gap by evaluating the impact of hatching egg storage on hatching performance and day old chick quality of Arab chickens. Understanding these dynamics will contribute valuable insights to enhance the overall productivity and contribution of Arab chickens to the national egg supply in Indonesia.

MATERIALS AND METHODS

Experimental Design

Two hundred hatching eggs were obtained at the same day from 55-weeks-old Arab chicken flocks. The average egg weight was 42.72 ± 4.18 g with a coefficient of variation of 9.79%. Hatching eggs were then randomly distributed into four treatments, including 1 day storage (1DS), 4 days storage (4DS), 7 days storage (7DS), and 10 days storage (10DS). Each of those treatment using five replicates and each of replicate consisted of 10 hatching eggs.

Egg Storage

At initial storage period, hatching eggs were disinfected using 70% alcohol solution. Egg were stored with large end up position and placed on the hatching egg tray. Temperature and relative humidity in storage room were 27.9 ± 0.55 °C and 55.4 ± 4.84%, respectively. At the end of storage, hatching eggs were re-disinfected using 70% alcohol solution.

Incubation

Hatching eggs were incubated at temperature and relative humidity of 37.8 ± 0.08 °C and 58.94 ± 5.66%, respectively. Regular turning was performed every hour at a 45° angle from 1-18 days. Candling was performed at 7 and 18 days to evaluate the embryonic development. At 18 days, eggs with viable embryos were collected from each replicate and moved to a separate hatching basket. Incubation stage was lasted for 516 hours.

Hatching Performance

Hatching performance traits including fertility, hatchability of set eggs, hatchability of fertile eggs, and embryonic mortality were evaluated according to Yulianti et al. (2023). Fertility was assessed based on the presence of embryonic development on the 7th days of incubation. Fertility was calculated by a formula = (number of fertile eggs/number of set eggs) x 100%. At the end of incubation, hatched chicks were counted, and unhatched eggs were opened and checked for embryonic mortality.

Hatchability of set eggs was calculated by a formula = (number of hatched chicks/number of set eggs) x 100%. Hatchability of fertile eggs was calculated by a formula = (number of hatched chicks/number of fertile eggs) x 100%. Embryonic mortality was calculated by a formula = (number of dead embryo/number of fertile eggs) x 100%.

Day Old Chick Quality

Day old chick quality traits including chick length, chick weight, hatch yield, Pasgar score, and saleable chicks were assessed according to Yulianti et al. (2023). Chick length was determined as the length from the tip of the beak to the toe. Chick weight was measured using a digital balance. Hatch yield was calculated by a formula = (average chick weight/average initial egg weight) x 100%. Pasgar score was evaluated based on the five criteria of abnormality: (1) low alertness; (2) suboptimal navel condition; (3) red hocks (red or swollen hocks); (4) abnormal beak; and (5) large size of the residual yolk sac (Boerjan 2006). For each of the 5 criteria, 1 point was subtracted from 10, with chicks scoring 10 being free of any abnormality and 5 being the lowest score. The criteria set for saleable chicks were free from any deformities and have clean and dry feathers. Saleable chicks were then calculated by a formula = (number of saleable chicks/number of set eggs) x 100%.

Data Analysis

Statistical analysis was done using a one-way analysis of variance. Significance value was declared at $P < 0.05$. Duncan test was used as a post-hoc test. Data of each parameters were presented as a mean followed by a standard deviation. Data analysis was performed using IBM SPSS version 25.

RESULTS AND DISCUSSION

Hatching Performance

Hatching performance of Arab chickens with different egg storage duration is showed in Table 1. Hatching egg storage of Arab chickens for up to 10 days did not affect ($P > 0.05$) fertility. However, 4DS treatment had a higher ($P < 0.05$) hatchability of set eggs and hatchability of fertile eggs. Embryonic mortality was also lower ($P < 0.05$) in 4DS than the other treatments.

Table 1. Hatching performance of Arab chickens with different egg storage duration

Parameters	1DS	4DS	7DS	10DS
Fertility (%)	90.00 ± 7.07	92.00 ± 8.37	92.00 ± 4.47	90.00 ± 7.07
Hatchability of set eggs (%)	74.00 ± 5.48[a]	86.00 ± 5.48[b]	74.00 ± 8.94[a]	72.00 ± 4.47[a]
Hatchability of fertile eggs (%)	82.39 ± 5.40[a]	93.78 ± 5.70[b]	80.45 ± 9.22[a]	80.17 ± 4.21[a]
Embryonic mortality (%)	17.61 ± 5.40[b]	6.22 ± 5.70[a]	17.33 ± 5.75[b]	19.83 ± 4.21[b]

[a,b] Uncommon superscript within the same parameter indicate a significant different ($P < 0.05$)
1DS: 1 day storage, 4DS: 4 days storage, 7DS: 7 days storage, 10DS: 10 days storage

This study establishes that the optimum hatchability in Arab chickens is achieved through a storage period of 4 days at room temperature. Notably, it is conceivable that during the initial day of storage, the albumen retains a dense consistency. This characteristic may impede the essential process of gas diffusion and constrain nutrient availability, thereby contributing to suboptimal hatchability (Nasri et al., 2020a). Conversely, the subsequent four days of storage witness a transformation in the albumen, transitioning from a thick to a liquefied state (Abioja et al., 2021; Nasri et al., 2020b).

The liquefaction of the albumen is anticipated to remove barriers to oxygen diffusion, fostering an environment conducive to embryonic development and ultimately improving hatchability (Nasri et al., 2020a). On the other hand, a decline in hatchability is observed beyond the 4 days onward, which is likely attributed to albumen degradation. The release of carbon dioxide from the albumen during storage contributes to an elevation in albumen pH

(Nowaczewski et al., 2022). This rise in albumen pH may adversely impact embryonic viability in the early developmental stages, leading to higher embryonic mortality and diminished hatchability (Ayeni et al., 2022; Tainika et al., 2024).

Day Old Chick Quality

Day old chick quality of Arab chickens with different egg storage duration is showed in Table 2. Egg storage duration had no effect ($P > 0.05$) on chick length, hatch yield, and Pasgar score. Chick weight from 7DS was lower ($P < 0.05$) as compared those 1DS and 4DS. The later reduction ($P < 0.05$) of chick weight was seen in 10DS. In term of saleable chicks, 4DS had a higher result ($P < 0.05$) than the other treatments. This study shows that hatching egge storage at room temperature for 4 days did not alter chick weight, while storage for 7 and 10 days reduce this trait.

Table 2. Day old chick quality of Arab chickens with different egg storage duration

Parameter	1DS	4DS	7DS	10DS
Chick Length (cm)	15.07 ± 0.89	15.70 ± 0.16	15.27 ± 0.40	14.82 ± 0.10
Chick Weight (g)	30.75 ± 0.94^{c}	29.82 ± 0.82^{c}	28.35 ± 0.53^{b}	25.99 ± 0.75^{a}
Hatch Yield (%)	67.43 ± 1.26	67.20 ± 2.20	66.77 ± 1.29	66.67 ± 1.78
Pasgar Score	9.65 ± 0.19	9.55 ± 0.19	9.49 ± 0.27	9.53 ± 0.15
Saleable Chicks (%)	74.00 ± 5.48^{a}	86.00 ± 5.48^{b}	74.00 ± 8.94^{a}	68.00 ± 4.47^{a}

^{a,b,c} Uncommon superscript within the same parameter indicate a significant different ($P < 0.05$)
1DS: 1 day storage, 4DS: 4 days storage, 7DS: 7 days storage, 10DS: 10 days storage

The reduction of chick weight was probably due to the moisture loss during prolonged storage duration which will reduce egg weight. Since egg weight was a key determinant for chick weight (Iqbal et al., 2017), the low egg weight in the initial incubation will cause low chick weight.

In this study, the calculation of saleable chicks was derived from the total number of set eggs, offering a comprehensive assessment of hatchery performance. It was observed that 4 days storage of hatching eggs yielded the highest number of saleable chicks compared to other treatments. This outcome is likely attributed to the optimal conditions for embryonic development (Nasri et al., 2020a), resulting in an optimal yield of saleable chicks.

CONCLUSION

In conclusion, this study reveals that storing eggs for a duration of 4 days at room temperature leads to the optimum hatchability and production of saleable chicks. By understanding the influence of storage duration on hatching performance and chick quality, hatcheries can implement strategies to enhance efficiency and profitability.

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