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Effects of High Light Intensity on Incubation Results in Quail Hatching Eggs during Incubation Period

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ABSTRACT

The purpose of this experiment was to establish the effects of high light intensity application during embryogenesis on incubation results in Japanese quail (*Coturnix coturnix japonica*) eggs. A total of 360 hatching eggs were randomly divided into 2 groups. The quail eggs (n= 360) were incubated continuously in the dark (Control; C) and in continuous light at 2900 lux (Light; L) during the first 14 days of incubation. There were no significant ($P>0.05$) differences in hatchability and embryonic mortality among treatments groups. The incubation time in the light-treated group was shorter than C group. The higher hatch was observed in L group at 390 to 416 h of incubation period than the C group ($P<0.01$). No significant differences were found between C and L group at other hatching times. These results demonstrate that continuous high light application during incubation affected the hatch time positively without adversely affecting hatchability or embryonic mortality.

1. Introduction

Fertilized eggs are often incubated in the dark in commercial hatcheries, and there are rarely used lighting schemes (Sabuncuoğlu et al. 2018). But in recent years there have been studies that applied lighting programs during incubation (Shafey 2004; Ozkan et al. 2012a; Ozkan et al. 2012b; Zhang et al. 2016a; Zhang et al. 2016b; Archer 2017; Sabuncuoğlu et al. 2018).

It is reported that the light programs applied during incubation have an effect on the hatchability (Shafey & Al-Mohsen 2002; Shafey 2004; Huth & Archer 2015), chick quality and hatching time (Shafey & Al-Mohsen 2002; Farghly & Abdelfattah 2018), and chick performance (Ozkan et al. 2012a; Farghly and Abdelfattah 2018). In previous studies, the intensity of light exposed to eggs during incubation is generally between 100 and 1800 lux (Shafey & Al-Mohsen 2002; Cooper et al. 2011; Huth & Archer 2015; Farghly & Abdelfattah 2018).

For this purpose, it is aimed to investigate the effect of high light intensity (2900 lux) on the incubation results in quail hatching eggs.

2. Materials and Methods

The experimental work was carried out at the hatchery laboratory, Department of Animal Science, Faculty of Agriculture, Selcuk University, Konya, Turkey. Three hundred sixteen Japanese quail (*Coturnix coturnix japonica*) eggs from a commercial farm in Konya were used in this study. Two trays containing 175 eggs each were placed in each of two incubators (one incubator per treatment). The eggs in the first machine were in a dark environment throughout the incubation period (C). In the other machine, 2900 lux lights were applied with the led bulbs during the first 14 days of incubation (L). 360 eggs were randomly distributed to each machine. The treatments were: (C) 24 h of dark (0L-24D), and (L) 24 h light per 24-hour day (24L-0D) at 2900 lux throughout the first 14 day of incubation period. Eggs were incubated at 37.5 °C and 55-60% relative humidity and the eggs were turned 12 times at 90° per day until 14 days of incubation. Eggs were transferred to hatching trays on d 14 of incubation, for chick identification at hatch. The hatching compartment condition was changed to 37.2 °C and 75% relative humidity. The hatched chick were recorded every 2 h between 360 and 430 h of incubation. After 17.5 d of incubation, all hatched chicks were removed from each hatcher basket. At d 17.5 of incubation, unhatched eggs were opened to establish the stage of embryonic mortality (Aygun et al. 2012). The stages of embryonic mortality were classified as follows: d 1 to 9 (black-eye visible and embryo without feathers), d10 to 16

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(embryo with feathers and embryo with yolk out), and d 17 to 18 (full-grown embryo dead and with yolk subtracted). Fertility was calculated as the percentage of set eggs. The hatchability was calculated as both set eggs and the fertile eggs.

Statistical analysis

At the end of the experiment, the variance analyses were applied to all variables obtained from the trial groups (Minitab 2000), and the differences between means of the groups were determined by the Duncan test (Duncan 1955).

3. Results

The effects of lighting during incubation on hatchability and embryonic mortality are shown in Table 1. The hatchability of set eggs in C (51.80%) did not differ significantly from that of L group (50.72%). Also, no significant differences were observed between C (62.55%) and L groups (62.96%) for hatchability of fertile eggs. There were no significant differences between treatments in terms of embryonic mortality. The effects of lighting during incubation on hatching time are presented in Table 2. The hatching time for the L group (401 h) is shorter than C group (424 h) ($P<0.01$).

Table 1
Effects of lighting during incubation on fertility, hatchability, and embryonic mortality (%)

Group	Fertility (%)	Hatchability of set eggs (%)	Hatchability of fertile eggs (%)	Embryonic mortality (% of fertile eggs)		
				1 to 9 d	10 to 16 d	17 to 18 d
C	82.49	51.80	62.55	16.18	16.64	2.29
L	80.58	50.72	62.96	11.96	20.27	4.10
SEM	3.790	4.270	4.020	2.810	2.950	1.170
P-value	0.733	0.865	0.945	0.330	0.418	0.320

C: 24 h of dark (0L-24D), L 24 h light per 24-hour day (24L-0D) at 2900 lux throughout the incubation period.

Hatching began at 386 and 404 h of incubation duration in L and C groups, respectively (Figure 1). The hatched chick rates of the L group was higher than that of the C group at 390 to 416 h of incubation ($P<0.01$). There were no significant differences between L and C groups at other hatching times.

Table 2
Effects of lighting during incubation on incubation time (h)

Group	Incubation time (h)
C	424.00[a]
L	401.00[b]
SEM	2.120
P- value	0.000

C: 24 h of dark (0L-24D), L 24 h light per 24-hour day (24L-0D) at 2900 lux throughout the incubation period.

[a,b]Means within a column with different superscripts differ significantly ($P<0.001$).

4. Discussion

Hatchability and embryonic mortality is not adversely affected by the lighting application during incubation. This result agrees with Archer et al. (2009); Archer & Mench (2014); Sabuncuoğlu et al. (2018) that reported that no differences in hatchability and Fairchild & Christensen (2000), report that light accelerates hatching without affecting hatchability. On the other hand, some researchers have stated that light application positively affected incubation results (Shafey 2004).

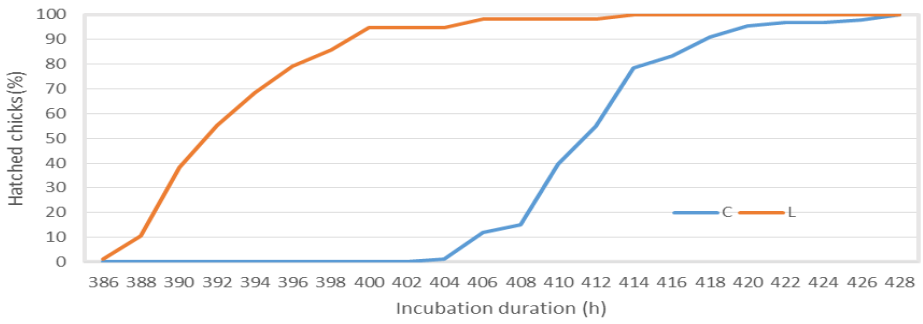

Figure 1
Effects of lighting during incubation on spread of hatch.
C: 24 h of dark (0L-24D), L 24 h light per 24-hour day (24L-0D) at 2900 lux.

It is evident from the data that the exposure of developing embryos to light accelerates growth and results in early hatching of fully developed chicks. In this experiment regarding the hatching time quail eggs which exposure 24 hours of light during incubation hatched early than the control group. The results of this experiment agree well with previous findings reporting accelerated growth of embryos exposed to light during incubation (Shafey & Al-Mohsen 2002; Farghly 2015; Farghly & Abdelfattah 2018). However, Tamimie (1967) and Tamimie & Fox (1967), reported different results, finding delayed hatching as the result of illumination during incubation.

5. Conclusion

In summary, the data in this study suggest that light accelerates hatching without affecting hatchability. Continuous high light application during incubation period may be a method to shorten the incubation period without affecting hatchability or embryonic mortality.

6. References

Archer GS (2017) Exposing broiler eggs to green, red and white light during incubation. *Animal* 11, 1203-9.

Archer GS & Mench JA (2014) The effects of the duration and onset of light stimulation during incubation on the behavior, plasma melatonin levels, and productivity of broiler chickens. *Journal of Animal Science* 92, 1753-8.

Archer GS, Shivaprasad HL & Mench JA (2009) Effect of providing light during incubation on the health, productivity, and behavior of broiler chickens. *Poultry Science* 88, 29-37.

Aygun A, Sert D & Copur G (2012) Effects of propolis on eggshell microbial activity, hatchability, and chick performance in Japanese quail (Coturnix coturnix japonica) eggs. *Poultry Science* 91, 1018-25.

Cooper CB, Voss MA, Ardia DR, Austin SH & Robinson WD (2011) Light increases the rate of embryonic development: implications for latitudinal trends in incubation period. *Functional Ecology* 25, 769-76.

Duncan DB (1955) Multiple range and multiple F tests. *Biometrics* 11, 1-42.

Fairchild B & Christensen V (2000) Photostimulation of turkey eggs accelerates hatching times without affecting hatchability, liver or heart growth, or glycogen content. *Poultry Science* 79, 1627-31.

Farghly M (2015) Using Light Flashes as Environmental Stimulator for Embryonic Growth and Hatch Performance of Rhode Island Red Chicken Eggs. *Egyptian Poultry Science Journal* 35.

Farghly M & Abdelfattah OE-GaM (2018) Enhancement of Embryonic and Hatching Performance of Rhode-Island Red Chicken by Exposing Incubated Eggs to Light Pulses in Relation to Their Shell Pigmentation. *Egyptian J. Anim. Prod* 55, 85-94.

Huth JC & Archer GS (2015) Effects of LED lighting during incubation on layer and broiler hatchability, chick quality, stress susceptibility and post-hatch growth. *Poultry Science* 94, 3052-8.

Minitab I (2000) MINITAB statistical software. *Minitab Release* 13.

Ozkan S, Yalcin S, Babacanoglu E, Uysal S, Karadas F & Kozanoglu H (2012a) Photoperiodic lighting (16 hours of light:8 hours of dark) programs during incubation: 2. Effects on early posthatching growth, blood physiology, and production performance in broiler chickens in relation to posthatching lighting programs. *Poultry Science* 91, 2922-30.

Ozkan S, Yalçın S, Babacanoğlu E, Kozanoğlu H, Karadaş F & Uysal S (2012b) Photoperiodic lighting (16 hours of light: 8 hours of dark) programs during incubation: 1. Effects on growth and circadian physiological traits of embryos and early stress response of broiler chickens. *Poultry Science* 91, 2912-21.

Sabuncuoğlu KM, Korkmaz F, Gürcan EK, Narinç D & Ersin H (2018) Effects of monochromatic light stimuli during embryogenesis on some performance traits, behavior, and fear responses in Japanese quails. *Poultry Science* 97, 2385-90.

Shafey T, & Al-Mohsen T (2002) Embryonic growth, hatching time and hatchability performance of meat breeder eggs incubated under continuous green light. *Asian Australasian Journal of Animal Sciences* 15, 1702-7.

Shafey TM (2004) Effect of lighted incubation on embryonic growth and hatchability performance of two strains of layer breeder eggs. *British poultry science* 45, 223-9.

Tamimie H (1967) Light exposure of incubating eggs and its influence on the growth of chicks—I. Brooding chicks under different light regimens. *Comparative Biochemistry and Physiology* 21, 59-63.

Tamimie H & Fox M (1967) Effect of continuous and intermittent light exposure on the embryonic development of chicken eggs. *Comparative Biochemistry and Physiology* 20, 793-9.

Zhang L, Zhu XD, Wang XF, Li JL, Gao F & Zhou GH (2016a) Green Light-emitting Diodes Light Stimuli during Incubation Enhances Posthatch Growth without Disrupting Normal Eye Development of Broiler Embryos and Hatchlings. *Asian-Australasian Journal of Animal Sciences* 29, 1562-8.

Zhang YP, Li SR, Ping J, Li SW, Zhou HB, Sun BJ & Du WG (2016b) The effects of light exposure during incubation on embryonic development and hatchling traits in lizards. *Scientific Reports* 6.