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Short Communication

Impact of Egg Pre-storage Incubation on Embryo Mortality and Hatching Efficiencies in Japanese Quail (*Coturnix coturnix japonica*)

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ABSTRACT

Present studies report the impact of two different pre-storage incubation (PRESI) periods (6 & 12 h) on embryo mortality and hatching efficiencies of Japanese quail eggs. In all, 540 quail eggs were obtained from a commercial Japanese quail flock, Differentiated into three treatments (with three replicates), containing 60 eggs each. Group I (control), without PRESI, was stored under controlled conditions (12°C & RH: 70%), while group II comprised short-term PRESI, incubated at 37°C for 6 h, and stored at control storage conditions for 42 h and group III, contained long-term PRESI, kept and incubated at 37°C for 12 h. Following three periods, eggs were incubated under usual conditions at 37.6°C and 60% relative humidity. It was resulted that, a hatchability ratio 86.6, 96.7 and 93.3%, was obtained for three respective groups. Maximum embryo mortality occurred in the control group, while that of Group II (short-term PRESI) had minimum mortality, with no significant differences occurred between groups II and III and that, embryo mortalities were significantly higher in group1 (3.3, 3.3 & 10%, respectively). PRESI could possibly reduce incubation length without altering chick weight. Incubating quail eggs for short-term prior storage improved hatching efficiencies.

Key Words: Japanese quail; Hatching efficiencies; Incubation

INTRODUCTION

After oviposition, the embryo is exposed to different environmental factors, which may affect embryo viability, the hatchability and chick quality. One of the factors known to influence embryonic development is temperature (Mahmud *et al.*, 2011). Earlier report suggested that, no developmental changes occurred in embryos, when eggs were stored at temperatures well below normal incubation (20°C), the temperature, called as 'physiological zero' (Reijrink *et al.*, 2008). Moreover, before laying, the embryo blastoderm starts to differentiate, as eggs remain at room temperature after laying is complete, embryos cease to develop further, and this stage is characterized by the formation of zona pellucida.

With an increase in temperature and relative humidity during incubation, embryo development is resumed (Fasenko *et al.*, 2001a). It is of interest to point out that, prior storage, heating the chick eggs for six hours (Fasenko *et al.*, 2001a; Silva *et al.*, 2008) and the turkey, for 12 h (Fasenko *et al.*, 2001b) allowed the complete formation of hypoblast. In the recent decades, several studies reported that pre-heating of poultry eggs before storage resulted in more live chicks and a lower level of embryonic mortality compared to the eggs that remained un-heated (Petek & Dikmen, 2004; Reijrink *et al.*, 2009). For chickens, it was suggested that pre-storage incubation (PRESI) has no effect on hatchability, when storage time is shorter than 7 days and can both be both detrimental and beneficial when storage time is prolonged (Reijrink *et al.*, 2009).

Fasenko *et al.* (2001b) hypothesized that embryos advanced to the developmental stage, in accordance with the classification table (Eyal-Giladi & Kochav, 1976). It was evident that, EG12 and EG13 proved to be more resistant for prolonged egg storage than the less or advanced embryos. At these stages, the embryo completed hypoblast formation and cell migration, with a minimum differentiation (Bellairs, 1986). It can also be suggested that maintenance of viable cells during storage was better than compensating for cell death, by increasing the developmental stage and the number of cells through PRESI (Reijrink *et al.*, 2008). In embryos less and advanced, damage caused by prolonged storage times might be irreversible and cause embryonic mortality.

Overall, in present studies, better hatchability and higher embryo weights were recorded after short-term pre-

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incubation storage (1-2 d) (Yalçin & Siegel, 2003). According to literature, many relevant studies have been conducted to investigate role of PRESI in terms of decline in mortality with long-term storage periods (Petek & Dikmen, 2004). Present work, therefore, was aimed at studying the impact of quail egg incubation before short-term storage on hatching efficiencies and embryo mortality in different developmental stages (0-7 d, 7-14 d, 14).

MATERİALS AND METHODS

Preliminary details: In this experiment, a total of 540 fertile Japanese quail eggs (day-egg; without storage) were obtained from a commercial breeding flock at the age of 10 weeks. After the egg numbering, eggs were subjected to three treatments, (each with three replicates) and contained 60 eggs.

Experimental grouping and conditions: Group I (Control) In this group, eggs were stored under normal storage condition (RH: 70%, 12°C) for 48 h to incubation time Group II (short-term heated) Here, eggs were heated at a 37°C for 6 h and stored at control condition for 42 h. Group III (long-term heated group) contained eggs, which were heated at a 37°C for 12 h and were stored for 36 h. PRESI treatment (for groups II & III) was done in hatchery. Thus, all eggs in three groups were stored for short term (36-48 h). Eggs weighted before and after the treatment with PRESI. They were also detected for any weight loss, which was not evident. Moreover, eggs were incubated in standard hatchery (SAM®, M168 – Iran) at 37.6°C (dry bulb temperature), with 60% relative humidity. For the exact observations and determination of incubation results, egg set of each treatment was enclosed with wooden boxes (to avoid any errors in counts of chicks at hatching time) for knowing incubation length, newly hatched chicks were removed from the hatchery in two periods, following hatching. Chicks from each group were weighed and at the end of 18 d (end of incubation & hatching process), total hatchability efficiencies were determined. Embryo mortality (early, mid & late) was estimated through cracking of non-hatched eggs and morphological examination of dead embryos.

Statistical analysis: Data was quantified and analyzed using SAS software (2000) and significance of means were tested through DMR Test.

RESULTS

Embryo mortality rates for three experimental groups are represented in Fig. 1, showing the early mortality almost negligible for short term PRESI. However, groups II indicated only 3.3% embryo mortality. About mid embryonic mortality, heated eggs (group 2 & 3) had lower rate (1.1%) in compared with control group (2.7%) and finally for late embryonic mortality, the heat treated groups showed 2.2% mortality rate, that is significantly lower than (7.3%) the rate of control group (Fig. 1). The group 2 (short-term PRESI) had lowest mortality rate in three different embryonic period; by 3.3, 0, 3.3, respectively for early, mid and late embryonic period (Fig. 1). Total hatchability was 86.6, 96.7 and 93.3% for group1 (control), 2 and 3, respectively. Control group had lowest hatchability (by 86.6%) and group 2 had highest hatchability by 96.7%. Overall, group 2 (eggs heated for 6 h) had significant difference with control group (eggs without heating) for all of hatchability and embryonic mortality in all stages (Table I). Length of incubation period was lower for PRESI groups (416.6 & 414.2 h for group 2 & 3, respectively) as compare with control group (421.4 h).The weight of hatched chicks in experimental groups was not negatively affected by PRESI (8.2, 8.3 & 8.5 g for group 1, 2 & 3, respectively).

DISCUSSION

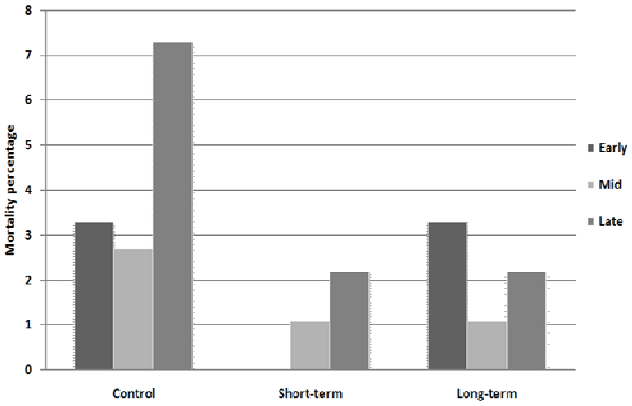
Many studies showed that hatchability can be improved by PRESI". Fasenko *et al.* (2001a) placed broiler breeder eggs in an incubator at 37.5°C for 0, 6, 12 and 18 h and then stored them for 4 or 14 days afterwards. Embryonic development advanced significantly with increasing length of the pre-storage incubation period. Hatchability of eggs stored for 4 days was not influenced by pre-storage incubation. Hatchability of eggs stored for 14 days was significantly better after 6 h of PRESI than without pre-storage incubation. Petek and Dikman (2006) found significant PRESI × egg storage interactions for apparent fertility, hatchability of total and fertile eggs and embryonic mortality and reported PRESI treatment did not have a detrimental effect on the hatchability of broiler breeder eggs stored for 5 days and it can increase hatchability, while it had a detrimental effect on the hatchability of broiler breeder eggs stored for 15 days. Lourens (2006) subsequently confirmed a positive effect of PRESI on hatchability of broiler breeder eggs. But in the ostrich eggs, it was reported that pre-incubation or PRESI had no significant effect on hatchability or embryo mortality (Van Schalkwyk *et al.*, 1999).

Petek and Dikman (2006) showed efficiency of PRESI for medium storage period (5 d). In Quail eggs, 7 h PRESI before 4 d storage period could improve hatchability rate by 79.58%. Also eggs stored for 2 d as short-term storage period, showed lowest mid and late embryo mortality rate, as well as heaviest chick weight, best feed conversion ratio, and best daily weight gain at the end of 42 d rearing period, in compared with control or long-term stored groups (Abdel-Azeem & Abdel-Azeem, 2009). In other study on quail eggs, 8 h PRESI significantly improved hatchability of fertile eggs by 82.6%. In comparison of storage times, there was no significant difference from 5 to 15 d storage, after PRESI for hatchability rate. It is suggested that 8 h PRESI can improve hatchability and reduce embryo mortality at early, mid or late embryonic stages (Petek & Dikmen, 2004).

Table I: Influence of Japanese Quail Egg pre-storage incubation (PRESI) on Hatchability

Experimental groups	PRESI * (hour)	Length of incubation (hours)	Embryo mortality (%)	Hatchability (%)	Weight of hatched chicks (g)
Group 1 (control)	0	421.4[a]	13.4[b]	86.6[b]	8.2[b]
Group 2 (Short-term)	6	416.6[b]	3.3[a]	96.7[a]	8.3[b]
Group 3 (Long-term)	12	414.2[b]	6.7[a]	93.3[a]	8.5[b]

Fig. 1: Mortality rate (%) at different stage of quail embryo development (early-, mid- or late-) affected by PRESI



In present study, we observed efficiency of short-term PRESI with short-term storage time in quail embryo livability and total hatchability by 96.7% in compared with control group (86.6%). Our results are in according to Petek and Dikman (2004) and Abdel-Azeem and Abdel-Azeem (2009) that they studied on quail eggs. Also PRESI could improve other incubation results with decrease of incubation length by 4.8 and 7.2 h for short or long term groups, respectively (Table I) similar to Silva *et al*. (2008) for PRESI treatments. Total hatchability of eggs in present study was significantly higher than that reported by Abdel-Azeem and Abdel-Azeem (2009) or Petek and Dikman (2004) in quail eggs and also more than total hatchability of hen eggs. Silva *et al*. (2008) also concluded that heating eggs for 6 h before storage improves incubation results as it decreases late embryo mortality and incubation length. Contrarily, Reijrink *et al*. (2009) suggested that PRESI was not effective in hatchability when storage time was short. Present study showed that PRESI can be very efficient in decreasing late embryo mortality and increasing total egg hatchability. Also, these two PRESI treatments had no adverse effect on chick weight (had slight positive effect). Ipek *et al*. (2003) had reported shorter incubation period with minor temperature elevation in incubator for ostrich eggs.

It is concluded that heating quail eggs for short-term before storage improves incubation results as it decreases mid and late embryo mortality, increase total hatchability and decreases incubation length without any negative effect on chick weights. PRESI was also efficient treatment for short-term egg storage. Short-term PRESI with 37°C for 6 h before short-term storage is more efficient in compared with long-term heating or no-heating treatments and can improve quail embryo livability during incubation period. Specially, early embryo mortality is reduced after short-term pre-storage incubation.

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