THE EFFECTS OF PRESTORAGE INCUBATION OF QUAIL BREEDER EGGS ON HATCHABILITY AND SUBSEQUENT GROWTH PERFORMANCE OF PROGENY

M. Petek
Department of Zootechnics, Faculty of Veterinary Medicine, University of Uludag, Bursa-16059, Turkey

Introduction

A number of methods have been investigated to improve the hatchability of eggs stored for more than seven days. Recently, it was reported that pre-heating of poultry eggs before storage resulted in more live chicks and a lower level of embryonic mortality compared to eggs that were not heated [2, 6, 7, 10]. However, no previously conducted research has tested pre-incubation storage (PRESI) as a method for improving the hatchability of quail eggs, and its interaction with breeder age and length of storage period. The specific goal of this study was to determine if PRESI would improve the hatchability of quail eggs. The second objective was to determine the interactive effect of different breeder age and length of storage period with PRESI treatment on hatchability and subsequent growth performance of quail.

Materials and Methods

Freshly laid quail eggs were collected from two flocks aged 20 and 37 wk-old. At the time of collection, 900 eggs selected at random from each flock were weighed and randomly distributed into two groups of 450 eggs recpectively exposed to an egg storage lasting 5 or 15 days. Eggs in each egg storage treatment groups were randomly allocated to two groups of 225 eggs exposed to the PRESI treatment for 8 hours or not (control, 0 h). Eggs for the 15-d storage group were collected 10 d prior to the eggs collected for the 5 d storage group, so that all the eggs from all groups could be set in the incubator at the same time. A total of 8 interactive groups constituted of this study (2 level of breeder age x 2 level of PRESI x 2 level of storage period). Forty-five eggs constituted a replicate in each treatment group.

Management

Eggs at 8 h PRESI were incubated at a standard dry-bulb incubation temperature of 37.5 ^{o}C. After the PRESI treatments were completed, all eggs including control and 8 h PRESI were stored at an average temperature of 15 ºC and relative humidity of 65% for 5 or 15 d and were turned twice a day. All eggs were weighed after storage, and eggs from each group were incubated in a commercial setter and hatcher for 17 d. The setter was operated at 37.5±0.5 ºC dry bulb temperature and 29.0±0.5 ºC wet bulb temperature. The hatcher was operated at 37.0 ±0.5 ºC dry bulb temperature and 31.0±0.5 ºC wet bulb temperature. Eggs in setter were turned 15 times per day. Trays representing all treatment groups were distributed in all positions in the setter and hatcher (45x8=360 eggs per tray and 5 trays in the incubator). Newly hatched chicks in all groups were reared under the same growing conditions in brooding cages (colony type) in an open-sided house with mechanical ventilation. Chicks belonging to the same group were randomized into five replicates at hatch. All chicks were brooded and reared at 28 ^{o}C for the 1st weeks, 27 ^{o}C for the 2nd week, 24 ^{o}C for the 3rd week, and 18-21 ^{o}C from the 28th day until 42 days of age. Standard production practices and standard quail feed produced in the centre were used during the treatment. All birds had *ad libitum* access to feed and water. Twenty-four h lighting were used throughout the growth period. Data for the growth performance were collected from the hatch to 42 d of age.

Data and Statistical Analysis

Three days after removing the chicks from the hatcher; all unhatched eggs were broken open to determine the fertility. If the eggs were fertile, period of embryonic development was determined according to Hermes [9]. Hatchability of fertile or total eggs was calculated as the number of chicks hatched per fertile or total eggs [1, 19]. The fertility results were reported as apparent fertility. Individual body weights of quail were measured at hatch and 42 d of age, and cumulative feed conversation (grams of feed intake per grams of body weight gain) was calculated for 42 d of age. Mortality was recorded on a per group basis as it occurred.

The hatchability and growth period data were analyzed by three way ANOVA with two levels of PRESI (0 and 8 h), two levels of breeder age (20 and 37 wk of age) and two levels of egg storage (5 and 15 d). The main treatments as well as the interactions were analyzed for significance at the 5% level. All data in percentages were transformed using arc sine square root transformations prior to analysis [16]. The statistical analysis for body weight apparent fertility, hatchability of total and fertile egg, feed conversion and mortality were calculated on the basis of the replicates. All tests were performed using SPSS® computer software 10.00 [17]. The PRESI treatment, breeder age, and length of storage were the main effects.

Results

The main effect of PRESI, breeder age, and egg storage on egg weight loss, apparent fertility, hatchability of total and fertile eggs, and embryonic mortality are presented in Table I. There was a significant difference for the egg weight losses during storage due to main effects of PRESI and egg storage treatments. There were significant PRESI x breeder age interactions for the hatch of total and fertile eggs. Breeder age x egg storage interaction was found significant for the hatch of total eggs. Hatch of total and fertile eggs were found significant due to main effect of PRESI treatment. The mortality rates of embryo belongs to two PRESI and two breeder age treatment groups were found to be not statistically different while the differences due to storage period were significant from 14 to 17 d of incubation.

The subsequent growth performances of progeny in main groups are presented in Table II. The body weight at hatch in the main groups was found similar. It was found that no significant differences for the body weight at 42 d of age of quail hatched from young and old breeders or 8 h PRESI and control treatments while the differences due to storage period was found to be significantly different. There was significant PRESI x breeder age and PRESI x egg storage interaction for FCR of progeny, respectively. The same interactions were observed for mortality of progeny. The cumulative feed conversion ratio (FCR) of quail hatched from both breeder age and storage treatment groups were found to be significantly different. Main treatment of breeder age on mortality of progeny was found to be significantly different.

Discussion

In this study, egg weight losses in 8 h PRESI and 15 d storage were .49 and .24 g greater than control and 5 d storage, respectively. This result was expected, as exposure to PRESI and long time storage would increase the opportunity for water vapour to escape from the egg. Although long storage time did not affect true fertility, the present study and the work of Petek et al. [14] have demonstrated that the long period egg storage prior to incubation decreased numerically apparent fertility. The fact that the collection of the eggs for the 5 and 15 d storage groups was separated by 10 d might have accounted for the differences in fertility. In this study, 8 h PRESI of the eggs prior to storage significantly affected hatchability of total and fertile eggs. In the same time, 5 d storage was numerically improved hatch of total and fertile eggs. This result was expected on in accordance with the previous reports in quail and other species related to egg storage and PRESI [2, 5, 6, 10, 14, 21]. Some embryos of eggs stored for long periods could not start developing immediately after normal incubation temperatures are provided. Another possibility is that the development of embryos from long period stored eggs proceeds at a slower rate thorough the first period of incubation. As reported previous studies about broiler breeder [4, 18] the age of quail breeder significantly affected the hatchability of total eggs. The eggs obtained from young breeder produced more chicks. Embryonic mortality rates in each stage of incubation examined in this study were not significantly affected by the main and their interactive effects, except for the main effect of storage period on mortality from 14 to 17 d of incubation (Table I). However, embryonic mortality of eggs 8 h PRESI treatment in each period was numerically reduced compared to non heated group. Most probably, embryos in PRESI are being pushed the optimal stage of development to safely store eggs (4, 8). A comparison of the main effects between two PRESI treatments, two storage period and two breeder age showed that 8 h PRESI treatment had significant beneficial effect on hatchability and embryonic mortality; however, embryos of eggs stored 15 d resulted in noticeably lower hatchability and mortality from 14 to 17 d of incubation and the eggs obtained from young breeder significantly produced more chicks. The significant PRESI x breeder age interaction for hatchability of total and fertile eggs revealed that superior effect of the 8 h PRESI was the highest when combined with the young breeder's age. There was significant breeder age x egg storage interaction for the hatchability of total eggs. This led to the conclusion that the depressive effect of 15 d storage on hatchability was highest in old breeders.

In this study, neither the hours of PRESI nor the breeder age between the main groups significantly influenced the subsequent body weight of progeny. The result for the body weight of progeny was not concurrent with the previous findings [15, 20, 22]. Egg storage for 15 d significantly depressed the body weight of quail due to probably, increased second grade of chicken in prolonged storage time. The feed conversion ratio of progeny hatched from 15 d stored eggs and old breeder group were significantly greater than progeny hatched from 5 d stored eggs and young breeder, respectively. Quail in groups of 5 d and young breeder consumed less feed for body weight gain. Findings about the body weight and FCR related to the storage period were not corroborate with previous observations in which body weight and FCR are not affected due to length of egg storage [14]. The mortality rate of progeny was not affected significantly due to main effects in the present study, except for main effect of breeder age. The survival rate of quail hatched from old breeders was found to be lower. Superior effect of PRESI for survival was greater in progeny obtained from young breeder and stored 5 days.

Conclusion

The results of the present study show that 8 h PRESI have a positive effect on the hatchability of eggs and subsequent growth performance of progeny. Further researches are necessary to determine the optimum length of PRESI time and storage durations for obtaining maximum hachability. Meanwhile, it should be kept in mind that the economic cost of PRESI must be evaluated in comparison with its beneficial effects.

References available on request.

Table I. The effects of PRESI, egg storage and breeder age on egg weight loss, embryonic mortality, fertility, hatchability of total and fertile eggs.

Main Treatment Effects	Fresh egg weight (g)	Egg weight loss during storage (%)	Apparent fertility %	Hatchability of Total eggs %	Hatchability of fertile eggs %	Embryonic mortality during incubation (%) 1-7 d	7-14 d	14-17^3 d	Total
PRESI (h)									
0	12.33	0.32	90.8	79.7	85.3	3.83	2.96	4.32	10.00
8	12.35	0.81	91.8	82.6	90.4	2.59	1.48	3.70	7.00
Breeder age									
Young	12.48	0.64	93.7	84.7	88.3	3.83	2.72	3.83	9.33
Old	12.23	0.74	88.9	77.6	87.4	2.59	1.73	4.20	7.67
Egg Storage (d)									
5	12.36	0.49	93.6	82.1	88.1	3.33	1.44	5.22	10.00
15	12.33	0.73	89.0	80.2	87.6	3.06	3.19	2.50	7.00
ANOVA									
PRESI	n.s	0.017	n.s	0.001	0.001	n.s	n.s	n.s	n.s
Breeder age	n.s	n.s	n.s	0.001	n.s	n.s	n.s	n.s	n.s
Egg Storage	n.s	0.001	n.s	n.s	n.s	n.s	n.s	0.01	0.01
PRESIxBreeder age	n.s	n.s	n.s	0.005	0.019	n.s	n.s	n.s	n.s
PRESIxEgg Storage	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s
Breeder agexEgg Storage	n.s	n.s	n.s	0.001	n.s	n.s	n.s	n.s	n.s
PRESIxBreeder agexEgg Storage	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s
SEM	0.40	0.02	0.25	0.25	0.25	0.03	0.03	0.02	0.31

a-b within columns , values with different superscript differ significantly at * P<0.05

Table II. Main effects of PRESI, breeder age, and length of storage period on growth performance.

Main Treatment Effects	n[1]	Body Weight (g) at hatch	Body Weight (g) 42 d of age	FCR[2]	Mortality (%)
PRESI (h)					
0	717	8.6	185.3	4.05	8.04
8	743	8.4	180.5	3.80	7.00
Breeder Age					
Young	762	8.7	182.0	3.56	6.74
Old	698	8.3	183.9	4.28	8.29
Egg Storage (d)					
5	739	8.5	191.3	3.65	7.46
15	721	8.5	174.4	4.21	7.58
ANOVA					
PRESI		n.s	n.s	n.s	n.s
Breeder age		n.s	n.s	0.001	0.001
Egg Storage		n.s	0.002	0.001	n.s
PRESIxBreeder age		n.s	n.s	0.001	0.001
PRESIxEgg Storage		n.s	n.s	0.022	0.001
Breeder agexEgg Storage		n.s	n.s	n.s	n.s
PRESIxBreeder agexEgg Storage		n.s	n.s	n.s	n.s
SEM		0.023	2.492	0.025	0.025

[1]: Number of chicks at hatch, [2] : Feed conversion ratio
a-b within columns , values with different superscript differ significantly at * P<0.05