EFFECT OF EGG WEIGHT AND PRE-INCUBATION HOLDING PERIODS ON HATCHABILITY OF JAPANESE QUAIL EGGS IN DIFFERENT SEASONS

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Summary

One thousand and eighty eggs of Japanese quail (Coturnix coturnix Japonica) were set into the incubator maintaining 36 treatment groups (3 egg weight groups × 3 seasons × 4 preincubation holding periods) to evaluate their hatchability performances. Holding periods had significant ($p < 0.05$) effect on hatchability and the seasons showed significant ($p < 0.05$) effect on chick weight. All the parameters (except fertility) were significantly ($p < 0.01$) influenced by the egg weight. None of the parameters maintained regular trend with egg weight and pre-incubation holding periods. Significant interactions were not observed on any of the parameters (except fertility) studied. The egg weight maintained significant ($p < 0.05$) negative correlation with fertility and positive correlation with chick weight. Eggs of medium weight (9.10 to 10.00 gm) could be hatched satisfactorily between 4 and 7 days of pre-incubation holding periods in any season of the year.

(**Key Words**: Egg, Holding Periods, Quail, Season, Hatchability)

Introduction

Effects of different factors on the hatching quality of chicken eggs have been reported by several researchers (Arora and Arneja, 1972; Reddy et al., 1972; Hamid and Salah Uddin, 1986; Salah Uddin et al., 1990) under different conditions. But there have been the paucity of information on the interactions of seasons, egg weight and pre-incubation holding periods on the hatchability of quail eggs produced in Bangladesh. Moreover, there is no information/recommendation on the optimum pre-incubation holding periods for quail eggs to be hatched. With this idea in view, this study was conducted to assess the hatchability performances of Japanese quail eggs as influenced by the seasons, egg weight and pre incubation holding periods.

Materials and Methods

One thousand and eighty eggs of Japanese quail (Coturnix coturnix Japonica) were collected from the flock (fed *ad libitum* on a diet containing 24% crude protein and 2,800 kcal metabolizable energy/kg computed with the available conventional feed ingredients) of the Bangladesh Livestock Research Institute. The eggs were stored at ambient temperature and relative humidity maintaining the holding periods of 10, 7, 4 or 1 days for each of the two batches in each of the three (summer, rainy or winter) seasons. The eggs were selected according to three (8.00-9.00, 9.10-10.00, and 10.1 to above) weight (g) groups. The weight groups were classified as small (8.59 g), medium (9.52 g) and large (10.56 g) eggs on the bais of average weight.

In each of the six hatches the eggs were set on the same date in the separate setting trays with proper identification in rows keeping large end up and small end down at the end of the pre-incubation holding periods. The eggs were turned manually twice a day at 6 hours' interval at 8.00 A.M. and 2.00 P.M. keeping at 45℃ angle in both the directions. During the pre-incubation holding periods the ambient temperature and relative humidity of the room were recorded three times a day.

The incubation temperature for the first 15 days of incubation was 101°F, after which it was reduced to 99.5°F for the rest of the incubation period. The relative humidity of 53 to 62% for the first 15 days of incubation and 64 to 71% for the rest period were maintained properly. Automatic

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turning devices were used to turn the eggs 12 times in 24 hours up to the 15 th day of incubation. The eggs were transfered to the hatching trays and arranged separately. The eggs were candled on the 7th days of incubation to detect the fertile eggs, dead-in-germs and dead in-shells. The embryos of fertile eggs showing the evidence of retarded development and no movement on candling were conaidered as dead-in-germs which were subsequently confirmed. At the end of each hatch the unhatched eggs and pips were accounted separately as dead-in-shells according to pre-incubation holding periods and egg weight groups.

Collected data were subjected to a 3 × 3 × 4 factorial arrangement and Analysis of Variance performed to differentiate the effects of seasons, egg weights and pre-incubation holding periods on the hatchability performances of eggs. The parameters were also regressed on egg weight and pre-incubation holding periods to have the unit change in each of the hatchability parameters.

Results and Discussion

Data on egg hatchability parameters are presented in tables 1 and 2.

Pre-incubation holding periods showed the significant ($p < 0.05$) effect only on hatchability (table 3). However, seasons exerted significant ($p < 0.05$) effect on chicks weight. Most of the hatchability parameters (except fertility) were significantly ($p < 0.01$) influenced (table 2 and 3) by the egg weight. The fertility was interacted ($p < 0.01$) by the pre-incubation holding periods and seasons. There was no other interaction on any of the parameters (table 1 and 2) studied. Egg weight maintained the significant ($p < 0.05$) correlation with fertility ($r = -0.468$) and chick weight ($r = 0.547$) whereas the pre-incubation holding periods failed to exert significant ($p > 0.05$) correlations (table 4) with any of the hatchability parameters.

Fertility was almost similar with all weight groups in all the seasons. Regardless of the egg weight and seasons, the rate of fertility was similar but highest with 4 and 7 days holding periods and maintained irregular trends with the increasing lengths of holding periods and increased egg weight. This trend is supported by the findings of Hamid and Salah Uddin (1986). However, the decreasing trends in fertility with the increasing lengths of holding periods (4 to 7 or 10 days) partially corresponds to the results of Arora and Arneja (1972).

Hatchability was significantly ($p < 0.01$) higher with medium eggs in any season. This might possibly be due to the proportionately decreased rates of dead-in-germs and dead-in-shells. However, with the increasing length (up to 7 days) of the pre-incubation holding periods the hatchability increased upto a certain stage and then decreased.

TABLE 1. MAIN EFFECTS OF SEASONS, EGG WEIGHT AND HOLDING PERIODS ON THE HATCHABILITY PERFORMANCES OF QUAIL EGGS

Parameters	Seasons			Egg weight			Holding periods (days)			
	Summer	Rainy	Winter	Small	Medium	Large	1	4	7	10
Fertility (%)[a]	83.03 (1.67)	82.84 (1.66)	83.28 (1.72)	83.03 (0.28)	83.22 (0.77)	82.88 (0.90)	82.86 (0.07)	83.60 (0.73)	83.24 (0.92)	82.49 (0.26)
Dead-in-germs (%)[b]	12.54 (2.45)	13.80 (2.68)	14.68 (4.10)	14.73 (2.42)	11.19 (1.71)	15.03 (0.96)	13.73 (2.34)	12.91 (0.69)	11.90 (1.13)	16.14 (2.10)
Dead-in-shells (%)[b]	11.72 (1.58)	12.10 (1.78)	13.40 (2.63)	13.00 (0.48)	10.01 (0.71)	14.20 (0.96)	11.99 (0.25)	12.14 (0.47)	12.48 (0.78)	13.04 (1.39)
Hatchability (%)[b]	75.71 (3.89)	74.06 (4.05)	71.85 (5.71)	72.20 (2.79)	78.75 (2.35)	70.66 (1.28)	74.25 (2.73)	74.93 (1.04)	75.52 (0.48)	70.79 (3.30)
Chick weight (g%)[c]	69.05 (0.64)	69.87 (0.80)	69.76 (0.78)	68.77 (0.38)	70.28 (0.25)	69.64 (0.42)	69.45 (0.18)	69.68 (0.33)	70.02 (0.57)	69.08 (0.39)

Figures within the parenthesis indicate the ± SD values; [a] over the total eggs set; [b] over the total fertile eggs; [c] over the total weight (g) of the fresh eggs.

TABLE 2. INTERACTION OF EGG WEIGHT, SEASONS AND PRE-INCUBATION HOLDING PERIODS ON THE HATCHABILITY PERFORMANCES OF QUAIL EGGS

Parameters	Sources of variations	Holding periods (days) 1	4	7	10	Mean ± SD
Fertility (%)						
	Among egg weight:					
	Small	82.64±0.97	83.06±0.54	83.01±1.71	83.44±1.92	83.03±0.28
	Medium	83.99±0.74	83.82±0.91	83.07±1.67	82.03±1.66	83.22±0.77
	Large	81.96±1.11	83.92±2.49	83.64±2.45	82.01±0.26	82.88±0.90
	Mean	82.86±0.84	83.60±0.38	83.24±0.28	82.49±0.66	83.04±0.13
	Among seasons:					
	Summer	82.78±0.80	82.56±1.13	84.34±1.00	82.46±2.44	83.03±1.67
	Rainy	82.96±1.47	84.12±0.70	82.08±2.19	82.19±0.97	82.84±1.66
	Winter	82.85±1.43	84.20±2.08	83.30±1.91	82.83±0.87	83.28±1.72
	Mean	82.86±0.07	83.62±0.75	83.24±0.92	82.49±0.26	83.05±0.18
Hatchability (% over fertile eggs)						
	Among egg weight:					
	Small	71.31±3.29	75.62±1.42	73.73±2.19	68.15±1.99	72.20±2.79
	Medium	78.91±1.81	79.09±1.29	81.81±0.89	75.19±3.78	78.75±2.35
	Large	72.53±3.41	70.08±2.44	71.02±1.28	69.04±4.29	70.66±1.28
	Mean	74.25±3.33	74.93±3.71	75.52±4.58	70.79±3.13	73.87±4.15
	Among seasons:					
	Summer	76.15±2.98	76.25±3.57	75.34±4.98	75.13±3.62	75.71±3.89
	Rainy	76.22±3.10	74.84±2.06	75.04±4.10	70.13±3.66	74.06±4.05
	Winter	70.38±4.26	73.70±5.53	76.18±5.29	67.12±2.61	71.85±5.71
	Mean	74.25±2.73	74.93±1.04	75.52±0.48	70.79±3.30	73.87±1.83
Dead-in-germs (% over fertile eggs)						
	Among egg weight:					
	Small	15.31±2.73	12.19±0.71	12.99±2.71	18.83±1.18	14.73±2.42
	Medium	11.23±1.87	10.61±2.28	9.09±0.44	13.83±2.78	11.19±1.71
	Large	14.66±2.55	15.65±2.48	13.65±0.79	16.17±2.48	15.03±0.96
	Mean	13.73±1.78	12.81±2.10	11.91±2.01	16.14±1.87	13.65±1.74
	Among seasons:					
	Summer	12.14±1.65	11.94±1.88	12.88±3.04	13.18±2.75	12.53±0.51
	Rainy	12.01±1.66	13.33±0.60	12.53±2.07	17.35±1.94	13.80±2.10
	Winter	17.05±2.27	13.47±4.64	10.31±1.71	17.90±1.12	14.68±3.02
	Mean	13.73±2.34	12.91±0.69	12.90±1.13	16.14±2.10	13.67±0.88

TABLE 2. CONTINUED

Parameters	Sources of variations	Holding periods (days) 1	4	7	10	Mean ± SD
Dead-in-shells (% over fertile eggs)						
	Among egg weight:					
	Small	13.37±0.57	12.19±0.71	13.06±0.77	13.40±0.83	13.00±0.48
	Medium	9.84±0.18	10.28±1.06	8.99±0.52	10.96±1.22	10.01±0.71
	Large	12.76±0.44	13.95±0.10	15.32±1.72	14.78±2.52	14.20±0.96
	Mean	11.99±1.54	12.14±1.49	12.45±2.61	13.04±1.57	12.40±0.40
	Among seasons:					
	Summer	11.86±1.33	11.79±1.68	11.56±2.01	11.67±1.13	11.72±0.11
	Rainy	11.76±1.44	11.82±2.01	12.41±2.03	12.50±1.72	12.12±0.33
	Winter	12.35±1.89	12.81±0.89	13.49±2.68	14.96±2.42	13.40±0.98
	Mean	11.99±0.25	12.14±0.47	12.48±0.78	13.04±1.39	12.41±0.71
Chick weight (gram% over egg weight)						
	Among egg weight:					
	Small	68.71±0.18	68.87±0.33	69.31±0.58	68.22±0.27	68.77±0.38
	Medium	70.02±0.28	70.45±0.56	70.61±0.69	70.05±0.42	70.28±0.25
	Large	69.70±0.16	69.72±0.13	70.17±0.52	68.98±0.50	69.64±0.42
	Mean	69.47±0.55	69.68±0.64	70.03±0.53	69.08±0.75	69.56±0.34
	Among seasons:					
	Summer	69.21±0.52	69.24±0.54	69.22±0.48	68.52±0.68	69.04±0.30
	Rainy	69.65±0.51	70.04±0.66	70.47±0.74	69.32±0.77	69.87±0.43
	Winter	69.50±0.63	69.76±0.80	70.39±0.44	69.40±0.79	69.76±0.38
	Mean	69.45±0.18	69.68±0.33	70.02±0.57	69.08±0.39	69.55±0.34

± Values are for SDs among egg weight, seasons and pre incubation holding periods for each parameter.

This trend is partially supported by Reddy et al. (1972) and Hamid and Salah Uddin (1986). It is revealed (table 2) that the hatchability was almost similar with 4 and 7 days' holding periods.

The embryonic mortality (dead-in-germs) and dead-in-shells (table 1 and 2) did not differ significantly ($p > 0.05$) due to seasons and pre-incubation holding periods. The increasing tendency of the dead-in-shells with the increasing length of the pre-incubation holding periods are in accordance with the findings of Hamid and Salah Uddin (1986). This might be due to increased stickiness of the chicks prior to pipping out resulting from the increased evaporative lossess of the eggs. Egg weight showed the significant ($p < 0.01$) effect but maintained irregular trends with the percentages of dead-in-germs and dead-in-shells.

The chick weight was influenced ($p < 0.05$) by the egg weight and seasons maintaining no trend. The pre-incubation holding periods exerted non-significant ($p > 0.05$) effect on chick weight. The values were almost similar for chick weight with all the holding periods but slightly higher chick weight was observed for 7 days' holding periods regardless of the seasons. The causes are still unknown and/or unexplainable.

From this study it is evident that the quail eggs of medium size could be hatched advantageously

TABLE 3. SEDS AND SIGNIFICANCE LEVELS FOR HATCHABILITY PARAMETERS

Parameters	SEDs and significance levels						
	Holding periods (days)	Seasons	Egg weight	Holding period × seasons	Holding periods × egg weight	Season × egg weight	Holding periods × egg weight × seasons
Fertility (%)	1.3431^{NS}	1.1631^{NS}	1.1631^{NS}	2.3263**	2.3263^{NS}	2.0146^{NS}	4.0293^{NS}
Hatchability (% over fertile eggs)	1.8064*	1.5644^{NS}	1.5644**	3.1289^{NS}	3.1289^{NS}	2.7097^{NS}	5.4194^{NS}
Dead-in-germs (% over fertile eggs)	1.5245^{NS}	1.3202^{NS}	1.3202**	2.6405^{NS}	2.6405^{NS}	2.2867^{NS}	4.5735^{NS}
Dead-in-shells (% over fertile eggs)	1.3201^{NS}	1.1432^{NS}	1.1432**	2.2865^{NS}	2.2865^{NS}	1.9801^{NS}	5.6007^{NS}
Chick weight (Gram % over egg weight)	0.3937^{NS}	0.3409*	0.3409**	0.6819^{NS}	0.6819^{NS}	0.5905^{NS}	1.6703^{NS}

± All SEDs are against 36 df; ^{NS} ($p > 0.05$); * ($p < 0.05$); ** ($p < 0.01$). NS (Nonsignificant).

TABLE 4. REGRESSIONS OF HATCHABILITY PARAMETERS (Y) ON HOLDING PERIODS AND EGG WEIGHT

Parameters (Y)	X = holding periods (days)			X = egg weight (g)		
	a	b	r	a	b	r
Fertility (%)	83.318	−0.049	−0.228^{NS}	83.818	−0.081	−0.468*
Hatchability (% over fetile eggs)	75.666	−0.326	−0.263^{NS}	82.356	−0.889	−0.199^{NS}
Dead-in-germs (% over fertile eggs)	12.491	0.210	0.281^{NS}	9.556	0.221	0.102^{NS}
Dead-in-shells (% over fertile eggs)	11.769	0.116	0.203^{NS}	5.940	0.676	0.308^{NS}
Chick weight (Gram % over egg weight)	69.719	−0.027	−0.130^{NS}	65.541	0.420	0.547**

^{NS} ($p > 0.05$); * ($p < 0.05$); ** ($p < 0.01$); NS (Nonsignificant).

between 4 and 7 days' pre-incubation holding periods in any season of the year under the climatic conditions of Bangladesh.

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