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Effect of Storage Period on Egg Weight Loss, Hatching Weight and Hatchability Percentage of Incubated Egyptian Balady Eggs

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Key Words: Egyptian balady chicken, hatchability, and storage period

ABSTRACT:

An experiment was conducted to evaluate the effect of storage period (0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 days) of Egyptian balady eggs on egg weight loss during incubation, hatch weight and hatchability percentages. Either immediate setting of fresh egg or prolonged storage duration affected significantly the hatchability percentage ($p< 0.05$). Regression equations as well as R2 values were estimated for weight loss during incubation, hatch weight and hatchability percentages with storage period length. The values of R2 were 0.95, 0.87 and 0.85 for weight loss during incubation, hatch weight and hatchability percentages with storage period length. Also, negative high correlation between weight loss and both of hatching weight and hatchability percentage was estimated. It was suggested that incubation of prolonged stored eggs affected negatively on incubation and hatching quality characters of Egyptian balady eggs.

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1. INTRODUCTION

Pre-incubation period of hatching eggs is very important as it affects the hatching egg quality. Collected eggs should be kept in an adjusted environment to obtain maximum hatchability. Eggs may be setted at the oviposition day (fresh eggs) suggesting that fresh eggs resulted in higher hatchability. On the other hand, breeder houses collect eggs daily and stored for periods of five to seven days then transferred to the incubator. In broiler production, the eggs should be stored for one to three weeks before incubation in order to obtain a sufficient number of eggs (Kuurman et al. 2002). Hence, the chicken embryo starts to develop just after laying, so fertile eggs have to be stored at particular environmental conditions. For eggs stored for less than four days, egg room temperature should be 20-25°C, whereas for those stored four to seven days, temperature should be maintained between 16 and 17°C, and for eggs stored for more than 7 days, temperature should be lowered to 10-12°C (Meijerhof 1992). Also, relative humidity should be maintained between 70 and 80% to decrease egg water loss. Previous studies reported that long storage periods increase the weight loss of table and hatching egg (Scott et al. 2000 and Samli et al. 2005). While, eggs during incubation normally lost about 12 to 14% for broiler and turkey eggs (Rahn et al. 1981). Increasing of storage period affected the egg weight loss during incubation (Romao et al. 2008), as well as affected negatively hatching quality and elevate the embryonic mortality percentage (Petek et al. 2006 and Khan et al. 2013).

The unique storage period doesn't yet determined, it differs according to species and breed. Rohd Island Red eggs didn't recommend to be stored for more than three days (Khan et al. 2013), up to ten days for egg and meat type quail (Romao et al. 2008), seven days for Cobb broiler breeders eggs (Tona et al. 2003) and six days for pullet breeders (Egbeyale et al. 2013).

Egyptian chicken breeds have insufficient research yet. Egyptian balady chicken is a good tolerant to harsh environmental conditions, as well as it is the most common house hold breed in Egypt. This study aimed to evaluate effect of storage period

on egg weight loss during incubation, hatching weight and hatchability of Egyptian balady eggs.

2. MATERIAL AND METHODS

2.1. Egg and storage conditions

This research was conducted at the Department of Animal Husbandary and Animal Wealth Development, Faculty of Veterinary Medicine, Alexandria University. A total of 300 eggs were collected from six month old Balady layer flock. Eggs were allocated to eleven groups, to be stored for 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 days. Prior setting, eggs were weighted and then weekly until hatching time. weight loss during incubation was calculated by subtracting weight of each egg from its weight at previous week. Eggs were stored at 15+ 1ºC and 75% relative humidity (Tona et al. 2003). Eggs were distributed in the trays randomly and fumigated before setting. Eggs from each group were incubated in a setter at 37.5ºC and 70 % relative humidity. Eggs in the incubator were turned 6 times per day. At last three days of incubation the eggs were transferred to the hatcher at 37.5ºC dry bulb temperature and 80 % relative humidity. The hatcher was opened at 21 days of incubation and all the chicks that fully emerged from their eggs and dried were removed, counted and weighted individually. Also, commercial hatchability percentages were calculated.

2.2. Statistical Analysis

The data were analyzed using SPSS 15.0 software (SPSS Inc., 2006), using one way ANOVA test. The significance between the means was tested using Duncan's multiple range tests at the 0.05 level of significance.

Regression equation was calculated

$\hat{Y} = bx + a$ (Chatterjee and Hadi, 2006)

Where:

$\hat{Y}$: predicted values of dependent variable

b: regression value

x: independent variable

a: Y intercept

Correlation values was calculated by

$$r_{xy} = \frac{cov(X,Y)}{\sigma X \sigma Y}$$

Determination coefficient $(R^2) = (r_{xy})^2$ (Nagelkerke, 1991)

3. RESULTS

Egg weight loss during incubation period was significantly ($p < 0.05$) influenced by the length of storage period. Table 1 showed that the long storage period resulted in increase in egg weight loss during incubation. Fresh eggs and that stored for one or two days lost only 2.47 to 2.57 g. While the weight loss of egg increased significantly to be ranged from 2.89 to 3.71 gram for the eggs stored for 3 to 7 days. Also, extension of storage period from 8 to 10 days raised egg weight loss significantly to be 4.53 to 4.89 gram.

There was statistical significant decrease ($p < 0.05$) for chick weight at hatch in relation to the length of the storage period. Table 1 showed that fresh eggs had significant high chick weight. While, stored eggs for one or two days showed significantly, lower hatch weight than that of fresh eggs. Increased storage period to three days caused more significant decrease in the hatch weight. Also, storage of eggs from five to eight days had statistically similar low hatch weight. Moreover, extra significant reduction in hatching weight was occurred after 9 to 10 days of storage. Also, newly hatching weight was found to be highly negatively correlated to weight loss in incubation (Table 2).

Stored eggs for one and two days surpassed on the fresh egg for its hatchability percentage Hatchability percentages gradually decreased as storage period extended, on the fifth day hatchability percentage decreased by 18.22% comparing to the fourth day of storage. The lowest hatchability was recorded after ten days of storage. Differences in hatchability percentage were found to be significant due to the effect of weight loss in incubation (Table 2) (there was significant negative correlation between the two traits). The non-hatched eggs were examined to determine the cause of non-hatching. Most of eggs stored more than four days suffered from late embryonic mortality, no early embryonic mortality was observed. Figure 1 (a, b and c) showed the linear regression relationship of weight loss during incubation, hatch weight and Hatchability percentages on storage period. Values of R^2 were 0.95, 0.87 and 0.83 for weight loss during incubation, hatch weight and Hatchability percentages on storage period, respectively.

4. DISCUSSION

Egg storage prior to incubation had both positive and negative effects on hatchability percentages (Brake et al., 1993). A number of studies showed that increase of storage period for eggs prior to incubation resulted in decreasing of hatchability percentage (Romao et al. 2008 and Alsobayel et al. 2012). On the other hand, other studies showed higher hatchability for eggs stored for few days than those incubated immediately after laying (Asmudndson and MacLlriath, 1948). These findings supported the present results. Storage for one or two days elevates the hatchability over the fresh egg but the long period induced dramatic decline in hatchability. Khan et al. (2014) studied the hatchability of Rohd Island Red eggs stored for two, three, five, seven and nine days in the store room at 16 °C and 78% RH and found that hatchability percentages were 73.23 % for two days, 70.7% for five days, 58.78 for seven days, 26.56% for seven days and 5.65% for nine days, respectively. They recommended duration of egg storage shouldn't be more than threeq days. These findings agreed with the present result which showed reduction of hatchability in Egyptian chicken breed after the fourth day of storage. Mather and Laughlin (1979) suggested that long storage duration can diminish hatchability through incidence of necrosis and regressive changes in the blastoderm even at low storage temperatures. Also, Van and Ven (2004) proposed that the main cause of low hatchability of long stored egg was decrease of albumen viscosity and increased pH of the albumen.

Table (1) Weight loss during incubation (gm), Hatch weight (gm) and hatchability percentages of Egyptian baladi eggs according to the length of the storage period

Storage period (days)	Weight loss (gm) (Mean ± SE)	Hatch weight (gm) (Mean ± SE)	Hatchability %
0	2.47±0.33^{c}	28.43±2.38^{a}	92.33
1	2.49±0.24^{c}	27.23±0.72^{b}	97.40
2	2.57±0.56^{c}	27.01±0.87^{b}	95.32
3	2.89±0.48^{b}	26.49±0.74^{c}	91.31
4	3.48±0.38^{b}	25.43±0.60^{d}	90.80
5	3.82±0.55^{b}	24.99±0.58^{e}	72.58
6	3.69±0.45^{b}	24.40±0.59^{e}	77
7	3.71±0.50^{b}	24.01±0.85c^{e}	73
8	4.53±0.42^{a}	24.55±1.22^{e}	75.2
9	4.50±0.86^{a}	20.35±2.25^{f}	70.4
10	4.89±0.32^{a}	19.42±1.23^{f}	66

Means within the same column of different litters are significantly different at ($P < 0.05$).

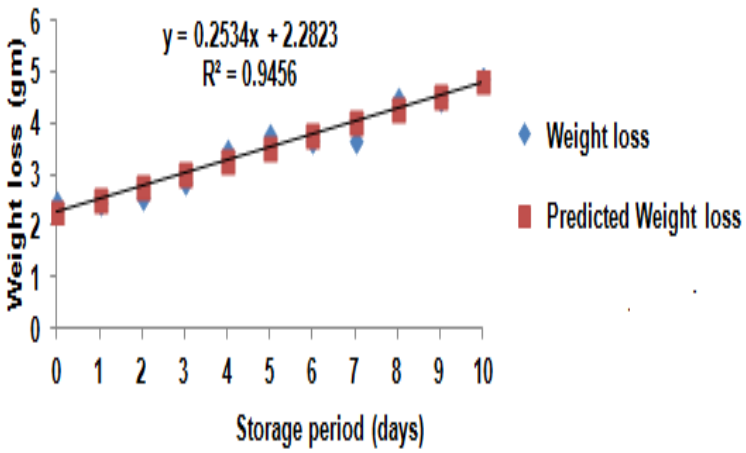
Table (2) the correlation coefficient values between egg weight loss and hatch weight and hatchability percentages

Traits	R
Hatch weight* Weight loss	-0.9377**
Hatchability* Weight loss	-0.9105**

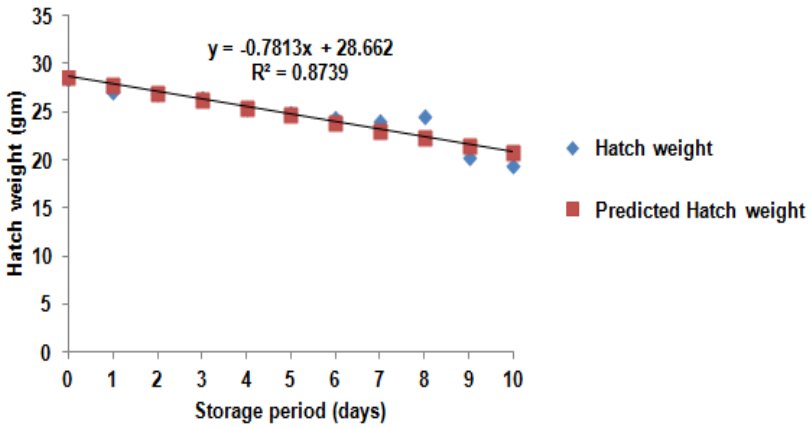
**

Correlation is significant at the 0.01 level (2-tailed)

a



b



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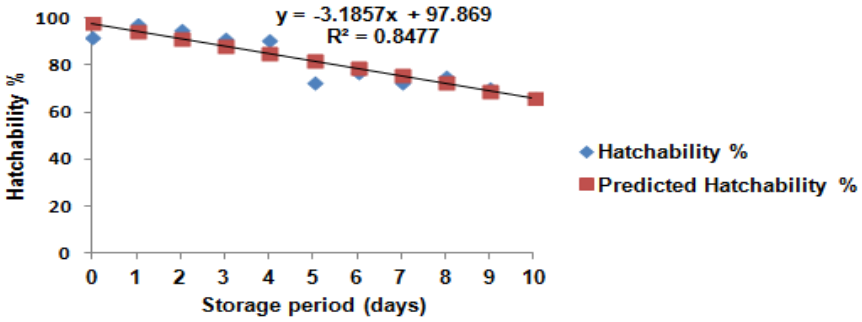

Figure (1): Linear regression relationship of (a) weight loss of eggs during incubation, (b) hatch weight and hatchability percentage and storage period.

The present study revealed that longer storage time of eggs caused increase in weight loss during incubation. This is in contrary to Romao et al. (2008) who reported that quail eggs tended to decrease the rate of egg weight loss as storage length increased.

Previous studies proved that the hatching weight is determined by many factors such as genetic, egg weight, incubator environment, storage length and weight loss in incubator (Shanwany 1978 and Schmidt et al. 2009). Fesanko (2007) explained the decrease of newly hatched chick in the long stored eggs as that the long storage causes delay in the growth and

metabolism of the embryo after incubation and cause slow developmental rate. Moreover, high calculated R^2 values of weight loss during incubation, hatch weight and hatchability percentages on storage period indicated that improvement of these traits is strongly dependant on eggs storage period length. Also, the obtained high negative correlation between weight loss in incubation with both hatching weight and hatchability may suggest that acceleration of weight loss during incubation by long storage has a role in decrease hatchability.

Finally, it was concluded that to obtain higher hatchability of Egyptian balady egg, they shouldn't store for more than 4 days at 18 ºC and 75% relative humidity.

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