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THE EFFECT OF STORAGE PERIOD AND HEAT EXPOSURE OF HATCHING EGGS BEFORE OR DURING STORING ON THE HATCHING CHARACTERISTICS OF HATCHING EGGS OF BROILER BREEDER (ROSS 308)

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Abstract

This study was conduct to determine the effect of the storage period and the treating of heat on hatching eggs after or during the period of storage in the qualitative characteristics of hatching eggs. A1200 hatching eggs of broiler chickens Ross308 were collected at the age of 31-33 weeks (215-226 days), the eggs were transferred to the hatchery on three periods according to the storage period 3, 7 and 14 days, the eggs were randomly distributed to 8 treatments by 3 replications to each treatment (50 eggs/Rep.). Control (storage hatching eggs for 3 days), T1 (Heat treating to hatching eggs for 6 hours and storage for 3 days), T2 (Storage of hatching eggs for 7 days), T3 (Heat treating to hatching eggs for 6 hours and storage for 7 days), T4 (Heat treating to hatching eggs for 3 hours every 3 days during the 7-day storage of period), T5 (Storage hatching eggs for 14 day), T6 (Heat treating to hatching eggs for 6 hours and storing for 14 days), T7 (Heat treating to hatching eggs for 3 hours every 3 days during the 14-day of storage period), eggs were treated to heat at 37.5° C and 55% relative humidity, The eggs were stored at 15- 18°C and 65-70% RH. Results showed no effect in significant hatching rate of total eggs, fertilized eggs, percentage of embryonic mortality, and percentage of piped eggs when the storage period of hatching eggs is prolonged or Exposure to heat before or during storage of eggs, and prolongation of storage period did not significantly affect on fertility. There was also a significant decrease ($P<0.01$) in the proportion of early hatching at lengthening the duration of storage to 14 days compared with egg storage for 3 and 7 days, but exposing the hatching eggs to heat before or during the storage period to 14 days improved the proportion of early hatching, while a significant increase ($P <0.05$) in the proportion of hatching medium when lengthening the duration of storage to 14 days compared with egg storaged for of 3 and 7 days, while it was observed significant decrease in the medium hatching rate when exposing hatching eggs to heat for 3 hours every 3 days during the storage period to 14 days compared with eggs exhibition for heat for 6 hours before storage and eggs non exposed to heat and storage for the same period, and the prolongation of the storage period to 14 days increased significantly ($P <0.05$) of the late hatching ratio compared to all experimental treatments. We can conclude that extending the storage period to 14 days and heat exposing to hatching eggs before or during storage did not have any effect on hatching characteristics. However, prolonging the storage period to 14 days significantly increased the period required for hatching, while heat exposing to hatching eggs before or during storage period reduce the period required for hatching.

Key words: storage period, heat exposure to hatching eggs, hatching characteristics.

Introduction

The main characteristic of the modern era after the start of third millennium is the great trend towards the consumption of poultry meat because of its characteristics, which led to an increase in the demand for poultry products and the high demand to purchase them (Al-Hjaw *et al*., 2017), which led the owners of projects of broiler breeder to work Strive to achieve the highest economic return by obtaining the highest percentage of production of eggs hatching, which is characterized by high fertility and thus get a high hatch rate (Hatchability) for the purpose of getting an active chick. The multiplication of broiler breeder and produce a strong chick day-old depends on the specifications and characteristics of the fertilized egg is associated with the good functioning of take care of it. Many researchers work to find the best methods and techniques which used for the storage of hatching eggs and these methods of heat treated to hatching eggs for certain hours and the same temperature and relative humidity used in the incubator before placing it in refrigerated stores, which aims to accelerate embryonic development and reach the stage of silence Hypoblast which can then carry the embryo storage conditions, this method is called pre-incubation before storage (Eyal-Giladi And Kochav, 1976; Gharib, 2013; Atif *et al*., 2015; Ebeid *et al*., 2016), as well as the method of exposing heat to hatching eggs during the storage period, which includes exposure of heat to hatching eggs for certain periods and for specific periods during the storage period on the same temperature and relative humidity used in the incubator and then re-enter the eggs into the refrigerated storage rooms (15-18ºC),

to regeneration and repair of embryonic cells affected thereby increasing the embryo 's ability to with stand the negative effects resulting from the increased length of storage and continued survival and thus minimize the damage caused by increasing the length of storage and improve the qualities of hatching (Wade And Andrew, 2014; Abdel-Halim *et al*., 2015; Tag EL-Din *et al*., 2017; Hy-Line, 2017). Therefore, the present study aims to know the effect of exposure of heat to hatching eggs before and during the storage period and for specific periods in hatching characteristics.

Materials and Methods

This experiment was carried out in Al-Anwar private company in Babel Governorate for 3/2/2018 to 11/3/2018 (35 days including 3-14 days storage period and 21 days incubation period). A 1200 eggs of broiler breeder Ross308 at 31-33 weeks of age (215-226 days), the eggs were transferred to hatchery in 3 groups depending on storage periods 3, 7, 14 days and eggs were fuming by formaldehyde, 35 ml Formalin and 17.5g potassium paramagnet with 50 ml of water per cubic meter to evaporation chamber for 30 minutes. Eggs were randomly distributed to 8 experimental treatments (three replicates per treatment of 50 eggs per Rep.), eggs were treated to heat at 37.5 ° C and relative humidity 55%, Store eggs at 15-18 °C and relative humidity 65-70% and distributed treatments as follows: Control: (Store hatching eggs for 3 days), T1 (Heat treating to hatching eggs for 6 hours and storage for 3 days), T2 (Storage of hatching eggs for 7 days), T3 (Heat treating to hatching eggs for 6 hours and storage for 7 days), T4 (Heat treating to hatching eggs for 3 hours every 3 days during the 7-day of storage period), T5 (Storage hatching eggs for 14 day), T6 (Heat treating to hatching eggs for 6 hours and storing for 14 days), T7 (Heat treating to hatching eggs for 3 hours every 3 days during the 14-day of storage period), eggs were treated to heat at 37.5 °C and 55% relative humidity, The eggs were stored at 15-18°C and 65-70% relative humidity. A multi-stage incubator Type petersime was used, the eggs are automatically flipping each 24 periods per day.

The Studied Characteristics

1. Percentage of fertility

This was calculated according to the following formula :

$$\text{Percentage of fertility} = \frac{\text{Number of eggs fertilized}}{\text{Total number of eggs}} \times 100$$

Number of eggs fertilized = total number of eggs - number of eggs not fertilized

2. Percentage of Hatch

The percentage of hatch was calculated based on the percentage of hatching of total eggs as well as on the basis of hatching rate of fertilized eggs according to the following equations.

$$\text{The percentage of hatch in total eggs} = \frac{\text{Number of chicks}}{\text{Total number of eggs inside of the hatchery}} \times 100$$

$$\text{Percentage of hatch in fertilized eggs} = \frac{\text{Number of chicks}}{\text{Number of fertilized eggs}} \times 100$$

3. Percentage of Fetal Mortality

The dead embryos were identified by breaking eggs non-hatched after the end of the day 21 of the incubation period. The percentage of embryos mortality account by the following equation.

$$\text{Percentage of dead fetus} = \frac{\text{Number of dead embryos at the end of incubation period}}{\text{Number of fertilized eggs}} \times 100$$

4. The percentage of Piped Eggs

The percentage of the eggs was calculated according to the following equation.

$$\text{The percentage of eggs in the cage} = \frac{\text{Number of piped eggs}}{\text{Number of eggs fertilized}} \times 100$$

5. Period of Hatching

The beginning of the hatching period was determined when the first chick came out of the egg according to the method of Willemsen *et al*. (2008), which mentioned that calculate the number of chick eggs after 480 hours of egg incubation and then repeat this process every two hours until the end of hatchery finally after 516 hours and the hatching period was divided into three periods (early, intermediate, late) as the duration of each 12 hours.

The experimental data were statistically analyzed by using the Completely Randomized Design (CRD) to determine the effect of treatments and the differences between the treatments were examined using Duncan test by Steel And Torrie (1980) at a significant level 0.05 and 0.01 The statistical program was used SAS (2012) according to the following model:

$$Yij = \mu + ti + eij$$

Results and Discussion

1. Effect of storage period and heat exposure of hatching eggs before or during storage in hatching characteristics.

1.1 Hatching rate, fertility rate, piped eggs, and embryonic mortality.

Table (1) showed the effect of storage and exposing eggs for heat before or during storage in hatching ratio of total eggs and fertilized eggs. The results indicate that there were no significant differences in the percentage of hatching of total eggs and fertilized eggs among treatments in which hatching eggs were exposed to heat before or during the storage period and treatments in which Store hatching eggs without being exposed to heat.

As shown in Table (1), the effect of storage period and exposure of eggs for heat before or during storage in fertility ratio where indicate that there were significant differences ($P < 0.05$) T1 Recording the highest fertility rate of 98.450% compared to the treatment T3 which recorded the lowest fertility rate of 92.248% and did not differ significantly with control treatment or with the other treatments.

The effect of storage and exposure of eggs for heat before or during the storage period in the percentage of piped eggs and ratio embryonic mortality, it indicated that no significant differences in the proportion of embryonic mortality and the percentage of piped eggs between all treatments.

The exposing the hatching eggs to heat before or during storage and storage of eggs for 14 days or more than 7 days has improved hatchability also reduced proportion of embryos mortality and proportion of piped eggs which notice by no significant differences between the treatments, perhaps due to the fact that embryos at the stage before embryonic development are less able to withstand the stress resulting from storage for a long period compared to the embryos at a later stage (Schulte-Druggelte, 2011). Therefore, exposure to hatching eggs to heat before or during storage may result in increased embryonic development in fertilized eggs and lead to phase Hyboplast Thus, the fetus will be able to repair the damage caused by the length of storage and compensation cell death and thus increase its ability to withstand the storage conditions. (Ferreira, 2018). This finding agree with findings Ebeid *et al.* (2016) who observed no significant differences in fertility rate and total hatching rate and mortality of early and intermediate embryos and late when expose hatching eggs to heat of strain Egyptian at the age of 25 weeks to a temperature of 37.5 ^{o} C for 0 and 6 hours stored for 4 and 10 days at a temperature of 17ºC and 75% RH. As agreed Gamble And Ingram (2010), who noticed significant differences in the ratio of piped eggs when exposed eggs hatching chicken of broiler breeder of Ross 708 to heat at 37.5 ^{o}C and 60% RH for periods 0, 12, 15, 18, 21 and 24 hours and storage for 3 days at a temperature of 15.5 ºC and relative humidity 60%.

While this finding is not agree with its findings Ebeid *et al* (2017) who showed a significant increase ($P < 0.01$) in hatching ratio of total eggs and fertilized eggs when exposing the hatching eggs of the Egyptian Anchas strain at 28 weeks of heat at 37.5°C for 4, 6 and 8 hours and stored at 12°C and relative humidity of 75% for periods 4 and 14 days compared to eggs hatching is the exhibition of heat and storage for the same periods, as noted for significant increase in the fertility rate when exposing hatching eggs to heat for 6 and 8 hours before storage and storage for 4 and 14 days compared to eggs hatching which was subjected to heat for 4 hours and eggs hatching no exposed to heat, but the percentage of fetal mortality did not match with the same researcher, which indicated a significant increase in the proportion of early, intermediate and delayed embryonic when the length of storage period, percentage of early, intermediate and delayed embryonic mortality when exposing hatching eggs to heat before storage.

This finding is not agree with AL-Samrai and AL-Dhanki (2017), which indicated a rise in the rate of hatching and total hatching rate on the basis of fertilized eggs exposed to heat at 37.5 ºC for 4 hours for days 4 and 7 during the 7-day the storage period which was 7 days and non-heat hatching eggs compared to hatching eggs exposed to heat at 37.5 °C for 6 hours before storage and storage for 7 days. Our results agreed with Tag EL-Din *et al.* (2017) who showed no significant differences in hatching percentage of total eggs and fertilized eggs of Schifferat age 34-week-old to 37 °C for 2.5 hours every 5 days during storage and storage for 7 days compared to fresh eggs, which non exposed to heat. This finding is agree with Al-Kerwi (2018), whoindicated that no significant differences in total hatching rate, hatching percentage of fertilized eggs, fertility rate, percentage of early embryonic mortality, and percentage of piped eggs when exposing hatching eggs in temperature 37.8 ºC for 0, 4 and 8 hours before storage and then it storage at 16 °C and 65% RH for 4 and 8 days.

1.2 Early, intermediate and late hatching period

Table (2) for percentage of early hatching (480-492 hours), intermediate (492-504 hours) and late (504-516 hours) which shows the results of the statistical analysis indicate that there were significant differences ($P<0.01$) in the percentage of early hatching for T2

which recorded highest rate for early hatching, which reached 50.909%, and significantly higher on T5 which recorded the lowest rate of hatching as it reached 2.02%, in addition to a significant superiority on T3 and T6 as there are significant differences between the control treatment T1 , T2 , T3 , T4 and T7 and also observed a significant decrease of treatment T6 Which reached to 16.722% compared to control treatment and T1, T2 , T3 , T4 and T7, while the T5 recorded the lowest hatch rate and thus significantly differed with all the experimental treatments.

The results of the statistical analysis indicated that there were significant differences ($P<0.05$) in the rate of intermediate hatching, the results of the treatment T6 which reached to 76.52% up to control treatment and T1 , T2, T3 , T4 and T7 were recorded 54.735, 57.111, 49.091, 59.716, 55.082 and 54.741%, respectively, but did not differ significantly with T5 which reached 71.821%, while no significant differ between control treatment and T1, T2, T3, T4 and T7. As for the rate of hatching late, the statistical analysis indicated that there were significant differences ($P<0.05$) in rate of hatching late was significantly higher for T5 which recorded 26.129% as compare with control treatment and T1, T2, T3, T4, T6 and T7 which reached 0.00, 0.00, 0.00, 2.491, 1.042, 6.748 and 4.274%, respectively. The cause of decreased of proportion of early hatching at lengthening the duration of storage to 14 days may be due to delayed embryonic development of storage eggs for a long period, which does not happen directly after being placed in the incubator and provide a normal temperature degree in incubator (Arora and Kosin, 1966), possibly due to the increase in non-developing cells ratio compared to developing cells (which have the ability to life) and may increase the preparation of deformed cells or dead, which reduced the number of embryonic cells viable to grow normally for chick growth and developed which reducing the metabolic rate in the fetus and thus an increase in the length of incubation eggs incubation because of the weakness of fetal development and thus the weakness of hatching chick (Fasenko, 2007; Hamidu *et al*, 2010; Tag El-Din *et al*., 2017), the low rate of hatching early when the length of storage period to decreasing levels of T3 and T4 hormones in storage egg for a long period because these embryos are slow in embryonic development compared to storage egg for short period which is caused by delayed hatching period for storage eggs for a long period before incubation (Tona *et al*., 2003) and the reason for the high rate of early hatching in eggs exposed to heat before or during storage and storage for 14 days may be due to heat can improve the vitality of the embryos during the incubation period (Lotfi *et al*., 2011), also, the treatment of egg to heat before or during the period of storage may lead to the progress stage of the evolutionary embryo that up to the stage where the fetus is then able to survive and has the ability to repair and regeneration of embryonic cells and minimize damage caused by the length of storage period and therefore my lead to the shortage of the length of total storage period (Wade And Andrew, 2017). The exposing hatching eggs to heat before or during storage may play a role in raising the level of thyroid hormones T3 and T4 in embryos because the thyroid hormones are involved in many physiological processes such as regulating the temperature and let fetus reach the stage of pulmonary breathing and preparation of the breathing process also regulating the metabolism after hatching (Ebeid *et al*., 2017). Our results is agree with Tona *et al*. (2003) whom found that storage egg for a period of 18 days which delay period of hatch or the longer incubation period at least 15 hours compared with egg storaged for a period of 3 days, which are associated with higher hormone corticosterone, which are necessary to increase the of T3 and T4 hormons which has a role to complete the puncture process and increase the concentration of gas Co_2 and low the oxygen, Our findings agree with Yildirim (2005), which indicated that the delay of the period of hatching when hatching eggs stored for 14 days, and with Boerjan (2010), which indicated that storage of hatching eggs for more than 7 days led to an increase in the period required for hatching. Our results agree with the Al-Kerwi (2018), who indicated that there was a significant effect between the exposure of hatching eggs to heat and the length of the storage period, led to reduced period required for hatching by exposing hatching eggs to heat for 4 and 8 hours and storage for 4 and 8 days compared to non-heat eggs. But it is not agree with to Abdel-Halim *et al*. (2015) Which showed no significant differences at the period of hatching for eggs hatching of the Arbor Acresstrain at the age of 29 weeks when storing hatching eggs for 7, 14 and 21 days at 17°C and 75% RH. While our results match with Wiggins (2008), which showed that the exposure of the eggs of Ross 708 broiler breeder to heat in Pre-storage temperature of 37.5 ^{o}C for 9, 12 and 15 hours and stored for 3 days at 15.5°C reduce the period required for hatching compared with non-heat eggs before storage, as agreed with Lotfi *et al*. (2011) who found a significant effect at the period of hatching when exposing the quail eggs for heat 37 °C For 6 and 12 hours and then stored at 12°C and 70% RH, for two days which reached 416.6 and 414.2 Hour respectively, compared with eggs unexposed heat and storaged for the same period, which amounted to 421.4 hours and attributed the reason for this to provide for moral development with increased duration of fetal exposure to heat before eggs stored , agree and with

Dymond *et al*. (2013) who demonstrated a period decrease in hatching for hatching eggs exposed to heat 37.5 °C for 4 hours every 4-5 days during the storage period of 21 days at a temperature of 16-18 °C and 75% RH, which amounted to 504 hours (length of incubation) compared to hatching eggs for same period and exposure to heat 37.5 ºC for 6 and 12 hours before storage and hatching eggs non heat treated which storage at same condition 507, 508 and 518 hours respectively. While our results are not agree with Dowden (2009), who not found any significant effect in the period to hatch when exposing hibber classic hatching eggs to heat 37.5 ^{o}C for periods 0, 30, 60, 90, 120 and 150 minutes per day and for a period of 3 days and storage at 15.5 ^{o}C with 60% RH for 4 days, and the same results when exposing the hatching eggs for periods 0, 30, 60, 90, 120 and 150 minutes per day and for a period of 5 days and storage for 6 days, but our results did not agree with Abdel-Halim *et al*. (2015) who note that exposing the hatching eggs of heat before or during. The storage period to 21 days did not have a significant effect on the length of the egg incubation compared to hatching eggs treated on non treated to heat for the same storage period. As well as Damaziak *et al.* (2018) showed that there was no effect at the period of hatching when exposing hatching eggs at a temperature of 30 °C and 50-55% RH for 4 hours every 5 days during the 12-day storage period.

Table 1 : Effect of the period of storage and exposing the eggs of the broiler breederof Ross 308 for heat before or during storage in hatching ratio of total eggs, fertilized eggs, fertility rate, egg piped, and percentage of embryonic mortality of the predators (average ± standard error).

Traits [1]	**Hatchability of total eggs (%)**	**Hatchability of fertile eggs (%)**	**fertility (%)**	**Piped eggs %**	**embryonic mortality (%)**
Control	82.669 ± 2.128	87.473±1.563	94.481 ab±0.812	0.000±0.000	12.527±1.563
T1	84.348±5.632	85.596±4.878	98.450 a±1.550	1.588±0.794	12.816±5.275
T2	87.597±3.379	91.071±2.253	96.124 ab±1.550	0.000±0.000	8.929±2.253
T3	82.171±6.345	88.816±4.115	92.248 b±3.100	2.527±1.410	8.657±4.713
T4	89.147±0.775	92.025±1.548	96.899 ab±0.775	0.794±0.793	7.182±1.341
T5	77.519±5.426	81.156±3.777	95.349 ab±2.685	1.588±0.794	17.255±3.998
T6	81.395±2.325	87.500±2.500	93.023 ab±0.000	0.833±0.833	11.667±0.004
T7	79.845±5.426	84.514±6.315	94.574 ab±0.775	0.000±0.000	15.488±6.315
Significant level[2]	N.S	N.S	*	N.S	N.S

(1) Control (storage hatching eggs for 3 days),T1 (Heat treating to hatching eggs for 6 hours and storage for 3 days), T2 (Storage of hatching eggs for 7 days),T3 (Heat treating to hatching eggs for 6 hours and storage for 7 days),T4 (Heat treating to hatching eggs for 3 hours every 3 days during the 7-day storage of period),T5 (Storage hatching eggs for14day),T6 (Heat treating to hatching eggs for 6 hours and storing for 14 days),T7 (Heat treating to hatching eggs for 3 hours every 3 days during the 14-day of storage period)
(2) The different letters within the same column mean that there are significant differences between the averages.
*At a significant level of 0.05. NS Means no significant differences.

Table 2 : Effect of the period of the storage and exposing eggs of the broiler breeder of Ross 308 to heat before or during storage at the period of early, intermediate and late hatching of the hatched broiler eggs (mean ± standard error).

Traits 1	**Hatch period**		
	Early %	**Middle %**	**Late (%)**
Control	45.265 ab±2.315	54.735 c±2.315	0.000 b±0.000
T1	42.889 ab±4.791	57.111 bc±4.791	0.000 b±0.000
T2	50.909 a±2.294	49.091 c±2.294	0.000 b±0.000
T3	37.793 b±6.107	59.716 bc±4.995	2.491 b±1.294
T4	43.876 ab±2.625	55.082 c±2.800	1.042 b±1.041
T5	2.020 d±2.020	71.821 ab±10.126	26.159 a±10.414
T6	16.722 c±3.541	76.529 a±2.780	6.748 b±1.996
T7	40.984 ab±2.123	54.741 c±3.911	4.274 b±2.737
Significant level[2]	**	*	*

(1) Control (storage hatching eggs for 3 days), T1 (Heat treating to hatching eggs for 6 hours and storage for 3 days), T2 (Storage of hatching eggs for 7 days), T3 (Heat treating to hatching eggs for 6 hours and storage for 7 days), T4 (Heat treating to hatching eggs for 3 hours every 3 days during the 7-day storage of period), T5 (Storage hatching eggs for14day), T6 (Heat treating to hatching eggs for 6 hours and storing for 14 days), T7 (Heat treating to hatching eggs for 3 hours every 3 days during the 14-day of storage period)
(2) The different letters within the same column mean that there are significant differences between the averages.
* At a significant level of 0.05. ** at a significant level 0.01

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