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EFFECT OF USING DIFFERENT PRE-STORAGE WARMING TIMES ON HATCHABILITY OF WHITE HISEX BREEDERS' EGGS

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ABSTRACT

It is well known that commercial hatcheries set their eggs after days of storage which increases the incubation duration, decreases hatchability, chick quality and growth performance. The objective of this experiment was to study the effect of different pre-storage warming (PRESW) times on hatchability, embryonic mortality and chick grades of White Hisex layer breeders' eggs. A total of 1200 eggs were collected from a flock at 67 weeks of age. Eggs were divided into four groups of 300 eggs each according to their warming time (0 hour as control, 2 hours, 4 hours and 6 hours, respectively). These groups were further subdivided into four replicates. of 75 eggs each and were assigned to the completely randomized design (CRD). Eggs were incubated at 37.5°C. All eggs after warming were stored for two days in a cooler at 18°C and a relative humidity of 75%, they were then incubated in (Pas Reform) setter for 18 days and hatcher for three days. At the end of the hatching process hatched chicks were graded (1st and 2nd grade chick); pipped - hatched eggs were then removed and counted. The remaining unhatched eggs were broken to determine fertility and embryonic mortality. Results indicated that pre-storage warming of hatching eggs at 37.5°C for 4 hours significantly ($P \leq 0.01$) reduced early dead embryos and total unhatched eggs. The first grade chicks were significantly ($P \leq 0.01$) higher in pre-storage warming eggs. It is concluded that 4 hours PRESW improved hatchability percentage as it decreased embryonic mortality percentage, increased the number of saleable first grade chicks which by far increases profits.

Keywords: Breeder eggs, Fertility, Hatchability, Egg storage, Unhatched, Chick quality.

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Contribution/ Originality

This study is one of very few studies which have investigated the effect of pre-storage of hatching eggs after laying on hatchability, embryonic mortality and chicks' quality in the region and it is the first one in Sudan.

1. INTRODUCTION

The increasing demand for poultry products and the associated cost of feed and energy along with the economic downturn has encouraged the commercial poultry industry to become more efficient and economical. Currently hatching eggs (HE) are stored between 1-3 days prior to setting, which ensures that the incubator will be filled to capacity. This procedure produces a large hatch quantity in a shorter time with decreased associated costs. There had been several previous projects dealing with pre-storage heating throughout the years. However, the majority of these trials attempted to increase hatchability in HE that were either stored for extended periods of time or in that laid by post-peak broiler breeders. Warming HE prior to storage may increase the development stage of fertile eggs from older broiler breeders to an inactive stage helping them to withstand storage [1]. It is well known that HE are often stored on farms or hatcheries to minimize transportation costs, or to provide enough egg to fill large incubators [2]. However, the storage of HE for more than a week is known to increase embryonic mortality and abnormalities due to the degradation of viscosity of egg albumen [3]. Longer storage periods lead to longer incubation period, impairing embryo development and livability, hatchability, chick quality and chick weight Christensen, et al. [4]; Ruiz and Lunam [5]; Elibol, et al. [6] and Tona, et al. [7]. Therefore, pre-heating of poultry HE before storage resulted in improved hatchability, more live chicks and lower levels of embryonic mortality compared to that not heated [8], [9]. As HE remain at room temperature after lay, embryos stop development at stages characterized by the complete formation of zona pellucid, but later, as temperature and relative humidity increase during incubation, embryo development is resumed. However, there is higher embryo livability and hatchability, and shorter incubation period when hypoblast stage is achieved before long storage periods. Before storage heating of chicken eggs for six hours, allows the complete formation of hypoblast [10]. However, in Sudan, very little information concerning the effect of pre- warming of HE is known.

The general objective of this experiment was to study the effect of pre-storage warming on hatchability. The specific objectives were to determine the best time of pre-storage incubation warming and their effect on embryonic mortality chick grades.

2. MATERIALS AND METHODS

This experiment was carried out in the hatchery unit of Coral Company for Feed and Chicks Production. Hatching eggs (HE) were collected from White Hisex layer breeder flock, 67 week of age. The flock was raised in closed system of housing. Natural mating was practiced; the ratio of

males to females was 1:10. The eggs were collected three times a day and were immediately transported to the hatchery.

2.1. Experimental Design and Layout

A Total of 1200 fertile eggs without shell abnormalities were selected and used in this experiment. The eggs were randomly divided into four treatment groups of 300 eggs each. Each group was further subdivided into four replicates of 75 eggs each, placed in setting trays.

Hatching eggs in the control group (treatment one) were immediately placed in the egg storage room at 18°C and relative humidity 75%. The other three treatments [2-4] were placed in a Pas Reform, setter type Corridor 57, 2002, Zeddam operating at 37.5°C. The treatment groups were removed after 2, 4 and 6 hours of warming respectively and transferred to the egg storage room.

2.2. Incubation Management

After two days of storage, HE were pre-heated at 27C for twelve hours, disinfected for 20 minutes using 3.2 gm/m3 Elphagen powder which was heated in an electric pan to 105°C in the fumigation room. The temperature was maintained at 25°C and relative humidity 70%, then the eggs were setted in a forced-draft air incubator (Pas Reform, type Corridor 57, 2002, Zeddam) at 37.8C and 60% RH for 18 days using single stage incubation program of layer egg . Level and position of the different treatments and replicates were randomly assigned inside the incubator (setter).On day 18 of incubation, HE were candled and clear eggs were removed and opened to determine macroscopically infertile or stage of embryonic mortality to calculate true fertility. After candling, HE with living embryos were transferred to the hatchery baskets and were placed in the Hatcher cabinets (Pas Reform, Tiros, 2002, Zeddam) in which the temperature and relative humidity were adjusted at 36.6°C and 75%RH.

2.3. Data Collection

Hatching was completed by the end of day 21. At the end of the hatching process hatched chicks and pipped eggs were removed and counted. All chicks were classified as first or second grade chicks based on the physical parameters. A chick was classified as a first grade chick if it was clean, dry, free of deformities or lesions, had bright eyes. The other chicks were classified as second grade chicks. The remaining unhatched eggs were broken to determine the stage of embryonic mortality. On the 18th and 21thday of incubation the following periods and phases of embryonic mortality were used to classify the dead embryos: Days 1 – 7 (white membrane over the yolk, blood ring).Days 8 – 14 (black eye visible, embryo without down).Days 15 – 21 (small embryo with down, full grown embryo with yolk out or full grown dead embryo) [11].

Using these data, the investigated variables can be determined as follows:

-True Fertility (%) = Number of fertile eggs/total number of eggs set X100

-Hatchability eggs set (%) = Number of chicks hatched / total number of eggs set X 100

-Hatchability of fertile eggs (%) = Number of chicks hatched / total number of fertile eggs X100

-Early phase mortality (%) = Number of embryos died in early phase / number of unhatched eggs X100

-Middle phase mortality (%) = Number of embryos died in middle phase / number of unhatched eggs X100

-Late phase mortality (%) = Number of embryos died in late phase / number of unhatched eggs ×100

-Pippedunhatched eggs (%) = Number of pipped eggs / total number of unhatched eggs ×100

-First grade chicks (%) = Number of first grade chicks /number of chicks hatched×100

-Second grade chicks (%) = Number of second grade chicks /number of chicks hatched×100 [12]

2.4. Statistical Analysis

Statistical analysis was done using SPSS computer software 17.0 [13]. A completely randomized design was used to analyze the data. Analysis of variance was done as described by Steel, et al. [14]. L.S.D tests were used to determine the differences among the treatment means.

3. RESULTS AND DISCUSSION

3.1. Fertility Percentage

Fertility results are shown in Table (1). True fertility was not a response variable in this particular experimental research, as fertilization of eggs occurred in the hens at the breeder farms. However, true fertility represents an important ratio that indicates the productivity of breeder flock, as it is necessary in calculating embryonic mortality and fertile hatchability. Data of apparent fertility are showed highly significant ($P \leq 0.01$) difference due to PRESI. This result was in agreement with Petek and Dikmen [2] who found significant differences in apparent fertility using different pre-storage incubation times.

3.2. Hatchability of Fertile and Total Eggs Set

Hatchability of fertile eggs (fertile hatchability) and hatchability of total eggs set are presented in Table (1). Results showed significant ($P \leq 0.01$) differences in both traits. Higher percentages of total hatchability and fertile hatchability were reported for the group exposed to pre-storage warming for four hours which were (79.03%, total hatchability and 87.18%, fertile hatchability). However, the lowest percentage of total hatchability and fertile hatchability for other groups (0 hour, and 6 hours) were 72.98%, total hatchability, 81.03%, fertile hatchability for 0 hour group, and that to 6 hours group were 74.3%, total hatchability and 82.6%, fertile hatchability. These results agree with Lotfi, et al. [15] who found that warming quail eggs for short-term before storage increased total hatchability and decreased incubation length without any negative effect on chick quality.

Table-1. Effect of pre-storage warming time on percentage of fertility and hatchability of White Hisex breeders' eggs

Parameters	Treatments				P
	0 Hr	2 Hr	4 Hr	6 Hr	
Apparent fertility	83.98±1.89^{b}	87.68±1.24^{a}	89.00±1.29^{a}	87.00±1.67^{a}	**
True fertility	90.00±1.73	90.35±0.70	90.68±1.10	90.00±0.81	NS
Total hatchability	72.98±0.65^{c}	76.00±1.06^{b}	79.03±0.65^{a}	74.33±1.30^{c}	**
Fertile hatchability	81.03±1.59^{c}	84.13±0.79^{b}	87.18±0.62^{a}	82.60±1.36^{bc}	**
Apparent fertility	83.98±1.89^{b}	87.68±1.24^{a}	89.00±1.29^{a}	87.00±1.67^{a}	**

Means in rows followed by different superscript letters are significantly different at P = 0.05.

These results also are in accordance with that reported for different species of poultry with reference to egg storage and pre-storage warming time [9]; [10]; [16]. These authors indicated that hatchability improved by pre-storage warming of hatching eggs. Also Reijrink, et al. [17] found significant effect of pre-storage warming time X egg storage interactions for total hatchability, fertile hatchability and embryonic mortality of broiler breeder HE. Lourens, et al. [18] as well confirmed a positive effect of pre-storage warming time on hatchability of broiler breeder eggs. In quail eggs, seven hours of pre-storage warming for two days stored HE as a short-term storage period, improved hatchability percentage as it decreased embryonic mortality rate [19]. Due to these findings along with results obtained by Gamble, et al. [20], a pre-storage warming protocol might increase hatchability in the commercial industry.

3.3. Embryonic Mortality

Results of embryonic mortality are shown in Table (2). It was found that eggs subjected to pre-storage warming for 4 hours had lower embryonic mortality through periods of incubation as compared with those subjected to 2 hours or 6 hours or un-warmed eggs(control). Early embryonic death was significantly affected ($P \leq 0.01$) by treatment (figure 1). However, mid-dead and late dead were not significantly ($P > 0.05$) affected by treatment. Pre-storage warming for 4 hours significantly ($P \leq 0.01$) reduced early embryonic mortality which was (7.35%). However, pre-storage warming at 2hrs, 6hrs, and control recorded (9.0%, 10.0%, and 10.68%, respectively).

Table-2. Effect of pre-storage warming time on embryonic mortality of White Hisex breeder eggs

Parameters			Treatments		P value
	0 Hr	2 Hr	4 Hr	6 Hr	
Early dead	10.68±1.10^{a}	9.00±1.29^{b}	7.35±0.75^{c}	10.00±0.81^{ab}	**
Mid dead	2.00±0.81	1.65±0.70	1.30±0	2.00±0.81	NS
Late dead	2.35±0.70	2.00±0.81	1.65±0.70	2.00±0.81	NS
Early dead	10.68±1.10^{a}	9.00±1.29^{b}	7.35±0.75^{c}	10.00±0.81^{ab}	**

Means in rows followed by different superscript letters are significantly different at P=0.05

As shown in (Figure 1) the total mortality rates of embryos were lower for group of eggs exposed to 4 hours which was (10.3%). However, the highest embryonic mortality rates were recorded by groups exposed to zero or 6 hours pre-storage warming which were (15.03% and 14.0%, respectively). These results are in accordance with Petek and Dikmen [21] who showed that total mortality rate of embryos of pre-storage warming of quail eggs did not significantly different according to the duration of storage. Furthermore, pre-storage warming did reduced embryonic mortality significantly using 0.0 hour pre-storage incubation time which was (10.96%) versus 8 hours which (7.72%). Also, Laurens [9] and Petek and Dikmen [21] observed that pre-storage warming of poultry eggs resulted in more live chicks and lower level of embryonic mortality. In quail eggs, 7 hours of pre-storage warming for two days stored eggs as a short-term storage period, improved hatchability percentage as it decreased embryonic mortality rate [19].

Total embryo mortality was significantly ($P \leq 0.01$) the highest in the control group. However, these finding were consistent with findings of Petek and Dikmen [2] who indicated that total embryonic mortality rate during incubation were significantly affected by pre-storage incubation warming and egg storage periods. They found that embryonic mortality of eggs of 5 hours pre-storage incubation warming was lower compared to the control group (0 hour) which were (10.96% versus 7.72% for the control versus 5 hours, respectively).

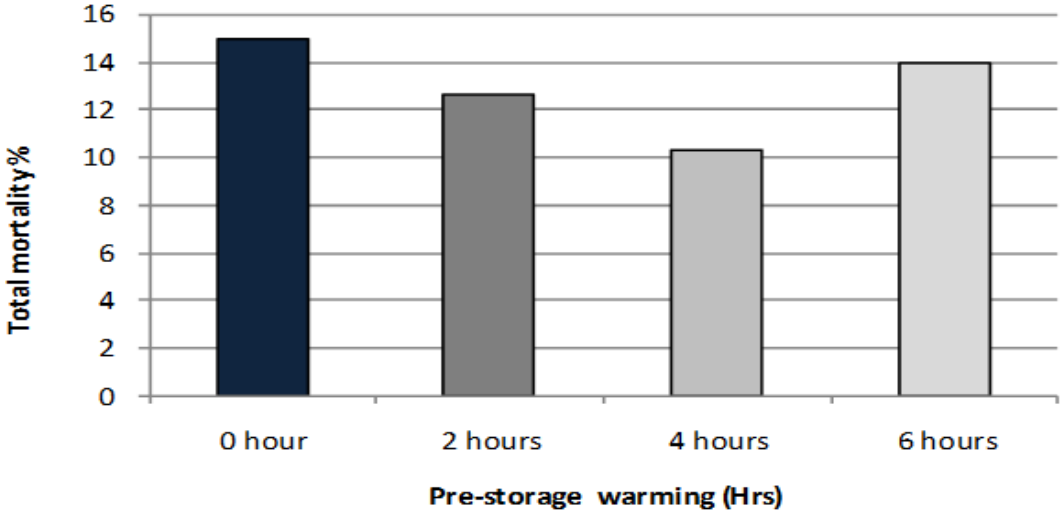

Figure-1. Effect of pre-stronge warming tiem on embrtyonic mortality of White Hisex breeder eggs.

3.4. Pipped Un-Hatched Eggs

As shown in figure (2) the pipped un-hatched embryos were not significantly ($P > 0.05$) affected by pre-storage incubation warming time. These findings disagree with that of Silva, et al. [16] who reported that warming eggs for six hours resulted in the lowest pipped egg percentage of eggs stored for nine and 14 days. Pipped eggs percentage decreased as the storage period increased, this might be due to the fact that the time of storage in this experiment was not long

enough to express the effect of pre-storage incubation in affecting the rate of pipped unhatched embryos stored for a long time (9-14 days) and were heated for different times. However, the number of pipped unhatched embryos was less on eggs warmed for 4 hours.

3.5. Chicks' Grades

As shown in figure (3) the chick grades percentage was significantly ($P \leq 0.01$) affected by pre-storage warming where the first grade chicks were highest for the HE warmed for 6 hours whereas the control group recorded the lowest percentage. These results are in accordance with Reijrink, et al. [17] who suggested that pre-storage warming can be positive or negative for chick quality in dependence of pre-storage incubation time. Also, Marandure, et al. [8] found that pre-incubation of broiler breeder HE significantly improved hatchability and post hatch chick uniformity.

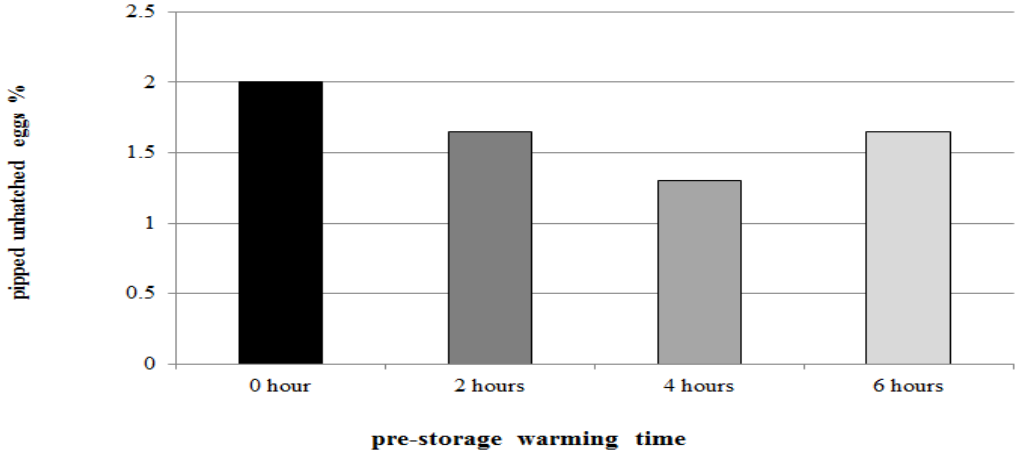

Fig-2. Effect of pre-storage warming time on pipped unhatched eggs of White Hisex breeders' eggs

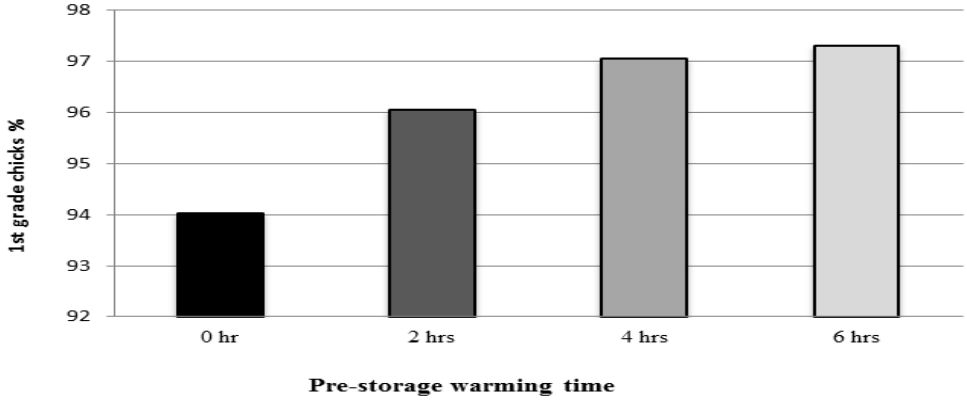

Fig-3. Effect of pre-storage warming time on chicks grading of White Hisex breeders' eggs

4. CONCLUSION

The result of this study showed that warming hatching eggs of White Hisex breeders at 37.5C for four hours before storage improve hatchability, reduce embryonic mortality and increase the percentage of first grade chicks.

It is recommended to warm hatching eggs before storage to preserve embryonic vitality and improve hatchability. Further study should be conducted on the interaction between the length of storage period and pre-storage warming time and their effects on hatchability and chick quality.

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