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STORAGE PERIOD AS AFFECTS WEIGHT LOSS AND HATCHABILITY OF FERTILE EGGS OF AN EXOTIC LAYING BIRD IN THE DERIVED SAVANNA ZONE OF NIGERIA

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Abstract: This research work was conducted to examine the effects of storage period on proportion of weight loss and hatchability of fertile eggs of exotic laying hen. Eight (8) matured breeder Cocks and fifty (50) hens were used for the experiment. Artificial insemination method of mating was used. A total number of 180 eggs over a period of six (6) different days (0, 1, 3, 5, 7 and 9 days) were initially stored at temperature of 15°C. After setting in the incubator, candling was done on day 3 and 18 to detect fertile egg and developed embryo respectively. Egg weights at fresh and subsequent interface were also monitored. On day 21, number of chicks hatched was noted and their weights were determined. Also, data on the number of fertile eggs, die back, dead in cell embryos all were documented and subjected to analysis of variance (ANOVA) using the general linear model of SPSS, 2010. The result showed that percentage weight loss before setting was significantly ($P<0.05$) increased with increasing storage time, so also the percentage weight loss during incubation and percentage total weight loss. Percentage fertility, percentage died back and hatchability were all exhibit significant difference ($P<0.05$). It could be concluded from this work that prolonged storage period beyond 7 days had significant effects on the percentage weight loss and hatchability of fertile eggs of layer birds.
Keywords: Fertile egg, Storage, Chick, Chick quality.

INTRODUCTION

Fertile eggs are eggs that are capable of hatching. They are eggs that have been fertilized and have formed embryo at ovipositor. Beaumont (1992) reported the measure of fertility as the number of fertile eggs and hatched during a 21 days incubation period after artificial insemination which is an important tool to improve reproductive performance of birds. It is a three-step procedure involving semen collection, semen dilution and insemination. The fertility of an egg is affected by factors originating from the hen such as her ability to mate successfully, to store sperm, to ovulates egg cell and to produce a suitable environment for the formation and development of the embryo (Brillard, 2003). Fertility also depends on her mate's ability to mate successfully, quantity and quality of semen deposited (Wilson and Eldred, 1997; Brillard, 2003). These factors (from both sexes) also seem to be subject to the age of the bird (Hocking and Bernard, 2000; Gumulka and Kapkowska, 2005). Fertility and

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hatchability are the major determinant of profitability of a hatchery enterprise (Peters *et al*., 2008). Meijerhof (1992) reported that during storage, hatching is influenced by the storage duration, storage temperature, positioning of the eggs, humidity and other environmental factors. Normally eggs are stored either at the hatchery or at the breeder farm. In most farms, the hatchery and the breeder farms are considerably separated from each other. The distance between them, coupled with the limited number of eggs, they may be stored longer in the hatchery until they are enough to fill large incubator racks, or when there is egg in excess than what the racks can accommodate and with this, the efficiency of space is optimized and hatching cost is assumed to be reduced. Romao *et al*., (2008) reported that quail eggs showed better hatchability until 10 days of storage and that eggs offered for storage have a reduced weight loss during incubation period. For chickens, it was recommended that pre- incubation storage has no effect on hatchability, when storage time is shorter than 8 days, the detrimental or beneficial effect of pre- incubation storage was noted when storage time was prolonged (Reijrink *et al*., 2009). Some negative changes in egg quality of all poultry species have been reported due to prolonged storage time. For example, water loss from eggs was related to hatchability results in pheasants (Kozuszek *et al*., 2009). Generally, if eggs are stored for a number of days their quality and hatchability is affected (Petek *et al.*, 2003).

Storage of eggs for more than a week is known to increase embryonic abnormalities and mortality due to the degradation of the viscosity of egg albumen (Muhammad *et al*., 2014). This research therefore aimed to determine the influence of storage period on weight loss and hatchability of fertile egg of a breeder laying chicken.

MATERIALS AND METHOD

The experiment was carried out at the poultry unit of Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria. Eight matured breeding cocks and 50 Isa-Brown hens were used to carried-out the experiment. The breeding stock was fed a well-balanced diet as required in order to fully meet the embryos' nutrient requirement. Medications were given to them as required. Cool and clean water was available for *ad-libitum* consumption. Artificial insemination was adopted in mating the hens, the cocks were massaged so as to stimulate and initiate the collection of semen. The semen collected from the cocks was inseminated immediately into the cloaca of the hens, insemination was repeated every seventy-two hours. Eggs collection began 48 hours after first insemination. Twenty (20) fresh eggs without spot, dirt free were selected from the picked eggs daily and stored on six (6) different storage periods (0, 1, 3, 5, 7 and 9 days).

Eggs were weighed individually and weight was recorded as their initial weights before being stored in the cool room of 15°C. The eggs were stored with the pointed end down for the appointed periods.

The eggs were arranged according to the storage periods in the setter with their storage periods indicated on the eggs. Eggs were set in the incubator with the broad end up and at a temperature of 37°C and a relative humidity of 76% for the first 18 days, then 67% for the last 3 days in the hatcher. On the 18th day of incubation, egg candling was carried-out. Each group of eggs was set on the Candler and a ray of light passed through the eggs. The fertile eggs were seen to be densely clouded and fully opaque, indicating development of embryo within the eggs while the eggs which did not exhibit signs of embryo development (Infertile) were removed, likewise those that were partially developed i.e Half opaque (Die back). Numbers of infertile eggs and early embryonic mortality in each group were recorded. While eggs with developed embryo were immediately transferred into pedigree hatching baskets for hatching which had been partitioned with perforated cardboard according to their storage period before being set in the incubator. On day 21, the hatched was pulled and chicks left to dry. After hatching, percentage hatchability was calculated. Data collected were subjected to analysis of variance (ANOVA) using the general linear model of SPSS, 2010. Means were separated using Duncan multiple range test of same package.

RESULTS AND DISCUSSION

Storage period of fertile eggs significantly influenced ($P<0.05$) the weight loss and hatchability of fertile egg (Table 1).

The result obtained showed that significant differences ($P<0.05$) existed in the mean values obtained from the percentage weight loss before setting, during incubation and total weight loss. The proportion of weight loss during storage time steadily increased from 0.09 in day 0 to 2.67% in day 9 with day 5 (2.13%) and day 7 (2.30%) significantly ($P>0.05$) similar. The weight loss observed in this present research was in line with the report of Reijrink *et al.*, (2009) for broiler breeder eggs when stored at 16°c -18°c for 15 days and the report of Gonzalez (2010) for Red-legged partridge eggs when stored at cool room temperature 15°c and 80% relative humidity. Many previous studies or authors reported similar results that, long storage periods increase the percentage weight loss of both the table and hatching eggs (Scott and Silversides, 2000). These observations following the logic that long-term stored eggs may lose weight due to moisture loss which may affect the viability of the eggs (Demirel and Kirikçi, 2009). This corroborate the findings of other authors viability of the

eggs is impaired, corroborate the findings of other authors for pheasants. (Kozuszek, *et al*., 2009)

Fresh eggs (0 day) loss 7.03% during incubation process while fertile egg stored for 9 days loss 10.00% of its weight. The Percentage weight loss during incubation process also increases significantly (P<0.05) as the storage length increased indicating that the storage period has corresponding influence on the weight loss of the eggs even after setting of the egg. Percentage total weight loss was not significantly (P>0.05) influenced by storage periods from day 1 up to 7 days but significantly (P<0.05) increased at day 9 storage period. Therefore, highest percentage total weight loss (12.66%) was recorded from egg stored for 9 days while least percentage total weight loss was recorded in eggs stored for 0 day (7.13%).

Percentage fertility observed in this study was influenced (P<0.05) by the egg storage periods. Highest percentage (93.33%) fertility was recorded in egg stored for 0 day, followed by those stored for 5 day (90.00), after which it depreciates to 83.33% on 7 days and 50.00% in day 9 storage period. However, 70.00% fertility was recorded in day 3 which may be as a result of improper insemination or effect of any other management practices. The fertility or infertility of egg is being determined before the egg is laid, therefore ordinarily, there should be no effect of storage period on fertility but the observed effect of storage period may be explained by the degeneration of early embryonic cells during long time storage period before incubation because egg showing no blood vessel during candling was considered infertile although it might be initially fertile (Muhammad *et al.*, 2014).

Differences in die back (late embryonic mortality) were found to be significant (P<0.05) due to the effect of egg storage duration. Most of the deaths were recorded from eggs stored for 9 days. This result (61.67) of embryonic mortality of eggs stored for 9 days showed evidently lower hatchability and higher mortality during incubation process at that storage duration. Similar finding was reported by Petek and Dikmen (2006), who reported that most embryonic deaths were observed in broiler breeder eggs stored for 15 days as compared to 5 days storage periods. Some studies showed that early and late embryonic death was increased with an increased egg storage periods, which were attributed to the degeneration of embryonic cells that occurred during storage period. The longer the storage period, the longer the degradation (Scott and Mackenzie, 1993. Elibol *et al.*, 2002).

Dead in shell (piping mortality) was also significantly different (P<0.05). However, no definite trend was observed, indicating that the mortality cannot be totally attributed to the storage period or condition. Early embryo mortality, late embryo mortality and piping

mortality (dead in shell), more often hatchery managers lacking training get confused with clear eggs and add them to the infertile eggs. These clear eggs are as a result of mortalities emanated from advanced blastoderm development (Khan *et al*., 2014).

The current study also showed that the hatchability of fertile eggs decreased, and early-mid-late embryonic deaths increased from fertile eggs stored for 9 day, due to water loss and albumen degradation during storage. Longer periods of storage will increase the spread of time over which hatching takes place and this may influence the total hatchability and overall quality of chicks (Hassan *et al*., 2005).

Best percentage hatchability was obtained from 5 days storage period, after which the hatchability significantly ($P<0.05$) reduced. The recorded lower hatching percentage at day 3 (37.89) could be attributed to hatchery management practices and problems from which this result was obtained. There is no doubt that up to 5 days storage period, the hatchability was reasonably okay with day 1(63.89) and day 5 had the highest hatchability potential (68.9). Meanwhile, the least value (36.11) was recorded for day 7 though statistically similar to day 3 and 9 storage period (37.89 and 36.11% respectively). Hatchability is a function of egg livability; several hatched chicks and percentage hatchability equally decrease with prolonging storage days as reported by Van de Van (2004). The main cause of low hatchability of long-stored eggs was traced to a decrease in albumen viscosity and increased pH of the albumen. Some studies on broiler breeder and quail species by Romao *et al*., (2008) and Alsobayel *et al*., (2012) also showed that increase storage period of eggs before incubation resulted in a significant decrease of hatchability percentage. The results of this study was in agreement with the results of (Khan *et al*., 2014) who studied the hatchability of Rohde Island Red eggs stored for two, three, five, seven and nine days in the cool room at 16 °C and 78% relative humidity and the hatchability percentage of 73.23, 70.7, 58.78, 26.56 and 5.65% respectively.

The percentage weight of chicks to egg was observed to be highest (83.53%) at 0day storage period while least percentage (72.93%) was recorded from 9 days storage length. Also, result obtained from day 0-7 days storage periods were found to be significantly similar ($P>0.05$). Therefore, storing eggs up to 9 days may not be encouraged since best chick proportion was noticed in days 0-7 storage period. This was in contrast with Alex *et al.*, (2018) who reported that the weight of chicks hatched in their study was not different among egg storage durations though eggs stored under cold room temperature had significantly higher chick weight than eggs stored under ambient temperature.

Conclusion and Recommendation

The result of this study has shown that prolonged storage period has negative effects on the weight loss, hatchability and chick to egg ratio of fertile egg. As the length of the storage period increases, the eggs reduce in weight and indirectly affect the hatchability index as well as chick to egg ratio. Therefore, it was recommended that storage time of fertile eggs may be extended until 7 day, but longer storage periods negatively influence hatchability and chick weight.

Table 1 Effect of different storage periods on egg weight and hatchability of fertile eggs

PARAMETERS	0	1	3	5	7	9	SEM
Weight loss before setting (%)	0.09^{e}	0.50^{d}	1.30^{c}	2.13^{b}	2.30^{b}	2.67^{a}	0.08
Weight loss during incubation (%)	7.03^{b}	8.67^{b}	7.68^{b}	7.11^{b}	7.44^{b}	10.00^{a}	0.34
Total weight loss (%)	7.13^{c}	9.15^{b}	$9.01^{\mathbf{b}}$	9.25^{b}	9.74^{b}	12.66^{a}	0.37
Fertility (%)	93.33^{a}	83.33^{b}	70.00^{c}	90.00^{a}	83.33^{b}	50.00^{e}	1.03
Die back (%)	17.78^{d}	12.50^{d}	47.83^{b}	19.07^{d}	35.64^{c}	61.67^{a}	1.51
Dead in shell (%)	25.56^{a}	23.61^{a}	14.29^{b}	$12.04^{\mathbf{b}}$	28.24^{a}	0.00^{c}	0.99
Hatched (%)	56.67^{b}	63.89^{ab}	37.89^{c}	68.89^{a}	36.11^{c}	38.33^{C}	1.48
Chick to egg weight (%)	83.53^{a}	81.15^{a}	82.27^{a}	81.74^{a}	82.09^{a}	72.93^{b}	0.37

^{ab} means along the same row with different superscripts are significantly different ($P<0.05$).

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