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RESEARCH ARTICLE

Effect of Different Storage Periods and Temperatures on the Hatchability of Broiler Breeder Eggs

A. Mahmud*, M. Z. U. Khan[1], Saima[1] and M. A. Javed

Department of Poultry Production; [1]Department of Food and Nutrition, University of Veterinary and Animal Sciences, Lahore, Pakistan
*Corresponding author: athar1122@yahoo.com

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ABSTRACT

Temperature and humidity have been the two most common variables used to manipulate the storage environment of hatching eggs. To ascertain the effects of different egg storage periods and temperatures on hatchability; 400 eggs were obtained from a broiler breeder flock of 32 weeks of age on a single day collection basis. These eggs were randomly divided into 5 equal groups of 80 eggs each. After collection these were cleaned, fumigated and stored on four temperatures viz 4°C, 16°C, room temperature (25°C) and ambient temperature (29°C). Each group was further subdivided into 4 replicates having 20 eggs each. Eggs of Group A (control) were set in incubator with temperature of 37.5°C and relative humidity 60% after the storage of one day. Eggs of rest of the four groups were set in the incubator after the storage of 3, 6, 9 and 12 days. Subsequently, these were shifted to hatchers on 18th day where the temperature and humidity were maintained at 36.5°C and 75%, respectively. The data on hatchability and dead-in-shell embryos for various groups were recorded. The results revealed that as the storage period increased at different temperatures, the hatchability decreased significantly ($P<0.01$). Similarly, as the storage time increased, the percentage of dead-in-shell embryos increased ($P<0.01$).

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INTRODUCTION

Poultry plays an important role in producing animal proteins most effectively and economically within the shortest possible time (Hosseinzadeh *et al*., 2010). Developing poultry industry on commercial lines has been considered to be a quick and economical source of producing human food of animal origin in developing countries. The broiler production, a segment of poultry industry in Pakistan, showed a tremendous increase particularly during last three decades to contribute the poultry meat production. Presently, daily per capita requirement of proteins for human beings in Pakistan is 27.4g, while the availability is only 16.63g (GOP, 2006-07). The conventional animal protein sources are becoming scarce and expensive due to multiple reasons. However, poultry can provide the short term means to fulfill the animal protein shortage in the country.

All over the world, quality chicks are obtained from the hatching eggs. The latter are selected on the basis of weight, size, shape, shell thickness and cleanliness. Various breeding practices and pre-incubation storage conditions for the hatching eggs can affect their hatchability. Temperature and humidity have been the two most important variables used to manipulate the storage environment of hatching eggs. In hatcheries, eggs are stored for varying periods until these are in sufficient numbers so as to utilize maximum capacity of the incubator which ultimately affects the hatchability. Fertility and hatchability are the two most important factors for the development of the quality chicks. Mass egg candling, grading, manipulation and better control of hatchery environment in term of temperature and humidity can improve the hatchability and subsequently, economics of the farmer in terms of quality day-old chicks. Keeping in view the above factors, a study was designed to determine the effect of storage time and different temperatures on the hatchability of broiler breeder eggs.

MATERIALS AND METHODS

A single day egg collection was made from a private breeder farm at Lahore having a flock of 32 week old

hens. Eggs were stored in the laboratory of the Department of Poultry Production, University of Veterinary and Animal Sciences, Lahore, Pakistan. These were examined for breakage or any other abnormality. Very small (<50g) and very large (>66g) eggs were rejected and 400 normal eggs were selected for experimental purpose. After collection, the eggs were fumigated with formaldehyde gas. The total duration of the experimental period was 33 days i.e., 12 days of storage and 21 days of incubation.

The selected eggs were randomly divided into 5 equal groups (A, B, C, D and E) each containing 80 eggs. Each group was further subdivided into four replicates for storage at 4 different temperatures viz. 4°C, 16°C, room temperature (25°C) and ambient temperature (29°C) comprising of 20 eggs each. The eggs of group A were set in incubator after the storage of one day and served as a control group. Eggs of groups B, C, D and E were set in the incubator after 3, 6, 9 and 12 day of storage, respectively. The temperature of incubator was maintained at 37.5°C with 60% relative humidity during the first 18 days. Eggs were turned after every hour till 18th day of incubation. The eggs were candled on 3rd, 7th and 14th day of incubation. After 18 days, the eggs were transferred from the incubator to the Hatcher. Temperature of the Hatcher was kept at 36.5°C with a relative humidity of 75%. On day 21st the hatching was completed. After drying, the chicks were taken out with same sequence and schedule as set in incubator after every 3rd day. They were counted after every hatch and shifted to the chicks holding room. The data on hatchability and dead in shell embryos for each group were recorded. The data thus collected were subjected to statistical analysis, using standard analytical procedure (Steel *et al*., 1997).

RESULTS AND DISCUSSION

Hatchability

The overall mean hatchability percentages of broiler breeder eggs in groups A, B, C, D and E stored for 1, 3, 6, 9 and 12 days were 80.0, 82.5, 72.5, 50.0 and 22.5, respectively. A decrease in hatchability was recorded with increase in storage time beyond three days. Highest hatchability was recorded for eggs of group B (82.5%) stored for 3 days and lowest in those of group E (22.5%) stored for 12 days before incubation. The hatchability on 4°C for all storage days showed non-significant difference, while at 16°C, hatchability for groups A, B, C and D was non-significantly different from each other but was significantly ($P<0.01$) higher than that for group E.

On overall basis, the highest hatchability (82%) was recorded for eggs stored at 4°C and the lowest (58%) for those stored at ambient temperature before incubation. The hatchability percentages for eggs stored at 16°C and room temperature were 66.0 and 60.0%, respectively (Table 1).

In the present experiment, a relationship was observed between storage duration, storage temperature and the hatchability of eggs. With increase in temperature and storage time, the hatchability decreased.

Regarding storage of eggs prior to incubation, Juarez (1996) reported similar findings as in this experiment. The eggs stored at room temperature (25°C) up to 3 days showed higher hatchability as compared to the eggs stored at ambient temperature (29°C). Luykx (1994) reported that eggs stored for 3 days showed better hatchability compared to those stored for 10 days. According to Romao *et al.* (2008), the egg hatchability of meat type and egg type quails was around 84% until 10 days of storage at 20°C, and then decreased significantly, whereas in the present study, there was a significant decrease (80 to 30%) in hatchability when the duration of storage was increased from 3 to 12 days at 16°C.

Wilson *et al*. (1997) reported that increased storage time drastically decreased the hatchability, although storage for up to 7 days had relatively little effect. In the present study, a significant ($P<0.01$) decrease in hatchability was observed in eggs stored for 6 or more days at room temperature (25°C), for 9 or more days at ambient temperature and for 12 days at 16°C. No difference was observed in hatchability of the eggs stored at 4°C up to 12 days.

Dead-in-shells embryos

Highest percentage of dead-in-shell embryos was found in eggs of group E (52.5%) stored for 12 days, followed by group D (32.5%), group C and group A (7.5%). Minimum dead-in-shells were found in group B (5%), where eggs were stored for 3 days before incubation (Table 2). Significant ($P<0.01$) differences were observed among all the groups except groups A and C. It was also observed that dead-in-shell percentage increased significantly as the storage time on different temperatures increased after 6 days (Table 2).

The dead-in-shell percentage on 4°C for all storage days showed significant ($P<0.01$) difference, except for day 3 and 6 when no dead-in-shell embryos were found. At 16°C, groups A and C had similar dead-in-shells but significantly ($P<0.01$) lower than groups D and E. There were no dead-in-shells embryos in group B. The dead-in-shell percentages of groups B and C at room temperature were similar, while groups D and E had significantly higher ($P<0.01$) dead-in-shell values compared to the former two groups. There were no dead-in-shell embryos in group A. At ambient temperature, percentages of groups A, B and C were similar but were significantly lower ($P<0.01$) than those of groups D and E (Table 2). Thus, as the storage time increased, the dead in shell increased accordingly.

The overall average dead-in-shell percentages on different temperatures Viz. 4°C, 16°C, ambient and room temperatures were 16.0, 22.0, 22.0 and 24.0, respectively. The highest (24.0%) dead-in-shell percentage was recorded at room temperature and the lowest (16%) at 4°C storage temperature.

According to Venkatasubramanian *et al.* (1980), 1440 White Leghorn eggs, taken from two hatches in July-August and from 3 hatches in December-January, were allotted at random 2-4 pre setting treatments and stored at 21.1°C and 80% relative humidity. The dead-in-shell embryos were 24.02%. However, in the present study, the highest dead-in-shell percentage was recorded at room temperature (25°C) and lowest at 4°C (16%). This shows that as the storage time increases, the dead-in-shell percentage also increases. Baumgartner *et al.* (1978) and Brah and Sandhu (1984) also reported that dead-in-shell increased with the increase in storage period.

Table 1: Hatchability in different storage groups

Groups	Days of storage	Hatchability on different temperatures (%)				Overall hatchability of groups (%)
		4°C	16°C	Room	Ambient	
A	1	80[a]	70[a]	90[a]	80 [a]	80[a]
B	3	80[a]	80[a]	90[a]	80 [a]	82.5[a]
C	6	80[a]	80[a]	60[b]	70 [a]	72.5[b]
D	9	90[a]	70[a]	40[c]	40[b]	50[c]
E	12	80[a]	30[b]	20[d]	20[c]	22.5[d]
Overall hatchability at different temperatures (%)		82	66	60	58	

Values in the same column with different superscripts differ significantly (P<0.01).

Table 2: Dead-in-shell values in different storage groups

Groups	Days of storage	Dead-in-shell on different temperatures (%)				Overall dead-in-shell values of groups (%)
		4°C	16°C	Room	Ambient	
A	1	10[a]	10[a]	-	10[a]	7.5[a]
B	3	-	-	10[a]	10[a]	5.0[b]
C	6	-	10[a]	10[a]	10[a]	7.5[a]
D	9	20[b]	40[b]	40[b]	30[b]	32.5[c]
E	12	50[c]	50[b]	60[c]	50[c]	52.5[d]
Overall dead-in-shell values for different temperatures (%)		16	22	24	22	

Values in the same column with different superscripts differ significantly (P<0.01).

Thus, it was concluded that as the storage period increases for different temperatures i.e 4°C, 16°C, room and ambient temperature, the hatchability decreases after the storage of 6 days. Similarly, dead-in-shell embryos increased as the storage time increased.

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