



# Incubation Duration of Broiler Breeder Egg and Post Hatch Performance

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## ABSTRACT

Incubation duration is a most essential factor to achieve standard hatchability, water loss and chick yield. Ross-308 different breeder flocks which were 42-46 weeks old and standard eggs that weighed up to 55-60g were selected. In the current study, two experimental groups each consisting of (n= 538560) eggs were selected to investigate the effect of eggs incubation duration on hatchability and post-hatch performance. Therefore, this experiment was conducted in order to evaluate the exact duration of incubation and its effects on broiler performance at the farm. Group A was incubated for 444hrs in setter and 62 hrs in hatcher. Hatch pulling for A was performed twice 1st after 494 hrs and remaining un-hatch eggs were again shifted to hatchers for next 12 hrs for 2nd pulling (conventional method of hatch pulling in Pakistan). For B hatch pulling was performed after 456hrs in setters and 50 hrs in hatcher, complete hatch pulling only once. Eggs weight at transfer was (53.9±0.8gm and 54.9 ±0.6gm), water loss at transfer was (11.67±0.7% and 10.6±0.7%) and chick weight was at (41.6±0.3gm and 42.7±0.3gm) on day one were significantly better for group B than A respectively. Similarly, hatchability (86.16±1.02% and 85.16±1.02) and dead in shell (5.10 ±0.8% and 6.61±1.5%) were also significantly better for group B than A respectively. Candling (8.23±0.9% and 8.23±1.33%) was same for both groups. Mortality was estimated to be at (1.80±0.06 and 2.47±0.23%), weight gain was determined to be at (2001.33±24.33gram and 1955.66±25.02gram), feed intake (g/bird) was at (3245.02±18.03 and 3260.51±13.47) and feed conservation ratio at day 35 (1.44±0.02 and 1.716±0.03) were found to have been significantly better for B than A respectively. So, incubation of eggs for 456 hrs in setters and 50 hrs in hatcher, along with single pull is better in term of water loss, chick yield, hatchability and post hatch performance.

**Key words:** Broiler, Chicks quality, Incubation duration, Post hatch performance

## INTRODUCTION

Poultry is the second largest industry in Pakistan, which plays a key role in the grass domestic production of country (Hussain et al., 2015). Poultry farming has been widely adopted in Pakistan and almost every farmstead keeps some poultry mainly for consumption and cash sales. The science and technology which have contributed widely to the expansion of poultry industry and a number of strategies have been adopted to modulate the quality of poultry products (Abel et al., 2014) Pakistan contain about 25000 poultry farms, about 400 hatcheries, 150 feed mills, 8.5 million broiler breeders (Anonyms, 2011; FAO, 2011).

Hatching egg quality and incubation conditions influence broiler performance (Jabbar and Yousaf, 2017). The incubation period of chicken (*Gallus gallus*) embryo is approximately (506 hours) 21.08 days including drying down, and the gap among first to last chick hatch time is approximately 12 to 24 hours (Tong et al., 2013; Van de Ven et al., 2011). This time interval between the first and the last chick hatch is called "Hatch Window" (Molenaar et al., 2011). In commercial hatcheries incubation times of chicken is approximately 504 hours (Almeida et al., 2006). The large scales of chicks pulling have been extended up to 510 to 526 hours (Laughlin et al., 2007). Pulling of the chicks from hatcher is started when almost 90-95% chicks are complete dry. The incubation practices may also influence the length of

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incubation. Such as, storage temperature (Tona et al., 2003) and also incubator temperature (Yildirim et al., 2004), the position of eggs placement in tray (Van de Ven et al., 2011), turning and turning angle (Tona et al., 2005) are recorded with great care in terms of good hatchability. Gaseous exchange and CO<sub>2</sub> concentration also affect the hatchability (Everaert et al., 2007). Post hatching fasting impairs the chick's weight gain and breast muscles deposition capacity (Halevy et al., 2000). The current experiment was performed to find out the exact hatch time and its effect on broiler performance.

## **MATERIALS AND METHODS**

### **Ethical approval**

This experiment was performed according to all ethics and animal rights (University of veterinary and animal sciences).

### **Site selection**

The study was carried out at Sadiq Poultry (Pvt) limited, Chakri Hatchery Rawalpindi which is situated five km from chakri interchange on motorway-2 (Islamabad to Lahore), Pakistan. The hatchery contains the latest in Heating Ventilation and Air Conditioning (HVAC) automation, having ISO (International Standard Organization) 1900-2000 certified. This is largest eggs capacity hatchery of south Asia which is producing the best quality of chicks through the single stage incubation system (Avida G4, Chick Master USA).

### **Selection of breeds**

Eggs (55-60 g of weight) from broiler breeders (Ross-308, 45 weeks of age) were divided into two groups, such as A for twice pulling (conventional method) and B single pull.

### **Selection of eggs**

Each experimental group was consisting of n=538560 eggs, which were graded upon their quality, poor shell, elongated eggs, cracks were isolated, only normal eggs (having 60-65 gram weight, good quality shell, oval shape without any crack and contamination) were set in the incubator machine Advida4 chick master USA having capacity of 1,34,640 eggs (Khan et al., 2016). These eggs were collected farm at 20°C and 75% relative humidity until used in hatching trial.

### **Eggs fumigation**

Before being tested, trial eggs were fumigated with 20g KMnO<sub>4</sub> and 40ml formalin (40%) and 40 ml of water for 100ft three areas for 15 minutes through automatic fumigation process provided by chick master.

### **Incubation programme**

Both groups were pre-heated at 82°F for five hours inside incubators. After completion of pre-warming the setter started automatically the incubation stage profile (Ross prime age recommended by Chicks Master USA).

### **Incubation durations in setters**

Group A was incubated for 444 hrs in setter and group B was incubated for 456 hrs in separate setter. The eggs were then shifted to hatchers.

### **Egg's water loss**

Before being transferred to the hatchers, water loss of both groups was measured. Water loss was measured for group A after 444 hrs, while for group B it was measured after 456 hours as given formula:

$$\text{Water Loss} = \frac{\text{full tray weight at setting (gm)} - \text{full tray weight at transfer (gm)} \times 100}{\text{Full tray weight at setting (gm)} - \text{empty tray weight (gm)}}$$

### **Candling**

Eggs from group A were transferred to hatchers after 444 hrs of incubation in setter while eggs for group B were transferred to hatchers after 456 hrs of incubations. For both groups during transfer from setter to hatchers candling was performed through candling tables.

### **Incubation durations in hatchers**

The duration of incubation in hatchers was short for A and B as compared to incubation duration in setters. For A it was 62 hrs and for B it was 50 hrs.

### **Hatch pulling**

**Conventional hatch pulling.** Hatch pulling for both groups was different. For group A hatch pulling was performed through the conventional method of hatch pulling in Pakistan. First pull at 494 hours (444 in setters and 50 hrs in hatchers, for second hatch pull the remaining pips and eggs that had not hatched were again shifted to hatcher for next 12 hrs. After 12 hrs again pulling of un-hatched eggs from group A was performed.

**Single hatch pulling.** Group B was pulled out only one time after 506 hours (456 hrs in setters and 50 hrs in hatchers). Nothing was left behind inside hatchers. Hatch pull out was performed through shell separator (KUHL). Body weights of chick were determined immediately after chick collection. Single hatch pull after 506 hours was performed first time in Pakistan to best of our knowledge.

**Chick grading.** Grading of chicks was performed on the automatic conveyer, grading table. Only stranded (shining eyes, soft legs and nose, healed naval and healthy chicks) were shifted to chick's box after counting, while under weight, weak, and unhealed naval chicks were removed as international standard.

**Chick yield measure.** As for hatch out the chick's weight and yield was immediately measured through electrical weight balance by using following formula:

$$\text{Chick Yield} = \frac{\text{Weight of chicks (gm)}}{\text{Egg weight (gm)}} \times 100$$

**Dead in shell analysis.** To investigate the reason of embryo's mortality inside the eggs, dead in shell (DIS) analysis was necessary. For this purpose analysis of un-hatch eggs was performed (Table 3).

### **Delivery to poultry house**

The total n=56,000 (A n=28000, B n=28000) day old chicks were send to Sadiq broiler farm Khilari-Chakri, Rawalpindi, Pakistan. Environmentally control vehicles (75 °F temperatures, 65% humidity) are used to deliver the chicks to control poultry house in the 102 chicks/box with dimensions of plastic chick's box (27×19.5×6.5 inches). Poultry house condition was remained same for both groups. At farm, chicks of both groups were offered water and feed *ad libitum*. Sadiq feed was offered to both groups. Feed with starter diets from 1 to 12 day (3020 Kcal ME/kg, 22% CP), grower diets from 13 to 22 day (3185 Kcal ME/kg, 20% CP) and finisher diets from 23 days to 35 days of age (3230 Kcal ME/kg, 18% CP). The diet was formulated according to the recommendations of the NRC (1994) using windows user-Friendly feed formulation (WUFFDA) software program. Intake of feed and water was record daily, while body weight and total feed consumed were recorded on a weekly basis. After 35 days trial the chick's weights were measured for both group. For ventilation Viper Touch (Big Dutchman, Co., Germany) system was installed (Table 1).

### **Statistical analyses**

All data were analyzed by using Statistical Analysis System package software (SAS version 9.2, SAS Institute Inc., Cary, NC, USA). All means were compared using Duncan's Multiple Range test and results were presented as mean ± SEM (standard error of mean). Result were considered significant if P<0.05.

## **RESULTS**

Initial eggs weight for both groups before setting was significantly same (same weight eggs were selected for both groups) (P<0.05) (60.2±0.7, 60.1±0.8gm). Eggs weight of group A at transfer was significantly high (P<0.05) (54.9 ±0.6gm) as compare to group B (P<0.05) (53.9±0.8gm) due to significantly more water loss from group B (P<0.05) (11.67±0.7%) compared to group A (10.6±0.7%). This water loss from eggs is major source of variation in chick quality and weight at day one. Chick weight of group A (P<0.005) (42.7±0.3gm) was significantly higher than group B (P<0.05) (41.6±0.7gm) due to high water loss from group B (Table 2). According to Tong et al. (2013) water loss for good quality chicks should be at 11-12%. Water loss less than 11% causes ascites. So, group B which had been incubated for 456 hours in the setter was found to be better for water loss at transfer.

Hatchability was significantly (P<0.05) better for group B (86.16±1.02%) as compared to A (85.16±1.02%). Similarly, dead in shell was significant (P<0.05) better for group B (5.10±0.8) as compared to group A (6.61±1.5%) while Candling was same for both groups (Table 2).

Chicks from both groups were shifted to broiler farms into separate houses through environmental control vehicles. During the 35 days' trial period, mortality, feed intake, weight gain and FCR were recorded weekly and the results have been presented in table 3. Interestingly, the effect of 506 hours incubation and single hatch pulling on broilers performance was found better as compared to incubation of 506 hours and twice hatch pulling.

Feed conversion ratio (FCR) was found significantly better (P<0.05) in group B (1.44±0.02) then A (1.716±0.03). Feed intake (g/bird) was better for group B (3245.02±18.03) then A (3260.51±13.47). Weight gain was recorded to have

been at maximum for group B (2001.33±24.33) as compare to A (1955.66±25.02) and mortality was reduced significantly (P<0.05) for B (1.80±0.06) as compare to A (2.47±0.23) (Table 3).

**Table1.** Poultry house condition at Sadiq broiler farm Khilari-Chakri Rawalpindi, Pakistan (February-May2016)

Parameters	1st Week	2nd Week	3rd Week	4th Week	5th Week
Temperature ( <sup>0</sup> F)	95-86	86-83	83-77	77-75	75
Humidity (%)	65	65	65	65	65
Ventilation (m <sup>3</sup> /hour/bird)	0.07	0.25	0.40	0.59	0.87

**Table 2.** Effect of single and twice hatch pull on Mortality, Weight gain(g), Feed intake(g) and FCR at Sadiq Hatchery Chakri Rawalpindi, Pakistan (February to May 2016)

Parameters	A	B
Mortality %	2.47±0.23	1.80±0.06 <sup>b</sup>
Weight gain (g)	1955.66±25.02 <sup>a</sup>	2001.33±24.33 <sup>b</sup>
Feed intake(g)	3260.51±13.47 <sup>a</sup>	3245.02±18.03 <sup>b</sup>
FCR	1.716±0.03 <sup>a</sup>	1.44±0.02 <sup>b</sup>

**Table 3.** Effect of single and twice hatch pull on Weight at setting, Egg weight at transfer , Water loss , Chick weight , Hatchability, Candling and Dead in shell at Sadiq Hatchery Chakri Rawalpindi, Pakistan (February to May 2016)

Parameters	A	B
Weight at setting (g)	60.2±0.7 <sup>a</sup>	60.1±0.8 <sup>a</sup>
Egg weight at transfer (g)	54.9 ±0.6 <sup>a</sup>	53.9±0.8 <sup>b</sup>
Water loss (%)	10.6±0.7 <sup>a</sup>	11.67±0.7 <sup>b</sup>
Chick weight (g)	42.7±0.3 <sup>a</sup>	41.6±0.3 <sup>b</sup>
Hatchability (%)	85.16±1.02 <sup>a</sup>	86.16±1.02 <sup>b</sup>
Candling (%)	8.23±1.33 <sup>a</sup>	8.23±0.9 <sup>a</sup>
DIS (%)	6.61±1.5 <sup>a</sup>	5.10±0.8 <sup>b</sup>

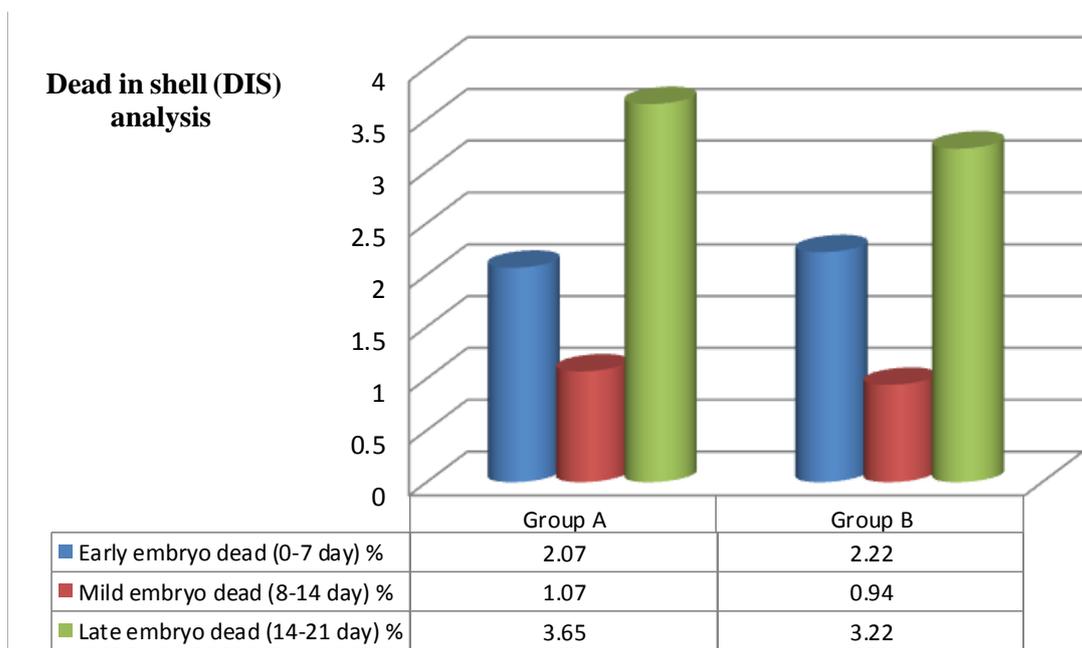
DIS: dead in shell

## DISCUSSION

It is a common practice in Pakistan for the first hatch pulling to be done first after 494 hours then the remaining un-hatch eggs were shifted again to same hatchers for next 12 hours for second hatch pull or balance. First time in Pakistan single pull at international standard (hatch pull only once after 506 hours) was performed and better results were achieved. Transfer of both groups from the setter to the hatcher was different. Transfer after 456hours was found to be better due to proper water loss (Table 3).

11-12% water loss is standard to achieve better chick quality and carcass yield (Tong et al., 2013). Proper water loss helps to avoid dehydration during the transportation of chicks to farm. Pulling of chicks for a second time disturbs the temperature and humidity for chicks which are under process of hatching becomes a source of increased dead in shell (DIS) (Van de Ven et al., 2011).

Pulling of chicks after complete incubation duration improves proper grading and post hatch performance (Yousaf, 2017). Dead in shell analysis also indicate that early (0-7days), mid (8-14 days) and late (15-21 days) embryonic mortality were found better in group B (Figure 1). The chicks produced through proper incubation have better ability to perform at the farm table 3. So, it's better to incubate eggs for 456 hours in setter and 50 hours in hatcher and single hatch pull after 506 hours to get better water loss, hatchability, dead in shell (DIS) and post hatch performance.



**Figure 1.** Effect of single and twice hatch pull on early, mid and late embryonic mortality at Sadiq Hatchery Chakri Rawalpindi Pakistan (February to May, 2016)

## CONCLUSION

In summary, the findings of current study tended to show that full time 506 hours incubation and single hatch pulling to broiler breeder eggs provides better quality chicks and enhances the post hatch performance.

### Author's contribution

Dr. Adnan Jabbar Ansari was main author responsible for tabulation of experimental data and article writing. Dr. Yasir Allah Ditta helped in statistical application while Dr. Adnan Yousaf helped in write up.

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### Conflict of interest

The authors declare that they have no conflict of interest with respect to the research, authorship, and/or publications of this article.

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