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EFFECT OF AGE WISE INCUBATION PROGRAMME ON BROILER BREEDER HATCHABILITY AND POST HATCH PERFORMANCE

Adnan JABBAR, Adnan YOUSAF✉

Sadiq Poultry (Pvt) Limited, Rawalpindi, Pakistan

✉Email: dr.adnan011@gmail.com

ABSTRACT: Temperature and humidity are most important environmental factors during incubation. The age of birds affect the eggs, its internal as well as external quality, that's why dissimilar conditions require for incubation. The aim of this study was to investigate the effect of age wise incubation profile on hatchability and chick's performance. For this experiment, eggs were collected from Ross-308 breeders which were divided into four groups according to the age of breeders having equal number of eggs in all groups (n=538560 eggs). Group A (Young, 24-31 weeks), B (Prime, 32-50 weeks), C (Old, 50+weeks) and D (control). For groups, A, B and C duration of incubation in setter machine was 456 hours (19th day) while for D (control), incubator duration was 449 hours (18.7 days). Fertility of eggs were performed through candling and shifted to hatchers for next 50 hours for A, B and C while 56 hours for D. Group B was significantly better (P<0.05) as compare to A in term of hatchability. Candling was significantly better for group B (P<0.05) than C. Group C was significantly (P<0.05) better for candling than A and D which contain same candling i.e. A and D. Groups A and B have significantly (P< 0.05) same dead in shell (DIS) (6.18±0.29 and 6.20±0.37 respectively) as compare to C (7.13±0.60). Group D (6.70±0.67) was same for DIS as groups A, B and C. Excellent performances of chicks with mortality (P<0.01) for A (2.93±0.60), B (2.77±0.49), C (2.85±0.53), D (3.10±0.82), weight gain (gram/bird) (P<0.01) for A (1972.66±0.33), B (2012.33±35.92), C (1996±14), D (1985.33±18.58), FCR (P<0.01) for A (1.55±0.12), B (1.51±0.15), C (1.54±0.13), D (1.57±0.11) and feed intake (gram/bird) (P<0.01) for A (3146.92±189.13), B (3138.63±203.4), C (3139.75±201.55), D (3166.72±154.84) all were same in all groups. Water loss was different for A (11.93±0.60) then B (12.34±0.76), C (12.24±0.65) as compare to D (10.17±0.55). Chick yield was same for A (69.28±0.18), B (69.51±1.12) and C (69.28±0.88) then D (71.46±1.54) had more yield and low water loss. Group A, B, and C were better as compared to D but overall group B has significantly better which mean the eggs from different ages of birds require different conditions of incubations and it will not affect the chick's performance at the farm.

Keywords: Broiler, Age Wise Incubation Regimen, Hatchability, Dead in Shell, Candling, Performance

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INTRODUCTION

Hatching egg quality and incubation conditions influence broiler performance. Growth rates of broiler chickens have been increasing day by day due to genetic selection and latest technology incubation system (Hulet, 2007; Baghbanzadeh and Decuypere, 2008). Numerous factors have been documented to influence fertility and hatchability of chicken eggs (Alsobayel and Albadry, 2012). Age of the hen appears to have an influence on fertility, hatchability and embryonic mortality (Alsobayel and Albadry, 2012). Fertility and hatchability of chicken decreased the age (Insko et al., 1947). Newly-hatched chicks can have their thermoregulatory capability affected by incubation temperature (Tzschentke and Rumpf, 2011), which can also affect their blood hormones levels (Christensen et al., 2001) and development after hatching (Molenaar et al., 2011).

Temperature and Humidity play a key role which is one of the most important environmental factors during incubation (Lourens et al., 2005). At end of incubation period, the eggshell temperature increases due to the higher heat production of the embryo (Lourens et al., 2005). Different temperatures degrees are required to the embryo at different stages and ages (Lourens et al., 2005). Modern broiler chickens are extra sensitive to metabolic disorders such as ascites because of the genetic selection for quick growth, low feed conversion ratio (FCR), and high meat yield (Balog, 2003; Arce-Menocal et al., 2009), which has resulted in decreased visceral organ development (Havenstein et al., 2003).

The aim of the research was to study the impact of broiler breeders' age on its eggs incubation Programme.

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MATERIALS AND METHODS

Site Selection

The current study was designed at Sadiq Poultry (Pvt) Limited, Chakri Hatchery Rawalpindi (Pakistan), which is situated 5km from chakri interchange on M2 motorway (Rawalpindi-Lahore). It is fulfilled from the latest automation and ISO 9001- 2000 certified hatchery. There were selected three category age wise breeder flocks, to assess the comparison of hatchability, chick's quality and post hatched performance of broiler chicks.

Eggs selection and Classification

Ross-308 breeder's four groups classified according to breeder's age. Each experimental group was consisting of (n=4, 03,920 eggs) with three replicates of (n=134640 eggs). Group D (Setter) was served as control group, while group A, B and C were treated with accordingly their age wise incubation regimen. Group A (Young age breeder eggs 24-31 weeks), Group B (Prime age breeder eggs 32-50 weeks), Group C (Old age breeders eggs 50+weeks) and Group D (control) having eggs of different age breeders. High-quality hatching egg shells were smooth, without ridges or small lumps of calcified material (pimples). The color of eggs within a flock was uniform. Young flocks produce eggs with thicker shells and when the flock older the shell becomes thinner and the incidence of abnormal shells increases. The eggs were graded on the basis of their quality and stander, all the hatchable eggs were graded through egg grading machine MOBA 9A. While the poor shell, crack, bloody stained, elongated eggs were rejected (Khan et al., 2016), only oval shape and good quality of eggs were selected. All group's eggs were fumigated with 20 g $KMnO_4$ and 40ml formalin40%, and 40 ml of water for 100ft^3 areas for 15 minutes.

Incubation Regimen

Groups A, B and C incubation duration in setter machine was 456 hours (19th day) while for D (control) in incubator duration was 449 (18.7 days). Fertility of eggs were performed through candling then shifted to hatchers for next 50 h for A, B and C while 56 h for D. All of these stage regimens were recommended by chick master USA. All the groups were treated for full time incubation period 21 days (506 hours). Body weights of chick were determined immediately after chick collection. Candling and DIS (dead in shell) were recorded for each group individually.

Chicks Counting/Grading

Hatch pull out was performed through shell separator and grading was performed on conveyer and grading table. Only good quality chicks having soft legs, shining eyes soft feathers, nose good naval were selected for the experiment. Chicks were shifted to box after counting, while dead, week, and unhealed naval chicks were removed.

Delivery to Poultry House

Each experimental group was consisting of (n=74,000) day old chicks, with 4 replicate (each replicate n=18,500). Environmentally control vehicles (75 ^{0}F temperatures, 65% humidity) were used to deliver the chicks up to poultry houses with 102 chicks/box packing to Sadiq Broiler Farm Khilri chakri. Continuous light was provided during whole study. Poultry house condition was same for all groups as shown as below (Table 1). Chicks were fed with starter diets from 1 to 12 d (3020 Kcal ME/kg, 22% CP), grower diets from 13 to 22 d (3185 Kcal ME/kg, 20% CP) and finisher diets from 23 to 35 d of age (3230 Kcal ME/kg, 18% CP). The diet was formulated according to the recommendations of the NRC (1994) using WUFFDA formulation software program. Intake of feed and water was taken daily, while body weight and total feed consumed was recorded on weekly basis. Viper Touch (Big Dutchman, Co., Germany) system was installed.

Table 1 - Environmental condition of Poultry House

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

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). Results were considered significant if exist $P<0.05$.

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RESULTS

After ten successful hatches out for Individual group, hatch abilities for individual groups were recorded. Hatchability was significantly (P<0.05) better for group B (89.02±0.41) then A (86.66±0.33, C (86.80±0.65) and D (86.25±1.22). Candling was significantly better (P<0.05) for B (4.77±0.17) then C (6.05±0.67). Group C was significantly (P<0.05) better for candling than A (7.15±0.33) and D (7.03±0.76) which contain significantly same in term of candling i.e. Group A and D. Group A and B have significantly (P<0.05) same dead in shell (DIS) (6.18±0.29) (6.20±0.37) respectively as compare to group C P<0.05 (7.13±0.60). Whereas, D significantly (P<0.05) (6.70±0.67) same in term of DIS as group A, B and C shown (Tables 2 and 3).

During 35 d trail period, mortality, feed intake, weight gain and FCR was recorded and results were presented in Table 3. Interestingly, the effect of age wise regimen on broilers performance was also found same. Mortality was reduced significantly (P<0.05) in A (2.93±0.60), B (2.85±0.53), C (2.77±0.49) as compared to control D (3.10±0.82) group. Weight gain (g/bird) was regimen same (P<0.05) in A (1972.66±0.33), B (2012.33±35.92), C (1996±14) groups as compared to control group (1985.33±18.58). Feed conversion ratio (FCR) was found significantly same (P<0.05) in A (1.55±0.12), B (1.51±0.15), C (1.54±0.13) than D group (1.57±0.11). However, feed intake (g/bird) was not affected (P>0.05) by the age wise regimen of eggs group A (3146.92±189.13), B (3138.63±203.4), C (3139.75±201.55) and control group D (3166.72±154.84) were significantly same (Table 4). Water loss was remain significantly different for A (11.93±0.60) then B (12.34±0.76), C (12.24±0.65) as compare to D (10.17±0.55). Whereas, the hatching chicks yield was remain same for A (69.28±0.18*),* (B 69.51±1.12) and C (69.28±0.88) then D (71.46±1.54) had more chicks yield low water loss, thus chicks had low yolk absorption (Table 4).

Table 2 - Effect of age wise and combine incubation programme

Groups	A (Young)	B (Prime)	C (Old)	D (Combine)
Hatchability %	86.66±0.33^{b}	89.02±0.41^{a}	86.80±0.65^{b}	86.25±1.22^{b}
Candling %	7.15±0.33^{a}	4.77±0.17^{b}	6.05±0.67^{c}	7.03±0.76^{a}
DIS %	6.18±0.29^{a}	6.20±0.37^{a}	7.13±0.60^{b}	6.70±0.67^{ab}

$^{a-b}$ denotes difference in columns (P<0.05), DIS= dead in shell

Table 3 - Dead in shell (DIS) analysis report

Weeks	A (Young)	B (Prime)	C (Old)	D (Combine)
1st week %	1.46±0.14^{a}	1.46±0.17^{a}	1.76±0.14^{b}	1.62±0.15^{ab}
2nd week %	0.54±0.4^{a}	0.47±0.7^{a}	0.55±0.8^{a}	0.58±0.5^{a}
3rd week %	2.71±0.73^{a}	2.79±0.74^{a}	3.36±0.65^{b}	3.28±0.74^{b}
Clear %	0.67±0.41^{a}	0.69±0.45^{a}	0.64±0.38^{a}	0.65±0.32 ^{a}
Contamination %	0.56±0.14^{a}	0.53±0.34^{a}	0.55±0.26^{a}	0.45±0.37^{a}
Crack %	0.24±0.4^{a}	0.26±0.7^{a}	0.27±0.8^{a}	0.23±0.7^{a}
Total DIS	6.18±0.29^{a}	6.20±0.37^{a}	7.13±0.60^{b}	6.70±0.67^{ab}

$^{a-b}$ denotes difference in columns (P<0.05) DIS= dead in shell

Table 4 - Chicks Performance of different groups at farm

Groups	A (Young)	B (Prime)	C (Old)	D (Combine)
Mortality %	2.93±0.60^{a}	2.77±0.49^{a}	2.85±0.53^{a}	3.10±0.82^{a}
Weight gain (g)	1972.66±0.33^{a}	2012.33±35.92^{a}	1996±14^{a}	1985.33±18.58^{a}
Feed in take (g)	3146.92±189.13^{a}	3138.63±203.4^{a}	3139.75±201.55^{a}	3166.72±154.84^{a}
FCR	1.55±0.12^{a}	1.51±0.15^{a}	1.54±0.13^{a}	1.57±0.11^{a}

$^{a-b}$ denotes difference in columns (P<0.05)

Table 5 - Water loss and Chick yield Age wise and Combine Incubation Programme

Groups	A (Young)	B (Prime)	C (Old)	D (Combine)
Water Loss %	11.93±0.60^{a}	12.34±0.76^{b}	12.24±0.65^{b}	10.17±0.55^{d}
Hatching Yield %	69.28±0.18^{a}	69.51±1.12 ^{a}	69.28±0.88 ^{a}	71.46±1.54^{d}

$^{a-b}$ denotes difference in columns (P<0.05)

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DISCUSSION

Uniform egg shell temperature is necessary tool to avoid condensation (Marandure, 2012). To achieve better hatchability and good quality of chicks uniform shell temperature and avoid condensation is necessary (Renema et al., 2006). Significant deterioration in the characteristics of the eggshell with the age of the hens was also found (Yilmaz and Bozkurt, 2009). Changes in the quality of eggs, especially of their shells, with the passage of reproductive season can affect the embryonic development during the incubation period and, finally, the hatchability results (Nowaczewski et al., 2016). Hatchability parameters and embryonic mortality are directly affected due to age of female's breeder during incubation period (Al-Bashan and Al-Harbi., 2010, Othman et al., 2014). Age wise incubation stage programme have three different incubation temperature and humidity set point for the eggs given by different age of breeders i.e. prime, young and old which provides uniform temperature for growing embryos, helps to achieve good quality chicks. Uniform temperature of every stage for developing embryos enhances the performance of chicks at farm (Fasenko, 2009) result better FCR and less mortality. It was clearly documented that best egg fertility and hatchability in hen age between 31 and 50 weeks (Islam et al., 2008) as shown in result that group B is better. Better result in term of hatchability and candling, DIS water loss and chick yeild in Ross 308 broiler breeders of Prime aged 32–50 weeks in comparison with older flock age of 51 +weeks (Elibol and Brake, 2006). Higher DIS was recorded in older flock (Nowaczewski et al., 2016). The finding of current study tended to show that age wise incubation stage programme to broiler breeder eggs enhances the hatchability. The high level of DIS and maximum infertility was recorded in older flock age (Nowaczewski et al., 2016) as shown in (Table 2). Hatchability, candling and DIS was found better for group A, B, and C then D but overall group B was found better due to prime age production (Tables 3 and 4). Greater water loss is a result of better chick yield as result good quality of chicks Table 4. So, incubation of eggs with their age wise temperature and humidity set points provides better results as compare to incubation of different age's eggs at same temperature and humidity set points. The age wise and combine incubation profile will not affect the FCR, Feed intake, weight gain of chicks at farms.

CONCLUSION

Age wise incubation stage programme is a good factor, which may be used to enhance the hatchability.

Authors' contribution

Both authors carry equal contribute in this study.

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Conflict of interests

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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