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Effect of Egg Weight on Water Loss and Chicks Yield of Broiler Breeders

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ABSTRACT

During incubation, water loss and chick yield are the two most crucial variables. The purpose of this study was to look into how water loss and chick yield were affected by the age-wise incubation profile. Eggs from Ross-308 breeders were gathered for this experiment, and the breeders' ages were used to split them into four groups, each of which had an identical number of eggs (n=538560 eggs). A Young (24–31 weeks), B Prime (32–50 weeks), C Old (50+ weeks), and Group D (control), and are the four groups. The setting machine was left incubating for 456 hours (19^{th} day) for groups A, B, and C, and for 449 hours (18.7 days) for group D, which was the control. Fertility of eggs was performed through candling and shifted to hatchers for the next 50 hours for A, B, and C while 56 hours for D. Group B showed significantly better $P<0.05$ (89.02±0.41) as compared to A and C which are significantly $P<0.005$ same (88.66±0.33), (88.80±0.65) than D (control) (86.25±1.22) in term of hatchability. Excellent performance in terms of chicks yields C Significantly $P<0.05$ remains the same (69.28±0.54) as compared to A (69.17±0.54) and B (69.99±0.54), While high yield was recorded for D (71.45±0.54). Dead in the shell (DIS) was significantly the same for A (6.18±0.29), B (6.20±0.37), and C (6.13±0.60) than D (7.70±0.67) which contain higher DIS percentage. In terms of eggs, water loss was significantly the same for A (11.93±0.26), B (12.24±0.26), and C (12.31±0.26) which was recorded as ideal than D (10.16±0.26) which contained low water loss percentage. Groups A, B, and C were better as compared to D, but overall group B was significantly better which means the eggs from different ages of birds require different conditions of incubation.

Keywords: Broiler; Age Wise Incubation; Chicks Yield; Water Loss; Hatchability; Dead in shell (DIS)

Introduction

Poultry products are a great source of both revenue and protein (Hussain, et al. 2015). The poultry business employs Thousands of veterinarians to treat diseases and ensure the quality of chicken products (Anonyms, 2011). Broiler hatchability is influenced by the caliber of the incubation and hatching circumstances for eggs (Jabbar, et al. [1]). During incubation, temperature and humidity are crucial environmental factors that must be considered (Lourens, et al. [2]). Water loss and chick production of chicken eggs are influenced by several variables (Alsobayel [3]). Numerous studies have demonstrated that the viability of the embryo and post-hatch performance are influenced by the quality of the breeder's egg (Yoho, et al. 2008). According to Alsobayel [3], the age of the hen may have an impact on hatchability, embryonic mortality, and fertility. As chickens get older, their hatchability and fertility decline (Insko, et al. 1947). One of the most crucial environmental variables during incubation is temperature and humidity (Lourens, et al. [2]). Due to the embryo's increased heat generation near the conclusion of the incubation phase, the eggshell temperature and water loss rise (Hussain, et al. [2,4]). Various stages and ages of the embryo require varying temperatures and humidity levels (Lourens, et al. [2]). Because the embryo is producing more heat during the third week of incubation, the eggshell temperature rises (Yousaf, Lourens, et al. [2,5]).

Because of their genetic selection for rapid growth and high meat yield (Balog, 2003; Arce-Menocal et al. 2009), modern broiler chickens are more susceptible to metabolic disorders like ascites, which

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can lead to decreased visceral organ development, ideal chick yield, and water loss (Havenstein, et al. 2003). As chickens get older, their hatchability and fertility decline (Yousaf, et al. [6,7]). Depending on the stage and age of the embryo, different temperatures and humidity levels are needed (Yousaf, et al. [2,8]). Water loss, chick weight, chick yield, hatchability, and temperature have all been shown to be tightly correlated (Jabbar, et al. [1]). Since temperature influences embryo development, temperature, humidity, and water loss are the three most important factors to consider while managing egg hatching (Yousaf, et al. [9]). Because hatchability and eggshell quality are related, maintaining hatching eggshell quality is crucial. The main determinants of eggshell quality are chickens' age, housing, nutrition, environment, and genetics. The quality of eggshells may also be related to eggshell color. This study aims to examine hatchery performance by taking into account key variables including water loss, chick weight, and chick yield of broiler breeders.

Materials and Methods

Sit Selection

The study was carried out at Salman Poultry (Pvt) Limited, Chakri Hatchery, Rawalpindi. The hatchery is situated 05km from the Chakri Interchange motorway (M2) to the west. It contains the latest HVAC automation, having ISO 1900-2000 certified. This is South Asia's largest egg capacity hatchery, which produces the best quality chicks through a single-stage incubation system (Avida G4 chick master USA).

Group Classification

Eggs from broiler breeders (Ross 308) were classified into four groups age-wise of breeder hens, such as A (Young age 24-31 weeks, 51.27±1.64g), B (Prime age 32-50 weeks, 57.81±1.48g), C (50 + weeks, 61.23±1.67g) and D (combine, 57.32±1.49g) (Table 1). Group D was served as control, while rests of three groups were treated with different age wise incubation program in commercial single stage setters (Avida G4, Chick Master USA).

Table 1: Weight Of Ross-308 Breeders Eggs.

Groups	Maximum Weight (g)	Minimum Weight (g)	Mean weight (g)
A (Young 24-31 weeks)	56.32±1.94	46.23±1.34	51.27±1.64
B (Prime 32-50 weeks)	61.42±1.51	52.21±1.45	57.81±1.48
C (Old 51+ weeks)	65.34±1.32	53.45±1.56	61.23±1.67
D (Combine)	58.96±1.76	53.12±1.92	57.32±1.49

Eggs Selection

High-quality hatching eggshells 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 is older the shell becomes thinner, and the incidence of abnormal shells increases. Hatchable eggs were selected based on shell quality, weight, and color. All the hatchable eggs were graded through the egg grading machine MOBA 9A. Only oval-shaped good-quality intact eggs were selected for hatching. Substandard eggs such as cracked, misshapen, blood-stained, dirty, and elongated were rejected (Khan, et al. [10]).

Fumigation Process

These eggs were collected at the farm and stored at 20°C and 75% relative humidity until used in the hatching trail. Before, trail eggs were fumigated with 20 g $KMnO4$, 40 ml formalin (40%), and 40 ml of water for 100ft3 areas for 15 minutes.

Incubation Programme

Each experimental group consisted of (n=4,03,920) eggs. All four groups were pre-heated at 82oF for 05 inside individual incubators. After completion of the pre-heating stage, the incubator started automatically age-wise stage profile (Recommended by Chicks Master USA). After completing 456 hours (19 days) in an incubator the weight of eggs was performed through digital balance to check the water loss during incubation. All the infertile eggs were removed from the tray and just fertile eggs were shifted to hatchers for the next 50 hours (2 days and 8 hours). Hatch pulling was performed after 506 hours. Upon hatching chicks' body weights, hatchability percentage, and hatching yield were determined immediately to calculate as described by (Sahin, et al. 2009).

Water Loss & Yield Measure

Water loss was measured through the formula (full tray weight at setting-full tray weight at transfer ÷ full tray weight at setting-empty tray weight x 100), while chick yield was measured through formula weight of chicks at hatch ÷ weight of eggs at time of setting x 100.

Results

After ten successful hatches out for individual groups, hatchability, Yield, (dead in shell) DIS, and water losses were recorded. Differences in terms of hatchability, yield, DIS, Water loss, and Chick weight were found for groups A, B, and C which were incubated age-wise program and D combined incubation program (control) respectively. Group B showed better hatchability percentage was recorded (89.02±0.41) as compared to A and C which are significantly P<0.005 same (88.66±0.33), (88.80±0.65) and D (control) (86.25±1.22) (Table 1). In term of chicks yield C significantly remain same (69.28±0.54)

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as compare to A (69.17±0.54) and B (69.99±0.54), While highly yield was recorded for D (71.45±0.54) (Table 2). Dead in the shell (DIS) was significantly the same for A (6.18±0.29), B (6.20±0.37), and C (6.13±0.60) than D (7.70±0.67) which contain high DIS percentage (Table 3). In terms of eggs, water loss was significantly the same for A (11.93±0.26), B (12.24±0.26), and C (12.31±0.26) which was recorded as ideal than D (10.16±0.26) which contained low water loss percentage (Table 2). Similarly, as the age of breeder increase size of egg also increase and chick weigh will also increase. The result in terms of the chick's weight significant no difference recorded as B (prime) (40.71±0.96) and D (combine/control) (40.02±0.78), while the chick's weight was less for A (35.46±0.89) than C (42.24±0.87) was recorded (Table 1).

Table 2: Effect of Agewise Incubation Programme on yield & water loss.

Variable	GROUPS			
	A (Young)	B (Prime)	C (Old)	D (Combine)
Yield %	69.17±0.54^{c}	69.99±0.54^{b}	69.28±0.54^{bc}	71.45±0.54^{a}
Eggs water loss %	11.93±0.26^{a}	12.24±0.26^{a}	12.31±0.26^{a}	10.16±0.26^{b}

Discussion

Age-wise wise incubation stage program has three different incubation temperatures and humidity set points for the eggs given by different ages of breeders i.e. prime, young, and old which provides uniform temperature and humidity for growing embryos, helps to achieve good quality chicks, and ideal water loss. Uniform temperature and humidity of every stage for developing embryos enhances the water loss (Jabbar, et al. [11,12]). Similarly, the age-wise breeder eggs incubation regimen had a high-water loss and better chick quality as compared to the combined incubation program. To achieve better hatchability ideal water loss of 10-12% is necessary (Jabbar, et al. [1,13]). It was documented that the best egg fertility and hatchability in hens aged between 31 and 50 weeks (Jabbar, et al. [14,15]) as shown in result that group B is better. Hatchability and good weight of chicks are critical factors to assess the performance of hatchery (Marandure, et al. [16]). Ideal water loss provides ideal chick yield and helps to achieve good quality chicks (Tona, et al. [17]). Hatchability, water loss, chick yield, and DIS were found better for groups A, B, and C than D but overall group B was found better due to prime-age production (Tables 1-4). So, incubation of eggs with their age-wise temperature and humidity set points provides better results as compared to incubation of different ages eggs at the same temperature and humidity set points. The finding of the current study tended to show that age-wise incubation stage program to broiler breeder eggs enhances the hatchability. The high level of DIS and maximum water loss was recorded in age age-wise incubation system (Nowaczewski, et al. [18-20]) as shown in (Tables 2 & 3).

Table 3: Dead In Shell 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}

Note: a-b denotes difference in columns (P<0.05).

Table 4: Effect of Agewise Incubation Programme on Hatchability & Chicks Weight.

Variable	GROUPS			
	A (Young)	B (Prime)	C (Old)	D (Combine)
Hatchability %	88.66±0.33^{a}	89.02±0.41^{b}	88.80±0.65^{a}	86.25±1.22^{c}
Chicks weight (g)	35.46±0.89^{a}	40.71±0.96^{b}	42.24±0.87^{c}	40.02±0.78^{b}

Note: a, b, c denotes difference in columns (P<0.05).

Conclusion

Age-wise incubation stage program is a good factor, which may be used to enhance the Chicks quality, hatchability, water loss, and chick yield.

Conflict of Interests

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

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