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Effect of Floor Eggs on Hatchability, Candling, Water Loss, Chick Yield, Chick Weight and Dead in Shell

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ABSTRACT

A chicken with high quality resulted from a clean egg, not broken, and not containing cracks. This experiment was performed with the goal to evaluate the effect of contaminated eggs on hatchability, egg water loss, chick weight, chick yield, DIS, A grade and B grade chicks. Eggs (Cobb 300, Ross 308, Hubbard classic n=8616960) from six different farms were collected and divided into two groups. Group A containing good quality eggs and group B contaminated eggs or floor eggs. Each farm participated (n=1436160) eggs for sixteen replicates. Candling was significantly better (P<0.001) in all flocks of group A as compared to B regardless of the age and breed of broiler eggs. The eggs from group B presented significantly less water loss as compared to group A. Chick yield was significantly better for group A than group B. Similarly, Chick weight, quantity of A grade chicks was significantly better for group A than group B. In short floor or contaminated eggs negatively affects the hatchery parameters and becomes a source of contamination for chicks in the hatchery and farms.

Keywords: Chick weight, Chick yield, Dead in shell, Floor Eggs, Hatchability, Water loss

INTRODUCTION

Many scientists have proven that the quality of the breeder's egg influences the livability of embryo and post hatch performance (Yoho et al., 2008). When the shell and membranes are broken they become exposed to bacterial contamination. This contamination may lead to embryonic death at any stage of incubation depending upon severity of infection (Barnett et al., 2004). To get more profit and fulfill the meat requirement, Intensive production of broiler has been practiced regardless the quality and contamination. Floor eggs or dirty eggs from breeder's farm are the main source of contamination. Several bacterial transmission e-g salmonella and mycoplasma may start from ovule, just after ovulation. The egg is wet and warm when laid and prone to microbial transferring into the shell (Hameed et al., 2014). The infection spreads from the egg shell surface to shell membrane through shell pores (Berrang et al., 1999). Some viral infections e-g corona virus responsible for internal as well as external egg quality deterioration leads to affecting overall egg production and decline hatchability. The quality parameters of a hatchery are badly affected through theses contamination (Gary et al., 2015). The washing of contaminated eggs has no effect on floor eggs. Bacterial contamination leads to decline hatchability and later life performance (van den Brand et al., 2016). The infected egg shell is unable for gaseous exchange as well as water loss during incubation becomes source of infection for other eggs and incubator due to expulsion and quality of chicks deteriorates. The factor water loss directly influences the chick yield that is necessary for quality chicks. Water loss, chick weight and chick yield are closely related and influence the post hatch performance (Jabbar et al., 2017). The infected birds are unable to perform result in poor FCR. The horizontal as well as vertical transmission of bacteria also effects hatchability (Saif et al., 2008). The egg contamination also increases

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with the age of breeders. The young and prime age breeders have less contaminated eggs as compared to old age breeders (Jabbar et al., 2017). The aim of this experiment was to investigate the effects of contaminated/floor eggs on egg water loss, chick weight, chick yield, DIS, A grade and B grade chicks.

MATERIALS AND METHODS

Ethical approval

This experiment was part of routine field work in a hatchery considering all rules and regulations regarding animal rights and ethic, university of veterinary and animal sciences, Lahore, Pakistan.

Site selection

The experiment was conducted at one of the biggest Poultry hatchery of Asia Sadiq Poultry (Pvt) Rawalpindi Punjab Pakistan. The hatchery is facilitated with latest Heating Ventilation and Air Conditioning (HVAC) automation, having ISO (International standard organization) 1900-2000 certified and producing 6.5-7 million best quality chicks/month through single stage incubation system (Avida G4, Chick Master USA).

Selection of breeds

Sadiq Poultry flock no. 101 cobb 300, 102 ross 308, 103 ross 308, 105 ross 308, Arslan Poultry flock no. 23 hubbard classic, Sarghoda farms ross 308.

Selection of eggs

Good quality eggs free from any kind of contamination were selected and graded on the basis of weight through Moba 9A egg grader (Khan et al., 2016)

Experimental groups

The experimental eggs were divided into two groups on the basis of contamination. Group A contains A grade eggs free from any kind of contamination while group B contain contaminated eggs**.** Each group contain (n= 8616960) for 16 replicates.

Eggs fumigation

Automatic fumigation system recommended by Chick Master with 20g $KMnO_4$ and 40ml formalin (40%) and 40 ml of water for 100ft 3areas and 15 minutes.

Incubation programme

Experimental eggs from both groups were pre-heated as recommended by (Jaabar et al., 2017). After pre-heated automatic setter incubation profile as recommended by chick master (USA)

Setter hall and hatcher hall

Environmental conditions in setter hall were at 75 ^{0}F temperatures and 40% Relative humidity; whereas in the hatcher hall temperature was at75^{0}F and relative humidity had been increased up to 60%. The positive pressure in setter and hatcher hall was 15 Pascal and 10 Pascal respectively, while negative pressure inside setter and hatcher plenum was -25 Pascal during the course of study.

Egg's weight loss

Eggs weight loss was measured by following formula for both groups individually.

$$\text{Water Loss (\%)} = \frac{\text{Full tray weight at Setting - Full Tray Weight at Transfer}}{\text{Full tray weight at Setting - Empty Tray Wight}} \times 100$$

Candling

Candling was performed automatic transfer table provided by KUHL (USA)

Chick grading

Chick grading and packing was performed on international standard through automatic grading table and chick counter provided by KUHL (USA).

A Grade chicks. Chicks with shining eyes, soft legs and nose, healed naval and healthy minimum weight of 38 grams were graded as A grade chick.

B grade chicks. Underweight less than 30 grams, weak and unhealed naval chicks were removed to mention as B grade.

Chick yield measure

Chick's yield was measure through by using following formula:

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

Chicks with 69% yield were graded as A grade while more than 69% or less than 67% were graded as B grade (Aviagen. 2).

Dead in shell (DIS) analysis

Dead in shell analysis was performed to investigate the embryonic mortality in both groups. For that unhatched eggs from both groups were broken individually.

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 t-test and results were presented as mean ± SEM (standard error of mean). Results were considered significant if P<0.001.

RESULTS AND DISCUSSION

All parameters from both groups were recorded individually. Candling was significantly better (P<0.001) in all flocks of group A as compared to B regardless of the age and breed of broiler eggs (Table 1). Candling also depends on age of breeders because decline in reproductive performance after 45 weeks has been well documented (Van de Ven, 2012). The farm management e-g mixing of male female, spiking and flock health condition also have impact on candling. The results clearly show that contaminated eggs have significant losses in term of candling.

Water loss is very important for good chick yield. The eggs from group B presented significantly (P<0.001) less water loss as compared to group A regardless the age and breed of broiler eggs (Table 2). For good quality chicks 12% water loss is recommended because less than 6% and more than 14% is difficult for chicks to hatch. For quality chicks water loss should be control in incubator from egg to chick. Water loss also depends upon the humidity levels in the incubators and humidity level in the fresh air coming to incubators. The hatch window is also affected by water loss. Adequate water level in incubators is essential to retain the required water inside eggs necessary to create air cell that helps chicks to come out from eggs in limited time. The air cell allows embryonic lung ventilation after internal piping for a successful hatch (Ar and Rahn, 1980).

Chick yield was significantly (P<0.001) better for group A than for group B (Table 3). The recommended chick yield is 69% for quality chicks. Water loss and chick yield are related to each other. If chick yield excels more than 69 % it becomes a source of dehydration, creates difficulty for chicks to comes out from eggs and hatch window will increase (Aviagen. 2). The chicks yield with more than 69% becomes source of high mortality at farm. Chick yield less than 67%, the water retains in belly of chicks. The chicks become lethargic and refuse to take feed at the farm (Jabbar et al., 2017)

The quantity of A grade chicks increases with good quality eggs as shown in table 4.Chick yield ingroup A was significantly (P<0.005) better as compare to B. The A grade chicks quantity also depends upon health condition of flock, vertically and horizontal transmitted diseases e-g (ND, IB, H9, EDS, MG, Salmonella etc.), and farm management issues (King'ori, 2011).

The percentage of B grade chicks/poor quality chicks were significantly (P<0.005) higher in B group as compared to A group (Table 5). The B grade chicks quantity were also affected by health condition of flock and vertically and horizontal transmitted diseases e-g (ND, IB, H9, EDS, MG, Salmonella etc.) and farm management issue (King'ori, 2011).

Table 1. Effect of floor eggs on candling percentage at Sadiq Hatchery Chakri Rawalpindi, Pakistan (January to May 2017)

Flock	Age (Weeks)	Group B	Group A
SP 101 cobb	65	13.51±0.28[a]	7.02±0.22[b]
SP 102 ross	65	19.42±0.54 [a]	16.87±0.73 [b]
SP 103 ross	60	18.30±0.45[a]	13.57±0.27[b]
SP 105 ross	60	15.613±1.00[a]	5.09±0.64[b]
AP hubbard	45	6.84±0.20[a]	5.25±0.03[b]
SRA ross	45	6.84±0.20[a]	5.25±0.03[b]
SRB ross	45	18.81±0.26[a]	12.465±0.29[b]

[ab] Different superscripts within each row show significant difference

Table 2. Effect of floor eggs on water loss at Sadiq Hatchery Chakri Rawalpindi, Pakistan (January to May 2017)

Flock	Age (Weeks)	Group B	Group A
SP 101 cobb	65	11.18±0.45[a]	12.34±0.30[b]
SP 102 ross	65	10.82±0.01[a]	11.88±0.01[b]
SP 103 ross	60	11.28±0.25[a]	12.14±0.20[b]
SP 105 ross	60	10.883 ± 0.26[a]	12.15±0.69[b]
AP hubbard	45	10.26 ±0.15[a]	12.26± 0.15[b]
SRA ross	45	10.84±0.2[a]	11.523±0.30[b]
SRB ross	45	10.06±0.21[a]	12.495±0.42[b]

[ab] Different superscript within each row show significant difference

Table 3. Effect of floor eggs on chick yield at Sadiq Hatchery Chakri Rawalpindi, Pakistan (January to May 2017)

Flock	Age (Weeks)	Group B	Group A
SP 101 cobb	65	67.65±0.45[a]	68.81±0.30[b]
SP 102 ross	65	68.18 ±0.01[a]	69.12±0.01[b]
SP 103 ross	60	67.64±0.34[a]	68.972±0.27[b]
SP 105 ross	60	66.819± 0.69[a]	69.247±0.26[b]
AP hubbard	45	67.74 ±0.45[a]	68.2±0.45[b]
SRA ross	45	67.16±0.2[a]	68.478±0.30[b]
SRB ross	45	68.2±0.20[a]	69.288±0.40[b]

[ab] Different superscript within each row show significant difference

Hatchability is complex thing effect by lot of factors e-g candling, water loss, DIS, chick yield, contaminated eggs, crack eggs, flock health condition, flock age, horizontal and vertical transmitted diseases, farm management and incubator proper temperature and humidity set points (Jabbar et al., 2017). These factors are critical to achieve standard hatchability. The results showed that hatchability also significantly (P<0.001) affected by contaminated eggs (Table 6).

Chick weight is related to water loss and water loss is related to chick yield. The eggs with contamination on egg shell are unable to hold require water inside egg necessary for proper hatch window. The standard water loss 12% will not meet and chicks becomes unable to get require weight as shown in result (Table 7). i-e contaminated eggs have significantly (P<0.001) less weight. Chicks that are comfortable, i.e. in their thermo neutral zone (rectal temperature (40-40.6ºC, 104-105ºF) lose 1-2 grams of moisture per 24 hours. Chicks that are overheated (rectal temperature over 106ºF, 41.1ºC) lose 5-10 grams of moisture per 24 hours. This is true in any situation where the chicks have no access to water, whether the chicks are in the hatcher or in transport to the farm (Hill et al., 2011).

Standard water loss and chick yield are necessary for chicks to come out from eggs. Due to the contamination they require water loss and yield can't be achieved and it becomes difficult for chicks to come out from eggs results in increased mortality inside egg or during hatching as shown in table 8. The contamination may become source of embryo mortality at any stage of incubation depending on severity of infection. Most of embryo dies during last week due to malposition, malformation, adhesion and dehydration (Kalita et al., 2013)

Table 4. Effect of floor eggs on percentage of A grade chicks at Sadiq Hatchery Chakri Rawalpindi, Pakistan (January to May 2017)

Flock	Age (Weeks)	Group B	Group A
SP 101 cobb	65	73.59±0.16[a]	87.38±0.29[b]
SP 102 ross	65	66.5±0.67[a]	79.19±0.54[b]
SP 103 ross	60	68.06±0.30[a]	80.11±0.41[b]
SP 105 ross	60	68.24± 0.35[a]	81.21±0.68[b]
AP hubbard	45	89.59 ±0.36[a]	90.58 ± 0.73[b]
SRA ross	45	68.213±0.35[a]	81.258±0.25[b]
SRB ross	45	67.983±0.25[a]	80.95±0.40[b]

[ab] Different superscript within each row show significant difference

Table 5. Effect of floor eggs on percentage of B grade chicks at Sadiq Hatchery Chakri Rawalpindi, Pakistan (January to May 2017)

Flock	Age (Weeks)	Group B	Group A
SP 101 cobb	65	2.37±0.26a	1.09±0.08[b]
SP 102 ross	65	2.07±0.15[a]	1.03±0.08[b]
SP 103 ross	60	2.34±0.08[a]	1.0705±0.07[b]
SP 105 ross	60	2.21±0.192[a]	1.06±0.04[b]
AP hubbard	45	1.37± 1.87[a]	0.97±0.94[b]
SRA ross	45	2.325±0.12[a]	1.025±0.05[b]
SRB ross	45	2.2±0.040a	1.1±0.040[b]

[ab] Different superscript within each show significant difference

Table 6. Effect of floor eggs on hatchability percentage at Sadiq Hatchery Chakri Rawalpindi, Pakistan (January to May 2017)

Flock	Age (Weeks)	Group B	Group A
SP 101 cobb	65	73.59±0.16[a]	87.38±0.29[b]
SP 102 ross	65	66.5±0.67[a]	79.19±0.54[b]
SP 103 ross	60	68.06±0.30[a]	80.11±0.41[b]
SP 105 ross	60	68.24± 0.35[a]	81.21±0.68[b]
AP hubbard	45	89.59 ±0.36[a]	90.58 ± 0.73[b]
SRA ross	45	68.213±0.35[a]	81.258±0.25[b]
SRB ross	45	67.983±0.25[a]	80.95±0.40[b]

[ab] Different Superscript within each row show significant difference

Table 7. Effect of floor eggs on chick weight at Sadiq Hatchery Chakri Rawalpindi, Pakistan (January to May 2017)

Flock	Age (Weeks)	Group B(gr)	Group A (gr)
SP 101 COBB	65	47.29±0.40[a]	48+0±0.40[b]
SP 102 ROSS	65	45±0.12[a]	47±0.12[b]
SP 103 ROSS	60	46.5±0.28[a]	48±0.01[b]
SP 105 ROSS	60	45±+0.01[a]	47±+0.50[b]
AP HUBBARD.C	45	40±0.17[a]	42±0.76[b]
SRA ROSS	45	45.5±0.20[a]	47.25±0.40[b]
SRB ROSS	45	40.92±0.04[a]	41.45±0.02[b]

[ab] Different superscript within each row show significant difference

Table 8. Effect of floor eggs on dead in shell percentage at Sadiq Hatchery Chakri Rawalpindi, Pakistan (January to May 2017)

Flock	Age (Weeks)	Group B	Group A
SP 101 cobb	65	10.71±0.24[a]	4.56±0.26[b]
SP 102 ross	65	9.71±0.23[a]	5.56±0.36[b]
SP 103 ross	60	10.71±0.24[a]	4.56±0.26[b]
SP 105 ross	60	5.88±0.21a	3.96±0.13[b]
AP hubbard	45	4.2±0.214[a]	3.2±0.31[b]
SRA ross	45	8.95±0.40[a]	6.48±0.40[b]
SRB ross	45	10.66±0.04[a]	5.31±0.03[b]

[ab]Different superscript within each row show significant difference

CONCLUSION

The floor eggs or contaminated eggs must be avoided from hatching. They can be a source of infections in the hatchery and the quality of chicks deteriorates. All hatchery parameters are negatively affected by such kind of eggs.

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Author's contribution

Both authors have equally contribution in this work.

Competing 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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