Full Length Article

EFFECT OF EGG CLEANING METHODS ON HATCHABILITY, MOISTURE LOSS AND EMBRYONIC MORTALITY IN BROILER BREEDER GRAND PARENT EGGS

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ABSTRACT

This study investigated the impact of different egg cleaning methods on hatchability, moisture loss, and chick yield in broiler breeder grandparent eggs. A total of 1500 eggs (300 eggs/treatment, (50 eggs/replicate) from 62-week-old birds were used. Five treatments were employed: fresh eggs from cages (T1 – control), dry cleaning (T2), and using didecyl dimethyl ammonium chloride at concentrations of 3 ml/L (T3), 4 ml/L (T4), and 5 ml/L (T5). The shape index of the egg was consistent across all treatments, ranging from 76.5% to 77.5%, ensuring a uniform basis for comparison. treatments T1, T2, and T4 exhibited better hatchability performance compared to the other groups (78.67%± 0.42, 78.67%± 0.67, and 71.33%± 0.42, respectively). Notably, the hatchability values for T1 (control) and T2 (dry clean) were numerically similar. Regarding moisture loss, dry-cleaned eggs (T2) exhibited the highest moisture loss (10.65% ± 0.32), with T3 (disinfectant cleaning at 3 ml/L) showing a closer level. Economically, T1 (control - cleaning eggs from cages) yielded the highest profit (Rs.40,050) compared to the other treatments. This study concluded that dry cleaned eggs and fresh eggs from cage will provide better hatchability and economic returns in broiler grandparent birds.

Keywords: Broiler breeder grandparent egg, egg cleaning, hatchability, disinfectant

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INTRODUCTION

Poultry breeding programs rely heavily on the production of high-quality hatching eggs from grandparent (GP) stocks. The health and viability of chicks from these eggs are crucial in determining the success of subsequent generations. One critical factor influencing egg quality is cleanliness. Dirty eggs have pathogens, leading to reduced hatchability, increased embryonic mortality, and poor chick yield. Effective egg cleaning and disinfection methods are essential to minimize the risk of contamination and ensure the production of healthy, viable chicks. However, the cleaning process can

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also potentially damage the egg or disrupt the cuticle, leading to reduced hatchability. Therefore, it is essential to evaluate the effects of different egg cleaning methods on hatchability, chick yield, and embryonic mortality in broiler breeder grandparent stock.

MATERIALS AND METHODS

A total of 1,500 hatching eggs were collected from a 62-week-old grandparent broiler breeder stock. The eggs were collected from the second to tenth collection of the day. Eggs laid in cages and contaminated with faeces were included in this experiment. All eggs were collected from the cages using temporary gloves, with separate gloves used for each treatment.

After collection, the eggs were graded into categories namely hatching eggs, jumbo eggs, misshapen eggs, and cracked eggs. Following grading, the selected eggs were allocated to each treatment, with 300 eggs per treatment and six replicates per treatment, totally 50 eggs per replicate. Eggs were collected over six days from each replicate, and the eggs were set in the hatchery the next day. A total of 1,500 eggs were used for this experiment.

Emery sheets (P60–P120) are used to dry-clean eggs, while wet cleaning involves a sponge or cotton with 0.3%–0.5% didecyl dimethyl ammonium chloride. Measuring jars, syringes, gloves, hand disinfectant, and color-coded trays help maintain hygiene, and weighing balances are used for eggs and chicks.

Egg Source and Characteristics

The eggs used in this study were obtained from grandparent broiler breeder flocks. The breeders were 62 weeks old at the time of egg collection. The eggs had an average hatchability rate of 78%, indicating good fertility and embryonic viability. Additionally, the average egg weight ranged between 70 and 72 grams, which falls within the optimal range for successful incubation and healthy chick development.

Flow Chart

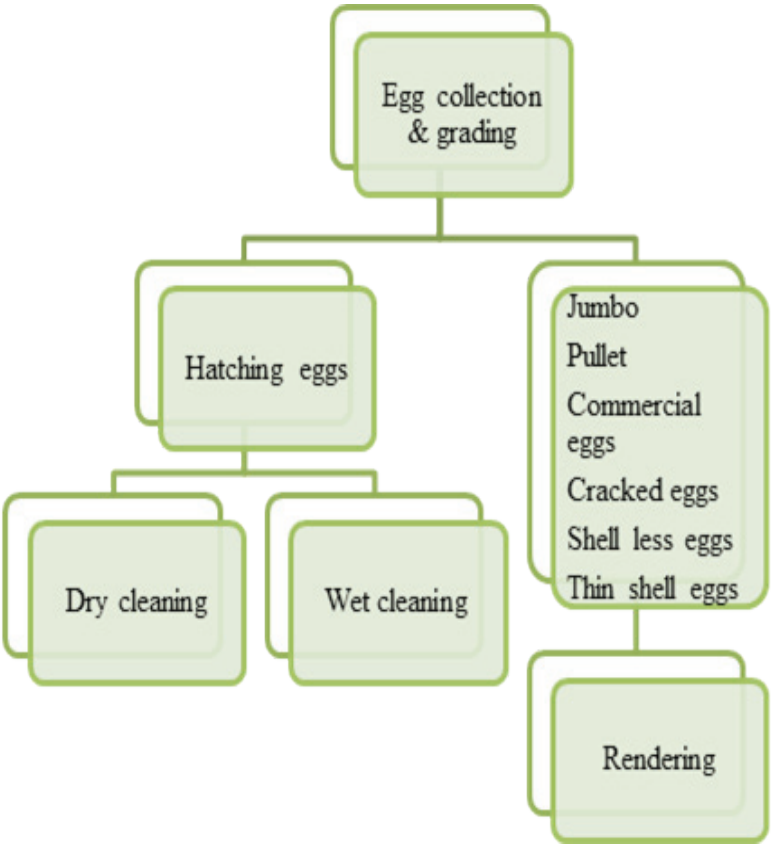
- Moisture loss is measured on the 18th day of the incubation period, when the eggs are transferred from the setter to the hatcher
- CRD method used for the statistical analysis
- 100 eggs per treatment were used for the breakopen analysis.

RESULTS AND DISCUSSION

1.Incubation moisture loss

Effect of different pre incubation egg cleaning methods on post incubation moisture loss of broiler grandparent is presented in Table 1. Highly significant ($P<0.001$) differences were noticed between treatment groups. Moisture loss is measured on the 18th day of the incubation period, when the eggs are transferred from the setter to the hatcher. The dry-cleaned eggs (T2) had shown higher moisture loss (10.65±0.32), the T3 eggs also (disinfectant cleaning at the rate of 3ml/L) close to T1, the other groups eggs showed lesser moisture loss. Higher

the moisture loss, better the hatchability performance, thus the eggs of dry cleaning and wet cleaning (T3) had shown better moisture loss in this trial. This may be due to exposure of cuticle thus increase the moisture loss through pores (Fig. 1).



2.Hatchability performance

a) Hatchability

Effect of different pre incubation egg cleaning methods on hatchability performance of broiler grandparent is presented in Table 2. Highly significant ($P<0.001$) differences were noticed between treatment groups in percent total hatchability, fertile hatchability and gas egg. The T1, T2 and T4 group eggs had shown better hatchability values than other groups (78.67±0.42, 78.67±0.67 and 71.33±0.42). The T1 (control) and T2 (dry cleaning) groups hatchability values were numerically close to each other (Fig.2).

b) Chick yield

The chick yield did not show any significant difference among groups.

c) Gas eggs

The T1, T2 and T3 (disinfectant at 4ml/L) group had lower gas eggs than other group eggs (4.00±0.00, 3.00±0.45 and 4.00±0.00), this shows better healthiness of the egg environment, it reflected in hatchability performance too. It is advisable to have less gas inside the egg.

3.Embryonic mortality

a) Early embryonic mortality

Effect of different pre-incubation egg cleaning methods on percent embryonic mortality of broiler grandparent is given in Table 3. Highly significant($P<0.001$) differences were observed between treatment groups. The T2, (dry clean eggs) T4 and T5 (disinfectant cleaning at the rate of 4ml/L and 5ml/L) had recorded lower early embryonic mortality(7.00±0.45, 5.00±0.45 and 7.00±1.34) and the other treatments had higher per cent early embryonic mortality. This may be due to the effect of disinfectant that prevents the microbial growth and enhance the better hatchability.

b) Middle embryonic mortality

Highly significant ($P<0.001$) differences were observed between treatment groups in middle embryonic mortality. The T1, (control)) and T2 (dry cleaning) had recorded lower middle embryonic mortality (3.00±0.45 and 4.00±0.00) and the other treatments had higher percent early embryonic mortality.

c) Late embryonic mortality

Highly significant ($P<0.001$) differences were observed between treatment groups in late embryonic mortality. Similar to middle embryonic morality, the T1, (control) and T2 (dry cleaning) had recorded lower late embryonic mortality (3.00±0.45 and 4.00±0.00) and the other treatments had higher per cent early embryonic mortality.

This showed, the dry cleaned and cage eggs had noticed lower embryonic mortality values than other groups. The disinfectant effect is minimal on embryonic mortality.

4. Economics

Effect of different pre incubation egg cleaning methods on economics of broiler grandparent in Table 4. Among the groups, the Treatment1 (control- clean eggs from cages) had higher profit (40050) than other groups. The T1 (control) is closer to the T2 with the profit differences of Rs.150 for 300 eggs, because of having good hatchability and lesser expenditure. It shows the dry cleaning and cage eggs had better hatchability performance and return on eggs (Fig.3).

Discussion

This study showed that the dry-cleaned eggs and cage fresh eggs before incubation had resulted in better hatchability

and economic returns. The moisture loss in this trail is partially agreed with Geng and Wang (1990); Rhodes and Godfrey (1950) and they found that the cleaning methods only decide the moisture loss, thus in turn affect the hatchability. Similarly, Funk (1940) also noticed washing of eggs in water lowers the hatchability. The better hatchability recorded in T1 (control) and T2 (dry cleaning) concur with the findings of Hulet *et al.,* (1987), they noticed higher hatchability in dry cleaning methods of eggs. The chick yield in this study did not show any significant difference, which does not agree with findings of Geng and Wang (1990); Rhodes and Godfrey (1950) and they noticed higher weight loss in eggs washed in water. The disinfectant used in this study did not show any positive values in hatchability performance as well as returns. Hence, choosing a disinfectant is an important criteria before cleaning the eggs (Badran *et al.,* (2018). This study concluded that the eggs dry cleaned and fresh eggs from cage will provide better hatchability and economic returns in broiler grandparent birds.

Table.1. Effect of different pre incubation egg cleaning methods on post incubation moisture loss of broiler grandparent (Mean ±SE) @

Treatment	Per cent post incubation moisture loss
T1-(control eggs- egg from cage as such)	8.42^{d}±0.12
T2 -(dry cleaned eggs)	10.65^{a}±0.32
T3 -(wet cleaning- 3 ml per lit of water)	9.90^{a}±1.10
T4- (wet cleaning- 4 ml per lit of water)	9.81^{ab}±0.29
T5- wet cleaning- 5 ml per lit of water	9.51^{c}±0.24
Average	**9.66±0.27**
F value	**12.23**
Significance	**

@Average of six trials
Means bearing different superscript between rows differ significantly (P<0.001)
** Highly significant

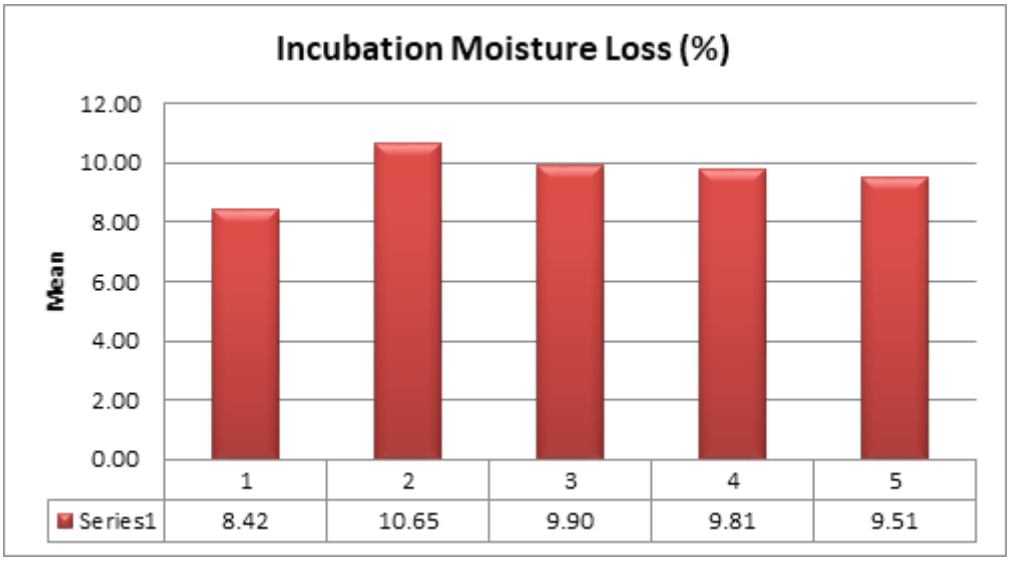


Fig.1. Effect of different pre incubation egg cleaning methods on per cent post incubation moisture loss of broiler grandparent

Table.2. Effect of different pre incubation egg cleaning methods on hatchability performance of broiler grandparent (Mean ±SE) @

Treatment	Per cent Total hatchability	Per cent fertile hatchability	Per cent Chick yield	Per cent Gas eggs
T1 -(control eggs- egg from cage as such)	78.67±0.42^{a}	81.41±0.08^{a}	69.92±2.03	4.00.00±0.00^{a}
T2-(dry cleaned eggs)	78.67±0.67^{a}	81.20±0.76^{a}	65.92±1.80	3.00±0.45^{a}
T3 -(wet cleaning- 3 ml per lit of water)	69.00±0.45^{b}	72.39±0.73^{ab}	74.06±1.77	4.00±0.00^{a}
T4- (wet cleaning- 4 ml per lit of water)	71.33±0.42^{a}	75.00±0.00^{a}	70.51±2.03	8.00±0.00^{b}
T5-(wet cleaning- 5 ml per lit of water)	66.67±4.72^{bc}	68.95±4.82^{b}	70.47±1.55	11.00±2.24^{bc}
Average	**72.87±1.34**	**79.79±0.99**	**70.18±1.84**	**6.00±0.35**
F value	**6.6****	**6.16****	**NS**	**11.06****

@Average of six trials
Means bearing different superscript between rows differ significantly (P<0.001)
** Highly significant
NS – Non significant

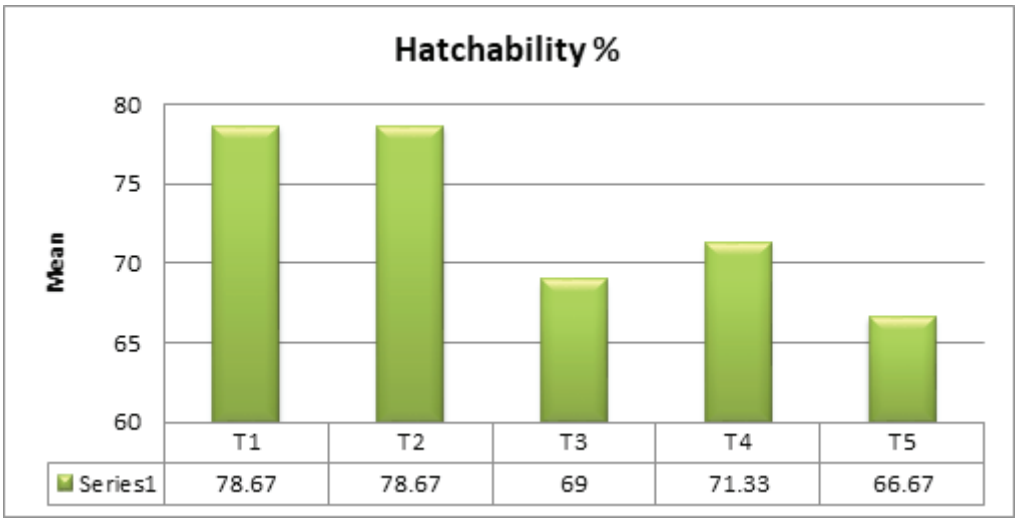


Fig.2. Effect of different pre incubation egg cleaning methods on hatchability performance of broiler grandparent

Table.3. Effect of different pre incubation egg cleaning methods on percent embryonic mortality of broiler grandparent (Mean ±SE)@

Treatment	Early embryonic mortality	Middle embryonic mortality	Late embryonic mortality
T1-(control eggs- egg from cage as such)	8.00±0.89^{b}	3.00±0.45^{a}	3.00±0.45^{a}
T2-(dry cleaned eggs)	7.00±0.45^{a}	4.00±0.00^{a}	4.00±0.0 ^{a}
T3 -(wet cleaning- 3 ml per lit of water)	10.00±0.00^{c}	7.00±0.45^{c}	5.00±0.45^{b}
T4- (wet cleaning- 4 ml per lit of water)	5.00±0.45^{a}	5.00±0.45^{b}	6.00±0.00^{bc}
T5- wet cleaning- 5 ml per lit of water	7.00±1.34^{a}	7.00±0.45^{c}	6.00±0.89^{bc}
Average	**7.40±0.38**	**5.20±0.42**	**4.80±0.40**
F value	**5.5****	**20****	**7.08****

@Average of six trials
Means bearing different superscript between rows differ significantly (P<0.001)
** Highly significant

Table.4. Effect of different pre incubation egg cleaning methods on economics of broiler grandparent@

Treatment	No. of eggs / treatment	Egg cost (Rs.)	Incubation cost (Rs.)	Cleaning cost / egg (Rs.)	Hatched chicks	Chick cost (Rs.)	Total expenditure(Rs.)	Income (Rs.)	Profit (RS.)
T1	300	90	1.5	0.00	225	300	27450	67500	**40050**
T2	300	90	1.5	0.50	225	300	27600	67500	**39900**
T3	300	90	1.5	0.03	207	300	27459	62100	**34641**
T4	300	90	1.5	0.04	216	300	27462	64800	**37338**
T5	300	90	1.5	0.05	192	300	47465	57600	**30135**

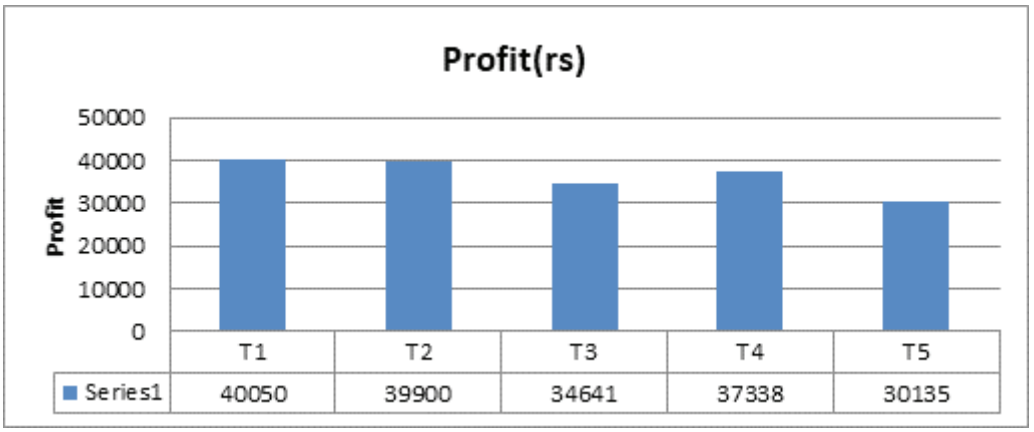


Fig.3. Effect of different pre incubation egg cleaning methods on economics of broiler grandparent

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