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Evaluation of Hatchability in Kuroiler Breed Eggs affected by Pre-incubation Storage Temperature and Formaldehyde Fumigation

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ABSTRACT

The present investigation was carried out to investigate hatchability of eggs of Kuroiler breed of chicken at poultry farm SKN College of Agriculture, Jobner (Rajasthan). For the study total 180 fresh eggs of Kuroiler chicken of 25-38 week age were collected and stored at different temperatures i.e. 30±2°C and 20±2°C as per treatment i.e. T_1 (30°C + NF), T_2 (30°C + F), T_3 (20°C+NF) and T_4 (20°C + F). Result shows that the hatchability (FES) was found higher (90.70%) at 20°C temperature and lower (83.33%) at 30°C temperature with fumigation. At same temperature 20°C, hatchability found some variation in fumigated group (90.70%) and non-fumigated group (88.10%) due to lower incidence of bacterial growth. There was non-significant difference of fumigation on mean percentage hatchability of fertile eggs. Storage temperature significantly ($P \leq 0.05$) affects the hatchability it found lower at 30°C than at 20°C. Embryonic mortality found lower (09.30%) in T_4 and higher (17.07%) in T_1 group. Embryonic mortality also affected by the interaction of temperature and fumigation. It is suggested that for higher hatchability eggs were stored at 20°C temperature and the eggs are necessary fumigate before the incubation for better hatchability results.

HIGHLIGHTS

- Hatchability (FES) was found higher (90.70%) at 20°C temperature and low (83.33%) at 30°C temperature with fumigation.
- Hatchability (FES) was found higher (90.70%) in fumigated eggs and lower (88.10%) in non-fumigated eggs.
- Embryonic mortality also observed in fumigated eggs.

Keywords: Storage Temperature, Formaldehyde, Hatchability, Egg Fumigation, Incubation

Poultry plays an important role in producing animal proteins most effectively and economically within the shortest possible time. Poultry particularly chicken provides products such as eggs and meat or protein of high biological value. Poultry is one of the fastest growing segments of the agricultural sector in India with around eight percent growth rate per annum. India ranks 3rd in egg production and 5th in chicken meat production in the world.

The Kuroiler is one of the important breed of chicken developed in India. Kuroiler, a dual-purpose breed produce around 150-200 eggs per year and can live on a kitchen and agricultural waste. Microbial contamination of hatching eggs is a main concern of poultry producers as it causes poor hatchability and reduces chick performance. Hatching eggs are disinfected to kill microorganisms on the surface of the shell and increase the production of healthy chickens. Formaldehyde (CH_2O / formalin / formol) is a gas at room temperature and readily soluble in

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water. It is commonly used as a disinfectant, as it is cheap, not corrosive and kills most bacteria and fungi, including their spores. Formaldehyde applied as a liquid or gas, but it is more effective when used as a gas (Bekle and Leta, 2016). The gas can be generated by several methods, but the most common way used in the poultry industry is the addition of formalin to potassium permanganate ($KMnO_4$) in 2:1 ratio (v/w).

MATERIALS AND METHODS

The experiment was conducted at the poultry farm, S.K.N. College of Agriculture, Jobner. District- Jaipur (Rajasthan). The climate of this region is a typically semi-arid, characterized by extremes of temperature during both summer and winters. All the layer birds for research were maintained under deep litter system with 3 sq. feet floor space / bird. The experimental birds are same age group (28- 35 weeks) and the sex ratio or female to male ratio (10:1) is maintained.

A total of 180 numbers of eggs were used in three replication, 60 eggs per replication this experiment. Eggs were stored for five days (*i.e.* 30°C and 20°C) which is same for all replication. Eggs were fumigated by formaldehyde gas with appropriate concentration under a close cabinet. Formalin gas is generated by the addition of formalin to potassium permanganate ($KMnO_4$) in 2:1 ratio (v/w). After 20 minutes of fumigation the eggs were removed from the disinfection room and kept in pre-incubation room for 8 hours for proper ventilation.

Incubation process

All experimental eggs were incubated with setter trays with the large end up in an automated electrical incubator at 37.50°F to 37.70°F and 60-65% humidity with turning. After 18th days the alive embryos were transferred to the hatcher. On 22nd day of incubation chicks were taken out from hatcher and percentage hatchability was recorded.

Table 1: Distribution of eggs according to treatments.

Treatment Interaction	Symbols
30°C Temperature + Non-fumigation	T_1
30°C Temperature + Fumigation	T_2
20°C Temperature + Non-fumigation	T_3
20°C Temperature + Fumigation	T_4

Hatchability

Hatchability is a number of chicks hatched per hundred eggs incubated. Hatchability denotes the percentage of fertile eggs that hatch successfully at the end of incubation period of 21 days. Hatchability therefore, basically involves losses due to embryonic death at various stages of development.

Hatchability percentage was estimated on the basis of total egg set i.e. both fertile and infertile included and on the basis of fertile eggs as per following formula:-

(i) Hatchability percentage (on total egg set basis)

Hatchability on total egg set (TES) was determined as the ratio of number of chicks hatched to the total number of eggs incubated.

$$\text{Hatchability (\%)} = \frac{\text{Number of chick hatched}}{\text{Total number of eggs (both fertile and infertile)}} \times 100$$

(ii) Hatchability percentage (on fertile egg set basis)

Hatchability on fertile egg set (FES) was calculated as the ratio of number of chicks hatched to the total number of fertile eggs incubated.

$$\text{Hatchability (\%)} = \frac{\text{Number of chick hatched}}{\text{Total number of fertile eggs setted}} \times 100$$

Embryonic mortality

Embryonic mortality was observed by the un-hatched egg (out of fertile) after the incubation of 21 days.

STATISTICAL ANALYSIS

The experimental data were statistically analyzed using standard statistical methods as per Snedecor and Cochran (1994) using Completely Randomized Design (CRD) with factorial structure. All data was subjected to analysis of variance. Consequently, a level of ($P \leq 0.05$) was used as the criterion for statistical significance.

RESULTS AND DISCUSSION

Hatchability of eggs of Kuroiler breed

Hatchability was calculated for different treatments on the basis of total eggs set as well as on the basis of fertile eggs set for eggs of Kuroiler breed. Percentage hatchability (fertile egg set basis) was found higher (90.70%) in T_4 treatment group and lower in (82.93%) in T_1 treatment group. Hatchability (total eggs set basis) was also found higher (86.67%) in T_4 treatment group and lower in (75.56%) in T_1 treatment group. Hatchability was also found different on same temperature group this could be due to fumigation effect. According to statistical analysis hatchability was significantly ($P \leq 0.05$) affected by the storage temperature. Slightly lower mean percentage hatchability was found at 30°C than 20°C. Interaction of egg storage temperature and fumigation also affect the hatchability. Temperature 20°C with fumigation was found higher hatchability (90.70%) as compared to temperature 20°C without fumigation (88.10%), but the differences were not significant. The finding suggests that hatchability declines when storage temperature is 30°C as compared to 20°C. Interaction effect of temperature and Fumigation also affect the hatchability but the difference was not significant. Hatchability of different treatment group was presented in table 2.

Table 2: Hatchability of eggs fertile egg set basis (FES) and total eggs set basis (TES) for different treatments

Treatments	Hatchability% (FES) (mean + SEm)	Hatchability% (TES) (mean + SEm)
T_1	82.93 ±0.018	75.56 ±0.144
T_2	83.33 ±0.019	77.78 ±0.197
T_3	88.10 ±0.141	82.22 ±0.211
T_4	90.70 ±0.084	86.67 ±0.087
P- value		
Temperature	0.006*	0.000*
Fumigation	0.204	0.073
Temp. x fumigation	0.965	0.611

*Significant at 5% level.

Results of present findings were in agreement with Bekele and Leta (2016) reported that egg storage temperature at 16°C and fumigation significantly improved hatchability in both Cobb-500 and Habbard broiler strain. The findings of this study were comparable with the findings of Harnacr *et al.* (2012) reported non-significance difference in hatchability between the non-fumigated and fumigated (with formaldehyde) at a concentration of 30 ml formalin added to 20 g $KMnO_4$ per m^3 (*i.e.* 400 mg released formaldehyde per m^3).

The present findings did not agree with Proudfoot and Stewart (1970) and Ahangaran *et al.* (2016) reported that pre-storage and pre-incubation fumigation with potassium permanganate and formalin resulted in significantly higher hatchability than with eggs which were not fumigated ($P \leq 0.05$).

Embryonic mortality

Embryonic mortality was found to be lower in T_4 (09.30%) and higher in T_1 (17.07%) treatment group. Embryonic mortality affected by storage temperature it was found higher at 30°C than 20°C. Embryonic mortality found lower in fumigated eggs this could be due to lower incidence of bacteria. According to statistical analysis embryonic mortality was significantly ($P \leq 0.05$) affected by the storage temperature and interaction of temperature and fumigation. These findings were in agreement with the report of Alsobayel *et al.* (2017) embryonic mortality of 5, 10 and 15 days stored Baladi eggs were 16.40%, 30.40% and 33.87%, respectively. Sahan *et al.* (2003) reported the embryonic mortality at 16, 21 and 25°C were 28.6%, 32.0% and 42.9% respectively.

Table 3: Embryonic mortality of different treatment groups

Treatments	Embryonic mortality (%) (mean + SEm)
T_1	17.07 ±0.105
T_2	16.67 ±0.072
T_3	11.90 ±0.086
T_4	09.30 ±0.065
P- value	
Temperature	0.005*
Fumigation	0.205
Temp. x fumigation	0.000*

*Significant at 5% level.

CONCLUSION

On the basis of present investigation it may be concluded that the hatchability (FES) was found higher (90.70%) at 20°C temperature and lower (83.33%) at 30°C temperature with fumigation. Hatchability also found some different at same temperature 20°C in fumigated (90.70%) and non-fumigated group (88.10%) due to lower incidence of bacterial growth. Storage temperature significantly (P≤0.05) affects the hatchability it found lower at 30°C than at 20°C. Embryonic mortality found lower (09.30%) in T_4 and higher (17.07%) in T_1 group. Embryonic mortality was affected by the eggs storage temperature it found high at 30°C temperature as compared to 20°C temperature. Embryonic mortality also affected by the interaction of temperature and fumigation. It is suggested that for higher hatchability eggs were stored at 20°C temperature and the eggs are necessary fumigate before the incubation for better hatchability results.

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